

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 14 - Power Cables and Overhead Conductors.
- .2 Section 26 12 19 - Pad Mounted, Liquid Filled Power Transformers.
- .3 Section 26 13 18 – Primary Switchgear Assembly to 15kV.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82/A82M-05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .4 ASTM C 478/C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - .5 ASTM D1056-00, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:

- .1 Submit shop drawings for precast manholes.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: submit certified test reports for specified materials from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative, Consultant in accordance with Section 01 32 16.06 - Construction Progress Schedule :
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements. Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 PVC DUCTS

- .1 All Duct Banks shall be CSA approved.
- .2 All Duct Banks containing primary and secondary conductors shall be in concrete encased duct banks when passing beneath a high traffic area.
- .3 Concrete encased ducts shall be supported by approved spacers placed at 1200mm intervals, no wire or metal ties are to be used.
- .4 A 100mm diameter duct shall be used for each run of primary cables and secondary.
- .5 All 90 Degree bends in a duct shall use rigid PVC conduit and for the remainder of the duct run, PVC Type DB-2 shall be used, also long sweep 90 degree rigid PVC conduit bends shall be used at both the pole and the concrete pad.

- .6 Provide minimum of #12 fish wire shall be installed in each duct and both ends of the duct shall be securely capped; for easy access to cables for future maintenance purposes.

2.2 PVC DUCT FITTINGS

- .1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.
- .2 Expansion joints.
- .3 Rigid PVC 5 degree angle couplings.

2.3 PRECAST CONCRETE MANHOLES

- .1 Precast concrete manholes and auxiliary sections fabricated in steel forms.
- .2 Aggregates: to CSA A23.1/A23.2.
- .3 Cement: CAN/CSA-A3001, Type GU.
- .4 Steel welded wire fabric mesh reinforcing: to CAN/CSA-G30.18.
- .5 Pulling inserts and bolts for racks integrally cast in concrete.
- .6 Neoprene gasket seals between manhole sections: to ASTM D1056.
- .7 Size: 762 mm clear diameter.
- .8 Precast Concrete Manholes: to ASTM C478/C478M.
 - .1 Manhole step and ladder rung spacing: 405.

2.4 DRAINAGE

- .1 Floor drain fittings: consisting of floor drain, back water valve, trap and pipe connection to drainage system.
- .2 Storm sewer connection: cast iron service saddle consisting of oil resistant gasket, stainless steel clamp and oil resistant O ring.
- .3 Sump pit: 300 x 300 x 125 mm.

2.5 MANHOLE NECKS

- .1 Concrete brick and mortar.

2.6 MANHOLE FRAMES AND COVERS

- .1 Cast iron manhole frames and covers.
- .2 Bolted on covers to prevent unauthorized entry.

- .3 Size: 762 mm clear diameter.

2.7 GROUNDING

- .1 Ground rods: in accordance with Section 26 05 27 - Grounding - Primary for cable rack grounding.

2.8 CABLE RACKS

- .1 Hot dipped galvanized cable racks and supports.
- .2 12 x 100 mm preset inserts for rack mounting.

2.9 CABLE PULLING EQUIPMENT

- .1 Pulling iron: galvanized steel rods, size and shape as indicated.
- .2 Pull rope: tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.10 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm, with words: "Cable", "Joint" "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.
- .2 Cedar post type markers: 89 x 89 mm square, 1.5 m long, pressure treated with coloured or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable", "Joint", "Conduit" with arrows to indicate change in direction.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

- .1 Install underground duct banks and manholes including formwork.
- .2 Build duct bank and manholes on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density. Open trench completely between manholes before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

- .3 Prior to laying ducts, construct "mud slab" not less than 75 mm thick.
- .4 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
- .5 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.
- .6 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75 mm horizontally and vertically.
 - .1 Stagger joints in adjacent layers at least 150 mm and make joints watertight.
 - .2 Encase duct bank with 75mm thick concrete cover.
 - .3 Use galvanized steel conduit for sections extending above finished grade level.
- .7 Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.
- .8 Use bell ends at duct terminations in manholes or buildings.
- .9 Use conduit to duct adapters when connecting to conduits.
- .10 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.
- .11 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .12 Allow concrete to attain 50% of its specified strength before backfilling.
- .13 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material.
 - .1 Remove weights or wood braces before concrete has set and fill voids.
- .14 Clean ducts before laying:
 - .1 Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .15 Duct cleaning:
 - .1 Pull 300 mm long x diameter 6 mm less than internal diameter of duct wooden mandrel through each duct, immediately after placing of concrete.
 - .2 Then pull stiff bristle brush through duct; avoid disturbing or damaging ducts where concrete has not set completely.
 - .3 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .16 Install four 3 m lengths of 15M reinforcing rods, one in each corner of duct bank when connecting duct to manholes or buildings.
 - .1 Wire rods to 15M dowels at manhole or building and support from duct spacers.
 - .2 Protect existing cables and equipment when breaking into existing manholes.

- .3 Place concrete down sides of duct bank filling space under and around ducts.
- .4 Rod concrete with flat bar between vertical rows filling voids.
- .17 Install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.3 MANHOLES

- .1 Build cast-in-place manholes. Install precast manholes.
- .2 Concrete Placement:
 - .1 Place concrete in two lifts with slab and sump in first, walls, roof and neck in second lift.
 - .2 Provide key in walls to slab.
 - .3 Place 100 x 6 mm PVC water bar vertically in key.
 - .4 Install ground rod before placing slab and place reinforcing steel, inserts for cable rack, pulling irons, drain, duct outlets, duct run dowels before casting walls. Make manhole to duct connection as indicated.
- .3 Provide 115 mm deep window to facilitate cable bends in wall at each duct connection.
 - .1 Terminate ducts in bell-end fitting flush with window face.
 - .2 Provide four 10M steel dowels at each duct run connection to anchor duct run.
 - .3 On runs of 16 ducts and over, support concrete duct encasement on a 700 mm wide by 75 mm thick concrete pier poured against manhole wall between slab and bottom of duct run, provide dowels for anchoring.
- .4 Alternately connect large duct runs by leaving square opening in wall, later pouring duct run and wall opening in one pour and install 10M x 3m reinforcing rods in duct run at manhole connection.
- .5 Build up concrete manhole neck to bring cover flush with finished grade in paved areas and 40 mm above grade in unpaved areas.
- .6 Install manhole frames and covers for each manhole:
 - .1 Set frames in concrete grout onto manhole neck.
- .7 Drain floor towards sump with 1 to 48 slope minimum and install drainage fittings as indicated.
- .8 Install cable racks, anchor bolts and pulling irons as indicated. Grout frames of manholes:
 - .1 Cement grout to consist of two parts sand and one part cement and sufficient water to form a plastic slurry.
- .9 Ensure filling of voids in joint being sealed.
 - .1 Plaster with cement grout, walls, ceiling and neck.
- .10 Spray paint "X" on ceiling of manhole above floor drain or sump pit.

3.4 MARKERS

- .1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run.
 - .1 Place concrete duct marker at ends of such duct runs.
 - .2 Construct markers and install flush with grade.
- .2 Mark ducts every 150m along straight runs and changes in direction.
- .3 Where markers are removed to permit installation of additional duct, reinstall existing markers.
- .4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.
- .5 Provide drawings showing locations of markers.

3.5 FIELD QUALITY CONTROL

- .1 Site Tests/Inspections:
 - .1 Inspection of duct will be carried out by Departmental Representative prior to placing.
 - .2 Placement of concrete and duct cleanout to be done when Departmental Representative present.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 19 - Waste Management And Disposal.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 14 - Power Cables and Overhead Conductors.
- .2 Section 26 12 19 - Pad Mounted, Liquid Filled Power Transformers.
- .3 Section 26 13 18 – Primary Switchgear Assembly to 15kV.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control. Certificates: signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
 - .1 Manufacturer's Instructions: for installation and special handling criteria, installation sequence, cleaning procedures and Storage.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management And Disposal.

PART 2 PRODUCTS

2.1 PVC DUCTS AND FITTINGS

- .1 Rigid PVC duct: Type DB2 with fabricated or moulded fittings, for direct burial expanded flange ends, Trade size 6.

- .1 Nominal length: 3m plus or minus 12 mm.
- .2 Rigid PVC split ducts.
- .3 All Duct Banks shall be CSA approved.
- .4 All Duct Banks containing primary and secondary conductors shall be in concrete encased duct banks when passing beneath a high traffic area.
- .5 A 100mm diameter duct shall be used for each run of primary cables and secondary.
- .6 All 90 Degree bends in a duct shall use rigid PVC conduit and for the remainder of the duct run, PVC Type DB-2 shall be used, also long sweep 90 degree rigid PVC conduit bends shall be used at both the pole and the concrete pad.
- .7 Provide minimum of #12 fish wire shall be installed in each duct and both ends of the duct shall be securely capped; for easy access to cables for future maintenance purposes.
- .8 Duct riser on the pole shall face away from any roads and sidewalks to provide adequate protection for persons in the vicinity.
- .9 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make a complete installation.
- .10 Rigid PVC 90 degrees, 45 degrees bends and 5 degrees angle couplings as required.

2.2 SOLVENT WELD COMPOUND

- .1 Solvent cement for PVC duct joints.

2.3 FIBREGLASS DUCTS

- .1 Fibreglass reinforced thermoset duct: Type AG BG, Trade size 6, watertight self-extinguishing type.
- .2 Couplings, reducers, plugs, caps, adaptors, and supports to make a complete installation.
- .3 Expansion joints every 3 m and as required.

2.4 PLASTIC POLYETHYLENE PIPE

- .1 Flexible, Rigid plastic polyethylene pipe with approved couplings and fittings required to make complete installation for duct drainage.

2.5 CABLE PULLING EQUIPMENT

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

2.6 MARKERS

- .1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

- .2 Cedar post type markers: 89 x 89 mm square, 1.5 m long, pressure treated with coloured or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable" "Joint" or "Conduit" with arrows to indicate change in direction.

2.7 WARNING TAPE

- .1 Standard 4-mil polyethylene 76 mm wide tape, yellow with black letters, imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW ".

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install duct in accordance with manufacturer's instructions and at elevations as indicated.
- .2 Clean inside of ducts before laying.
- .3 Install plastic duct spacers and ensure full, even support every 1.5 m and smooth transition throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.
- .6 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 material.
 - .1 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 Install a pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Place continuous strip of warning tape 300 mm above duct before backfilling trenches.
- .9 Install markers as required.
- .10 Notify the Departmental Representative for field review upon completion of direct buried ducts and obtain acceptance prior to backfill.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 19 - Waste Management And Disposal.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management And Disposal.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for fuse cutouts and fuse links and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for fuse cutouts and fuse links for incorporation into manual.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 PRODUCTS

2.1 FUSE CUTOUTS

- .1 Outdoor open cutout, vertical mounted, c/w fuse holder, continuous rating as indicated in drawings at 12.47KV, interrupting rating as indicated in drawings, hook stick operated.
- .2 Insulators: polymer.

2.2 FUSE HOLDERS AND LINKS

- .1 Fuse holders: automatic indicating drop-out type, extra heavy duty, ampacity rating as indicated in drawings.
- .2 Fuse links: electrically and mechanically interchangeable between various makes and types, removable button head design. ANSI type sized as indicated.
- .3 Connectors to be parallel groove type.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fuse cutouts and fuse links installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Assemble and mount fuse cutouts in accordance with manufacturer's written recommendations.

3.3 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.

END OF SECTION