

**CONCRETE ENCASED DUCT BANKS AND UTILITY VAULTS**

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**1. GENERAL**

**1.1 Work Included**

- .1 Supply installation of concrete encased duct banks and precast concrete utility vaults for site electrical services.

**1.2 References**

- .1 ASTM D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
- .2 CAN/CSA-A3000, Cementitious Materials Compendium, which includes:
  - .1 CAN/CSA-A5, Portland Cement
- .3 CSA A23.1/A23.2-00, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
- .4 CSA G30.18, Billet Steel Bars for Concrete Reinforcement
- .5 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement
- .6 CSA C22.2 No. 211-1, Rigid Types EB1 and DB2/ES2 PVC Conduit
- .7 American Standards for Testing and Materials: ASTM A48 - Grey Iron Castings
- .8 CAN/CSA A82.1 - Burned Clay Brick (Solid Masonry Units made from Clay or Shale)
- .9 CAN/CSA C83 - Communication and Power Line Hardware
- .10 CAN3-C22.3 #7 - Underground Systems

**1.3 Shop Drawings**

- .1 Submit Shop Drawings for precast concrete vaults, reinforcing for duct banks, floor drain, back-water valve, trap, and cable racks in accordance with Section 01300.

**2. PRODUCTS**

**2.1 PVC Ducts**

- .1 PVC ducts, type DB2, encased in reinforced concrete, size as indicated on drawings.

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**2.2 PVC Duct Fittings.**

- .1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors, spacers as required to ensure complete installation.
- .2 Expansion joints.
- .3 Rigid PVC 5 degree angle couplings.
- .4 Rigid PVC 1.5m radius bend fittings.

**2.3 Precast Concrete Utility Vaults**

- .1 Pre-cast concrete utility vaults, risers and auxiliary sections fabricated in steel forms.
- .2 Aggregates: to CSA A23.1/A23.2.
- .3 Portland cement: to CAN/CSA-A3000-A5.
- .4 Steel welded wire fabric mesh reinforcing: to CSA G30.5.
- .5 Steel reinforcing bars: to CSA G30.18.
- .6 Neoprene gasket seals between manhole sections: to ASTM D1056.
- .7 Nominal inside dimensions: as indicated in schedule.
- .8 Riser barrel/neck: 1200 mm inside diameter, height as required.
- .9 Sump pit: 300 x 300 x 125 mm.
- .10 Slab top complete with cast iron manhole frame and cover.
- .11 Cover size: 900 mm inside diameter minimum.
- .12 Uplift drain holes: 2-75 mm diameter holes each side 150 mm from top of floor located at third points.
- .13 50mm hole in floor for installation of ground rod.
- .14 Acceptable product: Vault Con-Force Type 108.

**2.4 Grounding**

- .1 In accordance with Section 16160 – Primary Grounding for duct bank, manhole and cable rack grounding.

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**2.5 Cable Racks**

- .1 Cable racks and supports manufactured from ASTM A-36 steel and hot dipped galvanized per ASTM A-123 and A-153.
- .2 12 x 100 mm galvanized steel inserts for rack mounting.

**2.6 Cable Pulling Equipment**

- .1 Pulling iron: galvanized steel rods, size and shape as indicated, integrally cast in concrete.
- .2 Pull rope: 6 mm stranded nylon, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

**2.7 Miscellaneous Materials**

- .1 Cast-in-place concrete shall conform to CSA-A23.1 and Section 03300 – Cast-In-Place Concrete, exposure Class S1.
- .2 Reinforcing steel for cast-in-place concrete shall conform to Section 03200 – Reinforcing Steel.
- .3 Drain pipe shall be PVC SDR 35 conforming to City of Winnipeg Standard Construction specifications.
- .4 75mm diameter floor drain fittings consisting of floor drain, back water valve and trap.
- .5 Manhole frames and covers: cast ferrous alloy frames and covers shall conform to ASTM A48, Class No. 30 C.
- .6 Waterproofing material shall be emulsified asphalt, anionic slow-setting type.
- .7 Granular material for bedding and backfill in accordance with Section 02223.
- .8 Concrete cable markers: 100 x 600 x 100 mm, with words: “cable”, “joint” or “conduit” impressed in the top surface, with arrows to indicate change in direction of duct runs.

**3. EXECUTION**

**3.1 Installation General**

- .1 Install underground duct banks including formwork and utility vaults.
- .2 Build duct bank and utility vaults on well-compacted granular fill not less than 100 mm thick, compacted to 95% Standard Proctor dry density.
- .3 Open trench completely between utility vaults to be connected before duct banks are placed and ensure that no obstructions will necessitate change in grade of duct banks.

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- .4 Install duct banks at elevations and with slope as indicated and minimum slope of 1 to 400. Duct runs shall be graded to drain towards one or both terminal points of each duct run and graded away from building or structure entrances.
- .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 as indicated. Stagger joints in adjacent layers at least 150 mm and make joints watertight.
- .7 Install 4/0 ground conductors as indicated on Drawings.
- .8 Make PVC duct transpositions, offsets, and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.
- .9 Use bell ends at duct terminations in vaults, buildings, or structures.
- .10 Conduit penetrations into buildings shall be sealed with Roxtek RS seals complete with acid proof stainless steel rings, unless indicated to be the draining ends.
- .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 75% 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. Remove weights or wood braces before concrete has set and fill voids.
- .14 Clean ducts before placing. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .15 Immediately after placing of concrete, 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. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling in cables.
- .16 Place concrete thoroughly filling space under and around ducts, vibrate or rod as required to fill all voids.
- .17 In each duct install pull rope continuous throughout each duct run with 3m spare rope at each end.

### **3.2 Utility Vaults**

- .1 Install precast concrete vault so as to bring manhole cover 40 mm above grade in unpaved areas, using riser rings as required.

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- .2 Seal and waterproof precast sections in accordance with manufacturer's instructions.
- .3 Install drain fittings and piping. Extend drain piping to 3m beyond vault, direction of drain will be provided by Contract Administrator.
- .4 Make vault to duct connections as indicated on Drawings.
- .5 Install 19 x 3000 mm copper clad ground rod through hole in vault floor.
- .6 Install 4/0 bare copper conductor around interior perimeter floor.
- .7 Bond each cable rack with two (2) 4/0 bare copper conductors.
- .8 Connect ground rod, perimeter conductor, duct bank ground conductors and cable rack ground together using cadweld connections.
- .9 Install ladder rungs, anchor bolts, pulling irons, and cable racks as indicated.
- .10 Install manhole riser and cover.

**3.3 Inspection**

- .1 Construction review of duct will be carried out by Contract Administrator prior to placing. Placement of concrete and duct cleanout to be done with Contract Administrator present.

**3.4 Installation of Utility Vaults**

- .1 Earth Excavation
  - .1 Earth shall be excavated to accommodate a minimum 150 mm thick granular base in accordance with Section 02223 using Type 2 fill compacted to 95% Standard Proctor density.
  - .2 Earth shall be excavated for drain pipes as indicated on the Drawings.
- .2 Installation of Utility Vaults
  - .1 Utility Vaults shall be oriented such that ducts or duct bank entries will have an angle of 90 degrees between maintenance hole wall and the axis of the ducts or duct bank. If this is not possible, the angle shall not be less than 45 degrees.
  - .2 All sharp projections and edges of concrete shall be ground smooth prior to installation of wiring baffles or mechanical supports for cables.
  - .3 All liquid and debris shall be cleaned from the units upon completion and prior to the acceptance of work by the Contract Administrator.
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- .5 The precast unit shall be installed plumb, true to alignment and grade, and firmly bedded on the granular base.
  - .6 During installation, the duct entry holes shall be oriented in the required direction. The enlarging of duct entry holes is prohibited.
- .3 Grounding
- .1 Vault manhole frames or covers shall be connected to the system ground wire. Where frames are not present, 1.5 m of #6 AWG ground wire shall be connected between the system ground wire and the metallic cover and at least 1.5 m of wire shall be left loose for cover removal.
- .4 Frames and Covers
- .1 Cast iron frames for vault access covers shall be adjusted to the required elevation and crossfall. Mortar mix shall be used to smooth out any edges protruding above the concrete envelope.
  - .2 Cast iron covers for vault access shall be secured as indicated on the Drawings.
  - .3 Covers for precast concrete vaults shall be firmly seated conforming to the manufacturer's instructions.
- .5 Backfill
- .1 Backfill for units installed within roadbeds or in sidewalks shall be carried out with clean granular material compacted to minimum 95% Standard Proctor density.
  - .2 Backfill for units installed in grassed areas shall be native backfill placed and compacted to minimum 95% Standard Proctor density.
  - .3 Install granular drainage material in accordance with Section 02223 around the vault perimeter with a cross section 300 mm above the uplift drain holes to the underside of vault floor and 600 mm wide. Wrap drainage material in filter cloth in accordance with Section 02223.

**END OF SECTION**