

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 30 00 - Cast-In-Place Concrete.
- .4 Section 04 22 00 - Concrete Unit Masonry.
- .5 Section 26 05 28 - Grounding - Secondary.
- .6 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A1064/A1064-13, Standard Specification for Carbon-Steel Wire, e Reinforcement, Plain and Deformed, For Concrete.
  - .2 ASTM C 478/C 478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections.
  - .3 ASTM D 1056-14, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .2 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction Test Methods and Standard Practices for Concrete.
  - .3 CAN/CSA-G30.18-09, Carbon 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.
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- .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 – Testing and 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 in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:
  - .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.
    - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
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- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2 - PRODUCTS**

### **2.1 PVC DUCTS**

- .1 PVC ducts, type DB2, encased in reinforced concrete.

### **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 MANHOLES**

- .1 Provide type indicated.
  - .2 Top, walls, and bottom: reinforced concrete.
  - .3 Walls and bottom: monolithic concrete construction.
  - .4 Locate duct entrances and windows near corners of structures to facilitate cable racking.
  - .5 Covers: fit frames without play.
  - .6 Form steel and iron to shape and size with sharp lines and angles.
  - .7 Castings: warp and blow hole free.
  - .8 Exposed metal: smooth finish without sharp lines and arises.
  - .9 Provide lugs, rabbets, and brackets.
  - .10 Set pulling-in irons and other built-in items in place before depositing concrete.
  - .11 Install pulling-in iron in wall opposite each duct line entrance.
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- .12 Cable racks, including rack arms and insulators: sized to accommodate cable.

## **2.4 PRECAST CONCRETE MANHOLES**

- .1 Precast concrete manholes and auxiliary sections fabricated in steel forms.
- .2 Aggregates: to CSA A23.1/A23.2.
- .3 Portland Cement: to CAN/CSA-A3001.
- .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 D 1056.
- .7 Size: 914 mm clear diameter, unless indicated otherwise.
- .8 Precast Concrete Manholes: to ASTM C 478/C 478M, size as indicated.
  - .1 Manhole step and ladder rung spacing: 405.

## **2.5 DRAINAGE**

- .1 Sump pit: 300 x 300 x 125 mm.

## **2.6 MANHOLE NECKS**

- .1 Concrete brick and mortar.

## **2.7 MANHOLE FRAMES AND COVERS**

- .1 Cast iron manhole frames and covers.
- .2 Size: 914 mm clear diameter, unless indicated otherwise.

## **2.8 GROUNDING**

- .1 Ground rods: in accordance with Section 26 05 28 - Grounding - Secondary for cable rack grounding.
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## **2.9 CABLE RACKS**

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

## **2.10 CABLE PULLING EQUIPMENT**

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

## **2.11 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.

## **2.12 WARNING TAPE**

- .1 4 mil Polyethylene warning tape 75 mm in width. Text on tape to read "CAUTION BURIED ELECTRIC LINE 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 GENERAL**

- .1 Install underground duct banks and manholes including formwork.
  - .2 Build duct bank on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.
  - .3 Open trench completely between manholes before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
  - .4 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
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- .5 Install base spacers at maximum intervals of 0.9 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.
    - .1 Tie ducts to spacers with twine or other non-metallic material.
    - .2 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 steel 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.
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- .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 Install precast manholes.
- .2 Install manhole frames and covers for each manhole:
  - .1 Set frames in concrete grout onto manhole neck.
- .3 Drain floor towards sump with 1 to 48 slope minimum and install drainage fittings as indicated.
- .4 Install cable racks, anchor bolts and pulling irons as indicated.
- .5 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.
- .6 Ensure filling of voids in joint being sealed.
  - .1 Plaster with cement grout, walls, ceiling and neck.
- .7 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 100 m along straight runs and changes in direction.
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- .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.
- .6 Lay warning tape throughout ductbank length half way distance between finish grade level and the top of ductbank.

### **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 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.