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30 DUCT BANK AND MANHOLES

30.1 GENERAL

30.1.1 Scope

- 1 This Part specifies the requirements for duct bank and manholes.
- 2 Related Parts and Sections are as follows:

This Section

- Part 6..... Cables and small wiring
- Part 7..... Conduits
- Part 8..... Trunking
- Part 9..... Cable Trays
- Part 10..... Accessories and General Power

30.1.2 Description

- 1 Duct bank and manholes shall be provided as specified and shown on the drawings.

30.1.3 Submissions

- 1 Submissions shall be in accordance with Part 1 of this Section and Part 7 of Section 1.
- 2 Shop Drawings submission shall include dimensional drawings of the duct bank and manholes, including sections and elevations, showing the following:
 - (a) sizes and positions of manholes
 - (b) duct routing
 - (c) location of entry to buildings
 - (d) other pertinent data.
- 3 Submission of the project data shall be as follows:
 - (a) full specifications of the enclosure and the components of the equipment with relevant sheets of manufacturer's catalogues
 - (b) confirmation that the equipment complies with the relevant specifications.

30.1.4 References

- 1 The following standards are referred to in this Part:
 - ASTM A48/A48MStandard Specification for Gray Iron Castings
 - ASTM C857Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
 - ASTM C891Standard Practice for Installation of Underground Precast Concrete Utility Structures
 - ASTM C1037Standard Practice for Inspection of Underground Precast Concrete Utility Structures

30.2 PRODUCTS

30.2.1 General

- 1 Duct Banks and manholes shall confirm to requirements as specified in relevant standard as applicable.
- 2 The specification shall be in accordance with latest edition of local and International regulations e.g. QGEWC (KAHRAMAA), NEMA, ASTM, IEE etc.
- 3 The product selected and proposed shall include manufacturer's instructions that indicate application conditions and limitations of use stipulated by the product testing agency specified under Regulatory Requirements.
- 4 The contractor shall select the product only from the manufacturer specializing in manufacturing products specified in this Part with minimum five years documented experience of the products being satisfactorily in use in a similar service and climatic conditions.
- 5 The contractor shall ensure proper co-ordination with related civil and other project associated activities prior to the selection of the equipment.
- 6 The contractor shall clearly show locations and arrangements of fittings on the drawings.
- 7 To ensure that field measurements are as indicated.
- 8 Provide detail routing and termination locations of duct bank prior to excavation. for rough in.
- 9 Provide locations of manholes prior to excavating for installation.

30.2.2 Rigid Steel Conduit

- 1 Rigid Steel Conduit: ANSI C80.1 or other approved standard.
- 2 Fittings: NEMA FB 1 or other approved standard, steel.

30.2.3 Plastic Conduit

- 1 Rigid Plastic Conduit: NEMA TC 2, Schedule 40 or 80 PVC or as specified, with fittings and conduit bodies to NEMA TC 3 or other approved standard.
- 2 Rigid Plastic Underground Conduit: UL 651A, Type A PVC; UL 651A, Type EB PVC; High-density polyethylene, Schedule 40 or Fibreglass-reinforced epoxy as specified or indicated.

30.2.4 Plastic Duct

- 1 Plastic Utilities Duct: NEMA TC 6; PVC or ABS Type EB or DB as specified or other approved standard.
- 2 Plastic Utility Duct Fittings: NEMA TC 9 or other approved standard.
- 3 Plastic Communications Duct and Fittings: NEMA TC 10, Type EB or DB as specified or other approved standard.

30.2.5 Reinforced Resin Conduit

- 1 Conduit and Fittings: NEMA TC 14, Type SW or HW as specified or other approved standard.
- 2 Joining Method: Tapered bell and spigot joints, threaded joints or saw-cut system as specified.

30.2.6 Pre-Cast Concrete Manholes

- 1 Pre-cast concrete manholes shall be as specified as follows:
 - (a) Description: Precast manhole designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories or as specified.
 - (b) Loading: ASTM C857, Class A-16, A-12, A-8 or A-0.3 as specified.
 - (c) Shape: Square or rectangular with truncated corners or as indicated.
 - (d) Nominal Inside Dimensions: Specified or indicated mm x mm.
 - (e) Corner Panel Dimensions: Specified mm wide.
 - (f) Inside Depth: Specified mm.
 - (g) Wall Thickness: Specified mm.
 - (h) Base Section: Include 75 or specified mm deep x 350 or specified mm round sump with cast sleeve, and two 25 mm ground rod openings where specified
 - (i) Top Section: Include 1000 mm diameter or other approved size and shape grooved opening for frame and cover.
 - (j) Riser Casting: 150 or 300 mm as specified or indicated, with manhole step cast into frame.
 - (k) Frames and Covers: ASTM A48/A48M; Class 30B gray cast iron, 686 or 762 mm size as specified or other approved standard and size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC, TELEPHONE or as directed by the Engineer to indicate utility.
 - (l) Duct Entry Provisions: Single duct knockouts, window knockouts or windows with plastic duct terminators and diaphragms as specified.
 - (m) Duct Entry Locations: As specified or indicated.
 - (n) Duct Entry Size: 100 or 150 mm as specified.
 - (o) Cable Pulling Irons: Use galvanised rod and hardware. Locate opposite each duct entry. Provide watertight seal.
 - (p) Cable Rack Inserts: Minimum load rating 365 kg or as specified. Locate at specified or indicated distance on centre.
 - (q) Cable Rack Mounting Channel: 38 x 19 mm or approved size steel channel, 1.2 m or specified length. Provide cable rack arm mounting slots 38 mm or at standard centres.
 - (r) Cable Racks: Steel channel, 38 x 19 x 350 mm or other approved size, with fastener to match mounting channel.
 - (s) Cable Supports: Porcelain, Maple or other approved type clamps and saddles.

- (t) Manhole Steps: Polypropylene plastic manhole step with 13 mm steel reinforcement, Cast steps at 300 mm on centre vertically or as specified or indicated or Ladder: Aluminium rung, approved length, with top hook to engage manhole step in riser casting. Provide one ladder for each manhole.
- (u) Sump Covers: ASTM A48/A48M; Class 30B gray cast iron or other approved standard.
- (v) Source Quality Control: Inspect manholes in accordance with ASTM C1037 or other approved standard.

30.2.7 Accessories

- 1 Underground Warning Tape: 100 mm wide plastic tape, detectable type, coloured yellow with suitable warning legend describing buried electrical lines.

30.2.8 Cast in Place Manhole Accessories

- 1 Frames and Covers: ASTM A48/A48M; Class 30B gray cast iron, 686 or 762 mm size as specified or other approved standard and size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC, TELEPHONE or as directed by the Engineer to indicate utility.
- 2 Cable Pulling Irons: Use galvanised rod and hardware.
- 3 Cable Rack Inserts: Minimum load rating of 365 kg or as approved.
- 4 Cable Rack Mounting Channel: 38 x 19 mm or approved size steel channel, 1.2 m or specified length. Provide cable rack arm mounting slots 38 mm or at standard centres.
- 5 Cable Racks: Steel channel, 38 x 19 x 350 mm or other approved size, with fastener to match mounting channel.
- 6 Cable Supports: Porcelain, Maple or other approved type clamps and saddles.
- 7 Manhole Steps: Polypropylene plastic manhole step with 13 mm steel reinforcement, Cast steps at 300 mm on centre vertically or as specified or indicated or Ladder: Aluminium rung, approved length, with top hook to engage manhole step in riser casting. Provide one ladder for each manhole.
- 8 Sump Covers: ASTM A48/A48M; Class 30B gray cast iron or other approved standard.

30.3 INSTALLATION

30.3.1 Duct Bank Installation

- 1 Install duct to locate top of ductbank at depths as indicated on drawings or install duct to locate top of ductbank minimum specified or indicated mm below finished grade.
- 2 Install duct with minimum slope of 100 mm per 25.4 m (0.33 percent) or as specified or indicated. Slope duct away from building entrances.
- 3 Cut duct square using saw or pipe cutter; de-burr cut ends.

- 4 Insert duct to shoulder of fittings; fasten securely.
- 5 Join non-metallic duct using adhesive as recommended by manufacturer.
- 6 Wipe non-metallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- 7 Install no more than equivalent of two 90-degree bends between pull points.
- 8 Provide suitable fittings to accommodate expansion and deflection where required.
- 9 Terminate duct at manhole entries using end bell.
- 10 Stagger duct joints vertically in concrete encasement 150 mm minimum.
- 11 Use suitable separators and chairs installed not greater than 1200 mm on centres.
- 12 Band ducts together before backfilling or placing concrete.
- 13 Securely anchor duct to prevent movement during concrete placement.
- 14 Place concrete under provisions of relevant section. Use mineral pigment to colour concrete where specified.
- 15 Provide minimum 75-mm or other specified concrete cover at bottom, top, and sides of ductbank.
- 16 Provide specified or indicated steel reinforcing bars in top of bank under paved areas.
- 17 Connect to existing concrete encasement using dowels.
- 18 Connect to manhole wall using dowels.
- 19 Provide suitable pull string in each empty duct except sleeves and nipples.
- 20 Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
- 21 Backfill trenches under provisions of relevant section.
- 22 Interface installation of underground warning tape with backfilling specified in relevant section. Install tape 150 mm below finished surface.

30.3.2 Pre-Cast Manhole Installation

- 1 Excavate for manhole installation under the provisions of relevant section.
- 2 Install and seal precast sections in accordance with ASTM C891 or other approved standard.
- 3 Install manholes plumb.
- 4 Use precast neck and shaft sections to bring manhole cover to finished elevation.
- 5 Attach cable racks to inserts after manhole installation is complete.

- 6 Where specified or indicated, install drains in manholes and connect to site drainage system or provide DN100 pipe terminating in 1/4 cu m crushed gravel bed under provisions of relevant section.
- 7 Damp proof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of relevant section.
- 8 Backfill manhole excavation under the provisions of relevant section.

30.3.3 Cast in Place Manhole Installation

- 1 Excavate for manhole installation under the provisions of relevant section.
- 2 Formwork: Form inside and outside manhole surfaces in accordance with provisions of relevant section.
- 3 Reinforcing: Install reinforcing under the provisions of relevant section.
- 4 Concrete: Provide air-entrained, 20 MPa compressive strength at 28 days under the provisions of relevant section or as specified.
- 5 Shape: As specified or indicated.
- 6 Nominal Dimensions: As specified or indicated.
- 7 Inside Depth: As specified or indicated.
- 8 Wall Thickness: As specified or indicated.
- 9 Base: Include 350 mm drain opening and two 25 mm ground rod openings where specified. Slope to drain at 6.35 mm per m (to 2 percent).
- 10 Top: Include 1000-mm diameter or other approved size and shape opening; cast 13-mm rod in opening to accept ladder hook.
- 11 Duct Entry: Cast ducts openings in walls as indicated.
- 12 Cable Pulling Irons: Locate opposite each duct entry.
- 13 Cable Rack Inserts: Locate at specified mm on centre.
- 14 Construct brick collar with 760-mm or approved size clear opening to bring cover to proper elevation.
- 15 Manhole Steps: Cast steps at 300 or specified mm on centre vertically or install ladder in each manhole.
- 16 Attach cable racks to inserts after manhole construction is complete.
- 17 Install drains in manholes and connect to site drainage system or provide 100 mm pipe terminating in 0.25 cu m crushed gravel bed under provisions of relevant section where specified or indicated.

- 18 Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of relevant section.
- 19 Backfill manhole excavation under the provisions of relevant section.

30.4 QUALITY CONTROL AND TEST PROCEDURES

30.4.1 General

- 1 The manufacturer shall provide proof of a stringent Quality Control (QC) Plan or Inspection Test Plan (ITP). In particular the main equipment manufacturing stages sanctioned by appropriate tests such as: incoming components inspection, discrete sub-assembly tests and complete functional checks on the final product. Final inspection and calibration operations shall be documented in a report drawn up by the supplier's Quality Inspection department.
- 2 The Assembly shall not leave the manufacturer's works until the works test sheets have been duly approved and stamped by the Engineer and written permission is obtained for their dispatch to site.

30.5 ENVIRONMENT

30.5.1 General

- 1 Environmental conditions shall be in accordance with Section 1 Part 1 unless specified herein.
- 2 Minimum ambient temperature shall be 0°C.
- 3 Maximum relative humidity shall be 95%.

END OF PART