**SECTION 26 05 43**

**UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS**

**BASED ON DFD MASTER ELECTRICAL SPEC DATED 03/01/23**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

**PART 1 - GENERAL**

**SCOPE**

The work under this section includes underground cast‑in‑place concrete ductbanks for electrical power and signal system distribution. The term “signal” is used thorough this specification as a generic term to include communications, control, security and other low voltage systems. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Submittals

PART 2 - PRODUCTS

Conduit

Elbows

Spacers

Conduit Termination in Manholes and Buildings

Plugs

Pull Tape

Grounding

Drainage Assembly

Concrete Encasement

Reinforcing Steel

Underground Warning Tape

PART 3 - EXECUTION

Excavations

Placement of Conduit

Placement of Reinforcing Bars

Placement of Concrete

Backfill

Restoration

Accessory Installation

Construction Verification Items

**RELATED WORK**

Applicable provisions of Division 1 govern work under this Section.

Section 26 05 44 ‑ Manholes

Section 26 08 00 - Commissioning of Electrical.

Section 01 91 01 or 01 91 02 – Commissioning Process

**SUBMITTALS**

Indicate material specifications, and provide product data on conduit, spacers, terminators, reinforcing steel and related components.

**PART 2 - PRODUCTS**

**CONDUIT**

Size: 5” nominal for voltages above 1000V, and 4” nominal for 1000V or lower and communication system applications unless noted otherwise on drawings..

Material: Rigid polyvinyl chloride (PVC) marked at uniform intervals to indicate the kind of material; type Schedule 40 heavy wall, type EB-20 (TC-6), or type EB-35 (TC-8). Type EB conduit is rated for use only in concrete encased applications.

**ELBOWS**

Material to match conduit; minimum bend radius of 36 inches (915 mm).

**SPACERS**

Plastic, to maintain 3” minimum between conduits.

**CONDUIT TERMINATION IN MANHOLES AND BUILDINGS**

Bell Ends:

Manufactured bell ends of appropriate sizes at each end of conduit. When entering a new building or a new manhole a pre-manufactured PVC bell end system (as manufactured by Formex or similar) with conduit seals, provisions for roughing into the concrete and water stops is allowed.

Seals:

When entering an existing building or manhole below grade, the concrete shall be core drilled for the appropriate size conduit and seal. The seal shall be a mechanical interlocking assembly of modular rubber links properly sized to fit the pipe and tightened in place, in accordance with the manufacturer’s instruction.

Bushings:

Steel grounding bushings shall be used on all metal conduits entering a building or manhole.

**PLUGS**

Expandable pipe plug, gas and water tight, for sealing empty conduit. Plug shall be high impact plastic with an outer rubber gasket expandable by hand tightening a wing nut on a central spindle.

**PULL TAPE**

Polyester pull tape, ½” width, tensile strength of 1,250 lbs. with sequential footage markings along the entire length of the tape as manufactured by Greenlee, Carlon, Garvin Industries, or Neptco (Muletape). Install pull tape in each empty conduit.

**GROUNDING**

Steel grounding bushings shall be grounded to manhole or junction box ground.

**DRAINAGE ASSEMBLY**

All ducts shall drain to an open end - preferably a manhole.

**CONCRETE ENCASEMENT**

Concrete used throughout shall be ready mixed concrete furnished by an approved mixing plant. The plant shall comply with the requirements of National Ready Mixed Concrete Association certification plan.

The concrete mix used with type Schedule 40 heavy wall conduit shall be 3000 psi minimum, 3/4” aggregate.

The concrete mix used with type EB-20 (TC-6), or type EB-35 (TC-8) thin wall conduit shall be 2500 psi minimum, 3/8” pea gravel aggregate.

The concrete mix used for electrical power encased ducts shall include a RED color mix, resulting in a red colored duct package.

The slump shall be just enough to allow the mix to flow to the bottom of the formation and yet not be so wet as to cause the ducts to float.

Encase duct with 3 in. minimum of concrete on top, bottom, and sides with top of duct bank troweled to a smooth crown to prevent pooling of water.

**REINFORCING STEEL**

Provide reinforcing steel the entire length of the duct system, four - #4 bars - one in each corner, minimum, or as shown on the drawings. Tie or dowel the reinforcement steel into the connecting walls of manholes, vaults and buildings, etc. to protect against vertical shearing.

**UNDERGROUND WARNING TAPE**

Detectable underground warning tape, 2” wide minimum, 5 mil thickness, containing a foil core as manufactured by Presco, Seton, or similar.

Tape color and labeling shall be as follows:

Electrical Power Systems: Red color and labeled with the words "CAUTION-BURIED ELECTRIC LINE BELOW" or similar.

Communication Systems: Orange color and labeled with the words "CAUTION-BURIED COMMUNICATION LINE BELOW” or similar.

**PART 3 - EXECUTION**

***Consultant shall provide ductbank cross section details on the drawings. The details shall include conduit size, quantity, configuration, reinforcement bar quantity and location, etc.***

**EXCAVATIONS**

Excavate trenches for ductbank to adequate width, depth, and proper slope as specified.

Install forms on sides of ductbank if trench is not of proper firmness to prevent cave-in.

The trench sidewall shall be less than 6 inches from the edge of the conduit being installed. Install forms if needed to limit the trench width.

Bottom of trench shall be undisturbed earth. If trench bottom is too low for proper grade, fill to proper level with sand and mechanically compact it.

Each excavated section from manhole to manhole and from manhole to building shall be completely excavated and graded before any duct is laid in that section.

**PLACEMENT OF CONDUIT**

Install flush bell ends on duct at manholes and buildings. When entering a new building or a new manhole, a pre-manufacture end bell system (by Formex or similar) with conduit seals is allowed.

When entering an existing building or manhole, core drill existing walls and waterproof using a mechanical seal of assembled rubber links properly sized for the pipe and tighten in place, in accordance with the manufacturer’s instruction, after the new conduit is installed.

Install spacers as recommended by conduit manufacturer and requirements stated above, but not to exceed a maximum of 6 ft-0 in. on center for PVC conduit and 8 ft-0 in. on center for steel conduit. Bottom spacers shall rest on 8" X 16" X 2" concrete pads to prevent them from sinking into the ground and reducing the bottom concrete cover. Stagger conduit joints in concrete encasement 6 in. minimum horizontally.

Tie the conduit assembly down at regular intervals so it does float up in the concrete during the pour.

Pitch conduit properly for drainage to manhole and to prevent low pockets or irregular dips between conduit ends. Pitch conduit away from building and toward manhole. Minimum pitch to be 4 inches per 100 feet.

Install not more than one 90 degree bend or equivalent between manholes for primary conduit and two 90 degree bends or equivalent for signal conduit.

In ductbanks with both primary and signal conduit, primary conduit shall be straight and the signal conduit shall contain bends as necessary to accommodate the primary duct.

Conduits for electrical power rated above 600V and for conduits for electrical power 600V or less shall not be routed in new or existing systems manholes. In addition, systems conduits shall not be routed in new or existing power manholes.

Install insulated grounding bushings on steel duct ends.

Install closure plugs in all empty conduits at manhole and building entrances and at terminations in equipment pedestals to prevent the entrance of water, sediment and vapors.

**PLACEMENT OF REINFORCING BARS**

At new building and manhole walls, tie duct bank and wall reinforcing steel together to provide a permanent connection.

At existing building and manhole walls, dowel reinforcement bar into the wall to provide protection against vertical shearing. Use epoxy adhesive to secure the dowels.

Install the bars - one in each corner, minimum or as shown on the drawings, overlap the joints 12” and tie into the connecting walls of manholes, vaults, and buildings, etc.

**PLACEMENT OF CONCRETE**

After ducts are in place and before the concrete is poured, the installation shall be inspected by the DFD Construction Representative. Notify the Construction Representative at least two days before the time of inspection.

The Contractor shall supervise the placement of concrete in the ductbank.

Complete entire section of conduit from manhole to manhole or from manhole to building before encasement by concrete.

Top of concrete envelopes shall be not less than 24 inches below grade.

In placing concrete around the conduit, adjust delivery chute so the fall of the concrete into the trench is minimal.

Vibrating is not allowed as it tends to cause the conduit to float up in the concrete.

Provide minimum of 3” (76 mm) of concrete cover over conduit at the top, bottom and sides with top of duct bank troweled to a smooth crown to prevent pooling of water.

Place concrete continuously from manhole to manhole to building without interruption.

Extend concrete envelope to finish floor grade or interior wall surface in buildings and finish pad grade at equipment. Maintain moisture seal.

**BACKFILL**

Compact backfill around ductbank.

Install warning tape 12" below finish grade over all ductbanks. For ductbanks more than 24” wide, install multiple runs of warning tape no farther than 18” apart. The warning tape shall not be farther than 12” from the ductbank edge.

**RESTORATION**

After completion of ductbank installation, return all ground and pavement surfaces to original condition or to condition as indicated on the drawings. This includes all sidewalks, curbs, streets, parking areas, lawns, plantings, etc.

**ACCESSORY INSTALLATION**

Pull a mandrel/swab (diameter 1/4 in. smaller than conduit) through each conduit in completed ductbank to insure adequate opening of duct run.

Install pull tape with measurement markings in each empty duct.

Install closure plugs in all empty conduits at manhole and building entrances and at terminations in equipment pedestals to prevent the entrance of water, sediment and vapors.

Ground all steel bushings to manhole or junction box ground.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION