

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the protection, furnishing, installation, and connection of precast manholes and pull boxes with ducts to form a complete underground raceway system.
- B. "Duct" and "conduit," and "rigid metal conduit" and "rigid steel conduit" are used interchangeably in this specification.

1.2 RELATED WORK

- A. Section 31 20 11, EARTH MOVING (SHORT FORM): Trenching, backfill and compaction.

1.3 QUALITY ASSURANCE

- A. Coordinate existing layout of ducts, manholes, pull boxes, and pull-boxes with final arrangement of other utilities, site grading, surface features, and new retaining wall as determined in the field.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Clearly present sufficient information to determine compliance with drawings and specifications and representation of existing underground utilities.
 - 2. Include existing manholes, pull boxes, duct materials, and hardware. Submit plan and elevation drawings, showing existing underground structures and utility raceways.
 - 3. Proposed deviations from details on the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes or pull boxes at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit four copies to the COR for approval prior to construction.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Concrete Institute (ACI):
 - Building Code Requirements for Structural Concrete

- 318/318M-05.....Building Code Requirements for Structural
Concrete & Commentary
- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute (ANSI):
 - 77-07.....Underground Enclosure Integrity
- D. American Society for Testing and Materials (ASTM):
 - C478-09.....Standard Specification for Precast Reinforced
Concrete Manhole Sections
 - C858-09.....Underground Precast Concrete Utility Structures
 - C990-09.....Standard Specification for Joints for Concrete
Pipe, Manholes and Precast Box Sections Using
Preformed Flexible Joint Sealants.
- E. Institute of Electrical and Electronic Engineers (IEEE):
 - C2-07National Electrical Safety Code
- F. National Electrical Manufacturers Association (NEMA):
 - TC 2-03.....Electrical Polyvinyl Chloride (PVC) Tubing And
Conduit
 - TC 3-2004.....PVC Fittings for Use With Rigid PVC Conduit And
Tubing
 - TC 6 & 8 2003.....PVC Plastic Utilities Duct For Underground
Installations
 - TC 9-2004.....Fittings For PVC Plastic Utilities Duct For
Underground Installation
- G. National Fire Protection Association (NFPA):
 - 70-08.....National Electrical Code (NEC)
- H. Underwriters Laboratories, Inc. (UL):
 - 6-07.....Electrical Rigid Metal Conduit-Steel
 - 467-07.....Grounding and Bonding Equipment
 - 651-05.....Schedule 40 and 80 Rigid PVC Conduit and
Fittings
 - 651A-00.....Type EB and A Rigid PVC Conduit and HDPE
Conduit
 - 651B-07.....Continuous Length HDPE Conduit
- I. U.S. General Services Administration (GSA):
 - A-A-60005-1998.....Frames, Covers, Gratings, Steps, Sump and Catch
Basin, Manhole

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE MANHOLES AND HARDWARE

- A. Structure: (Existing) Factory-fabricated, reinforced-concrete, monolithically-poured walls and bottom. Frame and cover shall form top of manhole. Comply with ASTM C 858. Modifications may be required to adjust rim height and provide for additional ladder rungs if necessary.
- B. Ladder: Existing
- C. Ground Rod Sleeve: (Assumed existing) Provide a 3 in [75 mm] PVC sleeve in manhole floors so that a driven ground rod may be installed.

2.2 GROUNDING (ASSUMING EXISTING IN PLACE)

2.3 WARNING TAPE (WHERE CONDUITS BECOME EXPOSED)

Standard 4-mil polyethylene 3 in [76 mm] wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

2.4 PULL ROPE FOR SPARE DUCTS (NOT ANTICIPATED)

Plastic with 200 lb [890 N] minimum tensile strength.

PART 3 - EXECUTION

3.1 MANHOLE AND PULLBOX INSTALLATION

- A. Assembly and installation shall follow the printed instructions and recommendations of the manufacturer. Install manhole extensions, cover, and pull boxes level and plumb.
 - 1. Units shall be installed on a 12 in [300 mm] level bed of 90% compacted granular fill, well-graded from the 1 in [25 mm] sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.
 - 2. Seal duct terminations so they are watertight.
- B. Access: Ensure the top of frames and covers are flush with finished grade.
- C. Ground Rods in Manholes: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 4 in [100 mm] above the manhole floor.
- D. Grounding in Manholes:
 - 1. If grounding of manholes does not exist, consult with the COR regarding this issue. A determination will be made if the general contractor shall provide or modify grounding as required in this specifications section.

1. Install a No. 3/0 AWG [95 mm²] bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
2. Connect the ring grounding conductor to the ground rod by an exothermic welding process.
3. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the manholes with a minimum No. 6 AWG [16 mm²] bare copper jumper.
4. Include compacted gravel between the newly constructed retaining wall and the existing manhole. Consult with the COR regarding the extents of compacted gravel, based upon excavation and visual inspection of the existing conditions.

3.2 TRENCHING

- A. Coordinate with Civil for trenching, backfilling, and compaction.
- B. Before performing trenching work at existing facilities, the Ground Penetrating Radar Survey shall be carefully performed by certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.
- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.**
- D. Cut the trenches neatly and uniformly.
- E. For Concrete-Encased Ducts:
 1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 4 ft [1.2 M] intervals to establish the grade and route of the duct bank.
 2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
 3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
 4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

3.3 DUCT INSTALLATION

A. Concrete-Encased Ducts and Conduits:

1. If **concrete encased ducts and conduits are encountered in the scope of work, bring this to the attention of the COR. The general contractor shall provide means and methods in which they will safely shore, support and maintain power of all services disturbed. If conduits are exposed and the voltage of the line in the conduit warrants encasement, the general contractor shall provide means and methods in which they will shore, support, maintain power, and installation of encasement. Also, see references in General Requirements 1.6, Operations and Storage Areas I.1.**

- a. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
- b. Duct lines shall consist of single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
- c. Tops of concrete-encased ducts shall be:
 1. Not less than 24 in [600 mm] and not less than shown on the drawings, below finished grade.
 2. Not less than 30 in [750 mm] and not less than shown on the drawings, below roads and other paved surfaces.
- C. Conduits crossing under grade slab construction joints shall be installed a minimum of 4 ft [1.2 M] below slab.
- d. Extend the concrete envelope encasing the ducts not less than 3 in [75 mm] beyond the outside walls of the outer ducts and conduits.
- e. Within 10 ft [3 M] of building manhole and pullbox wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
- f. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
- g. Where new ducts, conduits, and concrete envelopes are to be joined to existing manholes, pull boxes, ducts, conduits, and concrete envelopes, make the joints with the proper fittings and

fabricate the concrete envelopes to ensure smooth durable transitions.

- h. Conduit joints in concrete may be placed side by side horizontally, but shall be staggered at least 6 in [150 mm] vertically.
 - i. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 0.75 in [19 mm] reinforcing rod dowels extending 18 in [450 mm] into concrete on both sides of joint near corners of envelope.
 - j. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COR.
- B. Duct and Conduit Sealing: Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.

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