

SECTION 260543 – UNDERGROUND DUCT BANKS AND RACEWAYS

- 1.0 Components of Underground Ductbank and Raceway installations shall meet all applicable Federal Specifications, ANSI Standards, ASTM Standards, NEMA Standards, NFPA70 Code, and UL listing requirements.
- 2.0 Refer to Section 260533 – “Conduit” for conduit requirements. In general, schedule 40 PVC conduit shall be used in underground duct banks and raceways. Where underground conduits sweep up to equipment pads, etc, sweep elbows shall be schedule 40 RGS type to prevent “burn through” from cable pulling. Exceptions require approval of the University Engineering Department.
- 3.0 Refer to Section 260553 – “Electrical Identification” for identification and hazard warning requirements.
- 4.0 Underground Installations:
 - A Concrete encased ductbanks under roadways, parking lots, or other areas subject to vehicular traffic and all medium voltage work: Use schedule 40 rigid PVC conduit; steel reinforced concrete-encased ductbank. The minimum burial depth for all medium voltage duct banks is 3 feet below grade, measured to top of ductbank.
 - B Concrete encased ductbanks in all other areas:
 1. Use schedule 40 rigid PVC.
 2. Where elbows are required to transition from horizontal to vertical for stub-ups, use rigid steel conduit sweep elbows.
 3. Reinforcement of concrete is not required.
 - C Direct burial of branch circuit wiring for lighting, pumps, receptacles, etc.: Use Schedule 40 PVC conduit.
 - D Installation of conduits under building slabs and foundations is strictly prohibited. The only exception allowed is service entrance feeders which shall be permitted to be installed under slab, although horizontal entry through the foundation wall is preferred. Service entrance feeder conduits shall terminate in a pull box located on the inside of the foundation wall. Entrance pull boxes shall be have a drain line to building sump. Service entrance feeders shall continue via exposed conduit run from the entrance pull box to the service equipment.
 - E All wiring to devices located within the building will be installed in raceway systems located within the structure.
 - F Underground duct banks and conduit shall be located above water lines and below steam piping. Maintain a minimum 6-foot clearance between underground conduit or duct banks and any parallel steam lines. Underground crossings above and below steam lines shall maintain a minimum 24-inch clearance and the space between shall be filled with foam glass insulation.

- G Minimum Size Conduits shall be as follows:
1. Medium-Voltage Systems: 5" conduit.
 2. Low-Voltage Systems: 4" conduit.
 3. Site Lighting Circuits: 1" conduit.
 4. Controls Circuits: 2" conduit.
- H Install a minimum of one spare conduit for each feeder or controls circuit.
- 5.0 Manholes, handholes, ductbanks and underground raceways, etc. shall be sized to accommodate the proposed cables, planned future cables plus provisions for 20% minimum unplanned future cable requirements.
- 6.0 Manholes shall be pre-cast 3000 lb concrete with 8' x 8' x 8' internal dimensions. All joints in multiple-piece pre-cast manhole assemblies shall be sealed using the pre-cast manufacturer's recommended sealant. Manhole entrances shall be brought to grade using pre-cast concrete rings and cast-iron frame and lid assemblies. Do not use built-up brick in lieu of concrete rings. Manhole lids shall be rated for H-20 traffic loading.
- All manhole lids shall contain identification as follows:
- Electrical: "U of P Electrical"
- Telecom/Data: "U of P Telecom"
- All manholes shall be provided with a sump pit, minimum 12" X 12" and 6" depth.
- 7.0 The design professional shall secure the services of a University pre-approved electrical contractor familiar with the Campus 15kV distribution system to survey existing manholes and ductbanks to be utilized for splicing or pulling. The design professional shall verify from this survey that adequate space is available within a manhole for all cable pulling and modular splicing required for the project. The design professional shall also verify from this survey that any existing ducts intended for project use are continuous and clear.
- 8.0 Handholes shall be polymer concrete type, manufactured by Quazite. Provide H-20 traffic load-rated lids when handholes are located in roadways or other areas subject to vehicular traffic. Handhole lids shall be bolted using tamper-proof 316 stainless steel hardware.
- 9.0 Manholes or handholes located adjacent to building service entrance points shall be equipped with either drains to the building storm water sump, or duplex sump pumps in the manhole/handhole.
- 10.0 Design Professional is responsible for coordinating any sheeting/shoring requirements.
- 11.0 Ductbank construction:
- A. The underground ductbanks shall be sloped down towards manholes and handholes so that no point in the system will allow for accumulation of water in the conduits.
 - B. Ductbanks shall have a minimum of 36 inches of cover.
 - C. Provide a continuous bare #4/0 copper grounding conductor embedded in the concrete ductbank and connect to all exposed metal in manholes, to the manhole ground rod and to building ground loop(s) or substation ground bus at source and destination.

- D. Duct banks shall be dowelled to building foundations at the point of connection to a building.
 - E. Spacing of conduits in duct banks shall be maintained by the use of manufactured plastic spacer racks that allow sufficient space for proper settlement of concrete and aggregate between the conduits.
 - F. Conduit seals shall be installed at all building entrances, including all active and spare conduits. Conduit seals shall be Raychem “Rayflate” or equal as approved by the University Engineering Department.
- 12.0 Each manhole shall have a ground rod driven a minimum of 8 feet into undisturbed earth, below the manhole. Bond ground rod to cable racks, ladder, etc. with No. 4/0 AWG bare copper bonding conductor.
- 13.0 Provide cable racks with sufficient capacity to support the cables being installed. Provide pulling irons on each side of the manhole.
- 14.0 The design professional is responsible for performing any required pulling tension calculations to verify that the allowable cable pulling tension and sidewall pressure will not be exceeded, and for locating manholes and handholes accordingly. Under no conditions shall manhole/handhole spacing exceed 400 feet. The University requirements for future connections shall also be considered in the placement of manholes, when defined by the University Engineering Department.
- 15.0 All existing cables rendered unused or abandoned by the project shall be removed and a non-corrosive (plastic) pull line left in each empty duct.