

UNDERGROUND ELECTRICAL SERVICE

General

Scope

Provide concrete encased duct banks for primary power distribution cables and OSP telecommunications cables.

Provide direct buried ducts for secondary power cables, site lighting cables, and dedicated telecommunications circuits.

Provide spare ducts in concrete encased duct banks, and spare ducts or sleeves where direct buried ducts pass under paved surfaces.

Related Sections

Refer to Design Guidelines Section 03300, "Concrete", for concrete requirements.

Refer to Design Guidelines Section 16521, "Site Lighting", for direct buried conduit requirements for site lighting, emergency telephone kiosks, illuminated signs, parking lot electric gates and Parkmasters.

Underground Ducts

Specify Type DB PVC conduit for concrete encased duct banks, except where galvanized rigid steel conduit is required for strength.

Specify Schedule 40 PVC conduit for direct buried ducts, except where galvanized rigid steel conduit is required for strength or due to inadequate cover.

Under roadways, driveways, parking lots and sidewalks, specify Schedule 40 PVC conduit sleeves to enclose direct buried ducts.

Manholes and Pull Boxes

Specify reinforced concrete manholes where required to satisfy cable routing, pulling and splicing requirements.

Specify pre-cast polymer pull boxes where adequate space does not exist for the installation of manholes.

Manholes and pull boxes shall be accessible on at least 3 sides by trucks, cable reel trailers and other cable pulling equipment.

Products

Underground Ducts

PVC conduit for concrete encasement shall be Type DB, 4 inch diameter minimum, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.

PVC conduit for direct burial shall be Schedule 40, UL Labeled for 90 degrees C cables. Fittings shall be Schedule 40, solvent type, and from the same manufacturer as the conduit.

Galvanized rigid steel conduit shall be hot dipped galvanized inside and outside, in 10 foot lengths and threaded on both ends. Fittings and bushings shall be threaded, cast or malleable iron, and hot dipped galvanized inside and outside.

Sleeves shall be Schedule 40 PVC conduit, 6 inch diameter, UL Labeled for 90 degrees C cables. Couplings shall be Schedule 40, solvent type, and from the same manufacturer as the conduit.

Concrete shall have a minimum strength of 3,000 psi at 28 days.

Marker tape shall be plastic, vinyl, or mylar, 6 inches wide, red for electrical power and orange for telecommunications, and labeled to indicate the type of circuit buried below.

Manholes and Pull Boxes

Manholes shall be precast or cast in place concrete with a strength of 4,500 psi at 28 days, and steel reinforced to achieve an MDOT highway loading of H-20.

Primary manholes shall have inside dimensions of 10 feet long by 10 feet wide by 7 feet high. Telecommunications manholes shall have inside dimensions of 12 feet long by 6 feet wide by 6 feet 6 inches high.

Manholes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.

Manholes shall include a sealed depression in the floor off to one side for installation of a portable sump pump. Drains shall not be installed in floors.

The frame and cover for primary manholes shall be East Jordan Iron Works 1580C with the lettering, "UM ELECTRIC". The frame and cover for telecommunications manholes shall be East Jordan Iron Works 1805C with the lettering, "UM TELECOM".

Primary manholes shall be equipped with 3 Aickinstrut 20N-STA33 stanchions per wall, each bolted to the wall with 1/2 inch by 4-1/2 inch stainless steel rawl bolts. Each stanchion shall be fitted with 1 Aickinstrut 20N-ARM17 cable support arm.

Telecommunications manholes shall contain 7 full height vertical concrete inserts in each long wall, and 2 in each short wall. Inserts shall be 1-5/8 inch hot dipped galvanized Unistrut type channel or Aickinstrut nonmetallic channel of equal size and strength. Corner inserts shall be equipped with 12 inch corner brackets and side inserts shall be equipped with 3 inch side brackets to support full height perforated cable support racks. Each long wall shall also be equipped with 2 copper ground bus bars, 6 inches long by 2 inches wide by 1/4 inch thick, on 2 inch metal stand-offs bolted to the concrete.

Pull boxes shall be precast polymer concrete or polymer foam, heavy duty rated, bottomless, with a single piece cover. Pull boxes shall be one size larger than required to loop cables out of the opening and back in again without exceeding the minimum bend radii of the cables. Covers shall be of sufficient strength to withstand the weight of a riding lawn tractor or small truck, engraved "UM ELECTRIC", "UM TELEPHONE", or "UM OUTSIDE LIGHTING" as applicable, and attached with pentahead stainless steel bolts.

Ground splices and connections at manholes and pull boxes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.

Execution

Excavation and Backfill

Miss Dig shall be contacted at (800) 482-7171 before performing any excavation work.

Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes. Major sidewalk routes shall not be closed to pedestrian traffic.

Trees, shrubs and plantings in the area of excavation shall be removed by the Plant Grounds Department in advance. Barriers shall be provided to protect landscaping adjacent to the excavation area.

When rocks, concrete or other debris are encountered during excavation, remove completely.

Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.

Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.

Backfill excavations in 6 inch layers and mechanically compact to 98 percent compaction. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4 inch in diameter. Dispose of clay, rocks, concrete and other debris, and replace with MDOT Class II sand.

In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade. Backfill the last 6 inches with clean top soil. Reseed lawn areas.

Restore concrete sidewalks and asphalt in accordance with University Guidelines.

Underground Ducts

Duct banks shall be sloped downward toward manholes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from manholes into buildings. Duct banks shall not contain traps between manholes where water may accumulate.

Directional changes in duct banks shall be made with 20' minimum radius bends.

Duct banks and direct buried ducts shall be supported on undisturbed soil or on piers extending down to undisturbed soil.

Where primary and telecommunications duct banks run in parallel, they shall be separated by a minimum of 12 inches.

Primary duct banks shall include No. 4 steel reinforcing bars. Telecommunications duct banks do not require steel reinforcing.

Primary duct banks shall be grounded with a No. 4/0 AWG bare stranded copper ground wire that is run within the duct bank and is grounded at both ends. Telecommunications duct banks do not require grounding. Direct buried ducts shall be grounded by insulated, stranded copper ground wires installed in each duct.

Prior to concrete encasement, ducts, reinforcing steel and ground wires shall be secured with nonmetallic straps or cable ties to nonmetallic duct spacers at intervals not exceeding 8 feet. Duct spacers shall be sized for the ducts being held, and shall provide the minimum spacing between ducts required for concrete flow and by the NEC. Duct spacers shall be anchored to the ground using nonmetallic bands and stakes.

Duct banks shall have a minimum of 3 inches of concrete cover on all sides.

Where duct banks enter manholes or buildings, they shall be constructed as integral to the wall. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.

Bell ends shall be provided on ducts where the ducts enter manholes or buildings.

Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.

Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.

Where direct buried PVC ducts can not be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.

A marker tape shall be buried in the backfill approximately 12 inches above duct banks or direct buried ducts for the entire length of the duct run.

A flexible mandrel and a stiff bristled brush shall be pulled through the ducts to clean them prior to cable pulling.

Ducts shall be identified in the manholes and at both ends. Coordinate the identification requirements with the Plant Electric Shop through the Owner's Representative.

Manholes and Pull Boxes

Manholes shall be installed on a base of pea gravel or MDOT Class II sand at least 12 inches deep. Pull boxes shall be installed on a base of pea gravel or MDOT Class II sand at least 6 inches deep.

Pull boxes shall be located in mulched areas wherever possible. Tops of pull boxes shall be level with the existing grade.

Metal barriers shall be installed in pull boxes containing circuits of two different voltages or containing both power and telecommunications circuits.

Ducts shall enter telecommunications manholes on the short sides only. Ducts may enter primary manholes on any side, but should be positioned to permit installation of additional ducts in the future. Ducts should enter as perpendicular to the wall surface as possible.

Primary manholes shall be grounded with four $\frac{3}{4}$ inch diameter by 10 foot long ground rods, one driven inside of the manhole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the manhole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the manhole.

Sleeves

Sleeves shall be buried at a minimum depth of 24" to their top. Sleeves shall extend a minimum of 12" beyond the paved areas they pass under.

Spare sleeves shall be taped closed at both ends with duct tape.

Ends of spare sleeves shall be marked with steel stakes, pipes or conduits that are 3' long minimum, driven vertically down at the sleeve ends to a depth of 6" below grade to their top.

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A marker tape shall be buried in the backfill approximately 12 inches above the sleeves for the entire length of the sleeves.

Quality Assurance

The Owner's Code Inspection Department shall be contacted at (734) 764-2457 before pouring concrete and before backfilling excavations.

Details

See Details 1611001,001 through 1611010.001.

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