DIVISION 16 - ELECTRICAL

Section 16115 - Underground Conduits And Distribution Duct Banks

Introduction

When preparing the layouts for new underground distribution for the electrical systems, future capacity shall be included to provide for expansion/modification of the services in an area. In this area common sense and a discussion with the UA Electrical Engineer and the FM Medium Voltage shop shall be used in determining how many additional conduits shall be installed in a duct run above the number needed for actual work in the project. In addition it shall be the responsibility of the engineer doing the design to consult any and all of the as-built documentation of an area prior to laying out the duct bank for a particular area. Any changes caused by the lack of proper investigation shall be fully documented by the engineer in the form of revised drawings and not notes added to the original drawings. Fully document and detail the drawings such that major obstructions and other utility services are clearly indicated on the drawings.

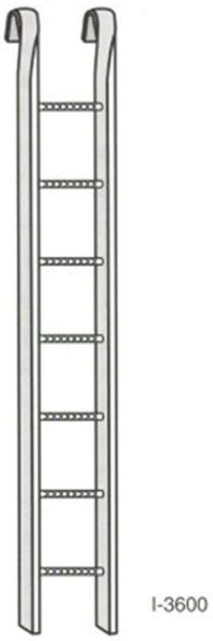
Part 1 - General

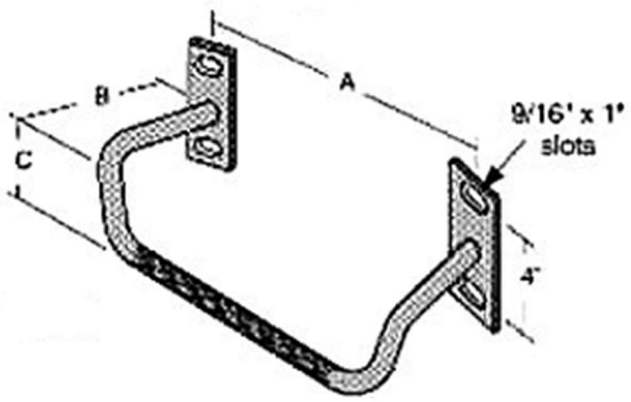
- Provide submittals for conduit, fittings, manholes, handholes, and all associated appurtenances.

Part 2 - Products

- UNDERGROUND CONDUIT AND DUCT BANKS
    - Use GRS (galvanized rigid steel) or Fiberglass for all offsets and bends 45 degrees and above. UFS Electrical Engineer or designated representative will determine if long sweeping radius bends will be required to be ridged conduit or if PVC will be acceptable. PVC schedule 40 for underground conduit and duct bank installations. Installation parameters are prescribed in Table 1 below.
    - Where required concrete encasement shall be per Table 1.
    - Red colored concrete encasement, where required, shall use a red pigment integrally mixed into the concrete. Dry shake or broadcast coloring agents are not to be used.
    - Use GRS (galvanized rigid steel) for all offsets and bends. Tape all underground GRS conduit with 10 mil PVC tape, half lapped or coat with a bitumastic compound.
    - For concrete encased conduits use manufactured PVC spacers and mounts for support and spacing of the conduits. Do not use concrete blocks or other means to support and space conduits that are to receive concrete encasement.
    - A metallic backed marking tape shall be installed 12” above all underground conduits and duct banks.
    - A #10 AWG trace wire shall be installed in all utility trenches.
    - All primary power shall have spare conduits between MV Switches, transformers and vaults.
- MANHOLES AND HANDHOLES
    - Minimum 12" x 18" x 12" with solid nominal I.D. concrete bottom for power or lighting runs. For Medium Voltage work manhole shall be sized 8’ x 8’ x 8’ minimum.
    - Shall be constructed out of 3000 PSI steel reinforced concrete.
    - Shall be traffic rated construction.
    - Cover shall indicate type of wiring enclosed within.
    - Octagonal vaults are preferred.
    - Shall include a securely mounted removable ladder when over 4' deep.

    See Example Below. Provide as indicated or approved equal.





Part 3 - Execution

- UNDERGROUND CONDUITS AND DUCT BANKS

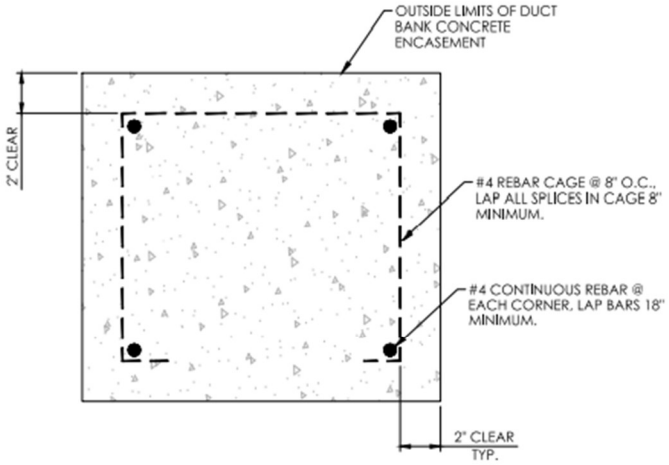
Install underground conduits and duct banks per Table 1, below, and locate a minimum of 1’ from other utility systems, including phone, steam, sewer, chilled water, etc.

Table 1

Underground Conduit and Duct Bank Installation Requirements			
	Above 600V	600 V and Below	Other Systems
Below Building Slabs	PVC or GRS, 36" deep, red concrete slurry	PVC or GRS, 14" deep, no concrete encasement required	PVC or GRS, 14" deep, no concrete encasement required
Outside of Bldg.	PVC or GRS, 36" deep, red concrete encasement, 3000 psi at drive lanes. 1000 psi Slurry within 10’ of equipment	PVC or GRS, 36” deep, no encasement, or PVC, 24” deep with 2000 psi concrete encasement	PVC or GRS, 36” deep, no encasement, or PVC, 24” deep with 2000 psi concrete encasement
Outside of Bldg. Min. depth requirement cannot be met	Special permission required, Contact PDC Electrical Engineer		

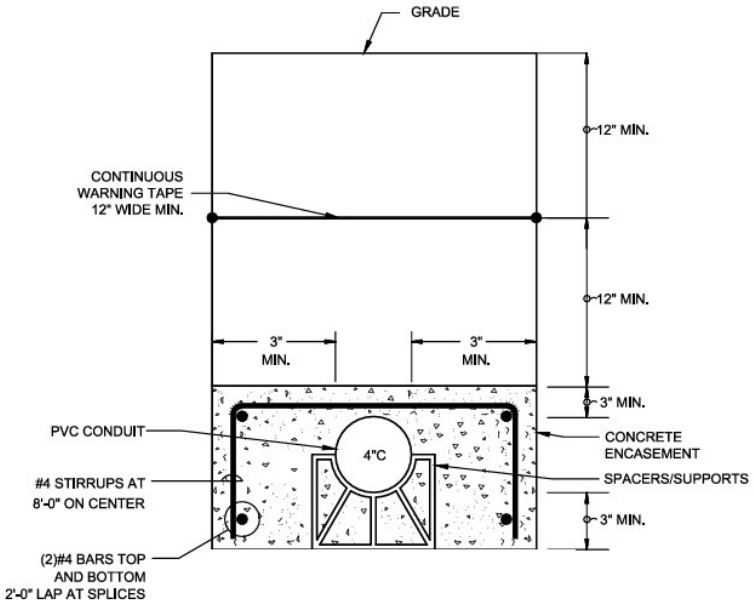
- Install not less than 3 - #4 reinforcing bars tied to a “U” shaped stirrups at 8' centers for duct banks under roadways.

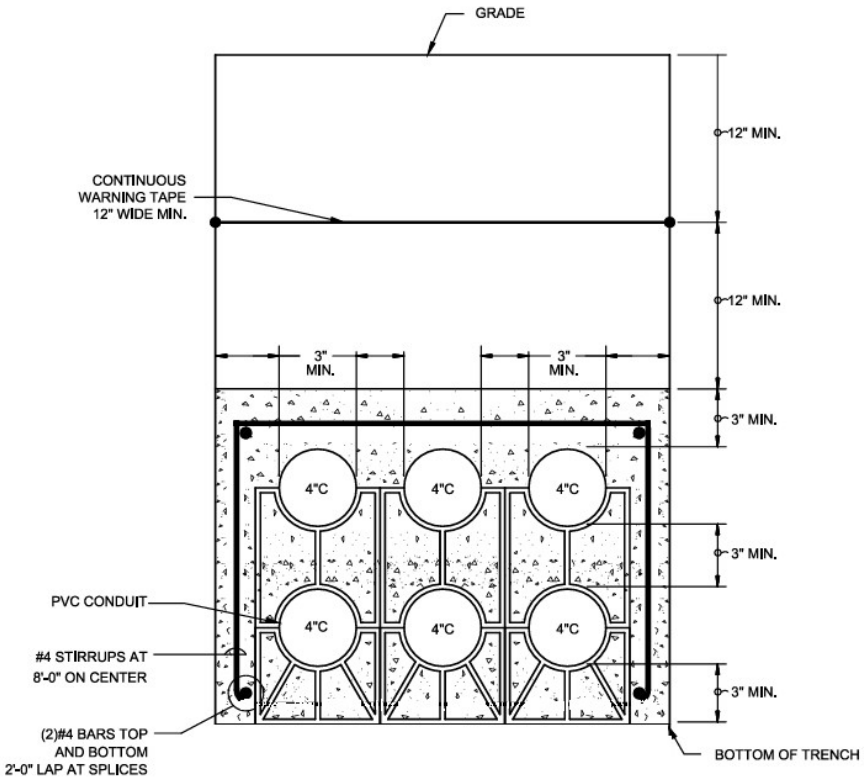
See Example below.



NOTES:

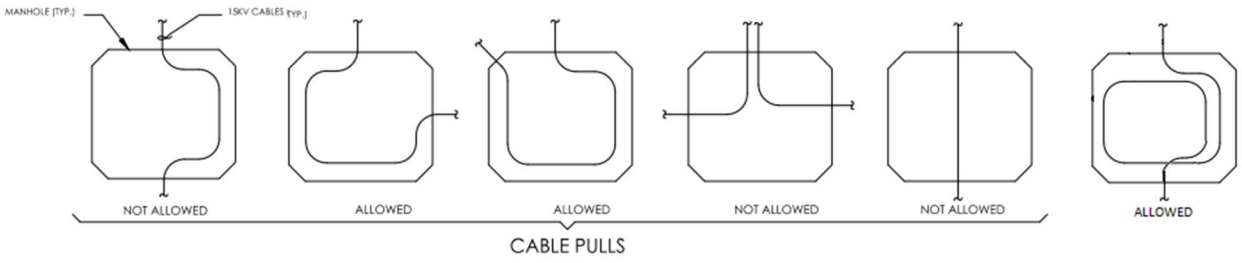
1. REINFORCEMENT SHALL BE #4, GRADE 40 REBAR.
2. PROVIDE REBAR REINFORCEMENT IN CONCRETE DUCT BANK UNDER ALL TRAFFIC AREAS AND ROADWAYS PER UA GUIDELINES.
3. REINFORCEMENT SHALL BE PLACED AND TIED TO PREVENT MOVEMENT OF THE REINFORCEMENT DURING CONCRETE PLACEMENT. DO NOT INSTALL METALLIC TIE WIRE AROUND CONDUITS.





- Concrete encased with a minimum envelope of 3" around each conduit where encasement is required.
- Minimum 3" spacing between outer diameter of conduits.
- Conduits to be used for high voltage cable shall be installed by journeyman electricians having minimum of five years experience in the installation, splicing, and testing of high voltage wiring. Contractor shall have class A-17 license for minimum of 2 years prior to work. Refer to 16050-1 part 1
- Use bell adapters where conduits enter manholes.
- Concrete shall be red dyed utilizing red dye mixed into the concrete for a minimum of 5 minutes prior to pouring. Minimum of 1 bag of dye per 1 yd of concrete.
- For 4" diameter and larger GRS conduit bends, minimum bending radius shall be 48". Standard factory bends may be used for 3-1/2” diameter and smaller GRS conduit bends.
- Tie banks down and stake using rebar at each support At no time shall metal stakes being used to tie the duct bank down be in direct contact with the metal rebar reinforcement. Metal stakes with a PVC sleeve shall be allowable.
- Spacers and supports to be at 5’ centers.
- Conduits shall be cleaned and tested for continuity prior to installation of cables as follows:
    - Provide Brass ID Tags for location and destination of feeders.
    - A steel sectional mandrel shall be pulled through the conduit. The mandrel outer diameter shall not be less than .5" less than the inside diameter of the conduit.
    - Should the mandrel become stuck in the conduit then the length of conduit where the mandrel was stuck shall be condemned and replaced to the satisfaction of the UA Electrical Engineer.
    - The conduit shall then be swabbed out by pulling through a brush and/or rags which remove any additional debris from the conduit.
    - Spare conduits shall receive a mule tape and be capped at both ends. Spare conduit shall be identified as to other end. Spare conduit where subject to weather shall be sealed using a coupling and steel insert.
- MANHOLES AND HANDHOLES
    - Ring and lid shall be installed above grade so that water drains away from them.

- Shall be installed on a bed of gravel (minimum of 12" deep) with a drain hole to allow for water to drain out of them.
- Shall be installed with cover flush on sidewalks.
- Shall be installed with top of cover minimum 2" above grade in landscaped areas.
- For handholes use cover appropriate to the area located.
- For manholes use traffic rated cast steel outer cover with an inner lid which can be padlocked from above. The inner lid shall be welded to the manhole ring.
- Provide a ¾ " x 10' ground rod driven into the bottom of the manhole near one of the sides for grounding of wires and cables.
- Provide pulling irons opposite potential duct entrances.
- Have inset unistrut to allow for cable racks in manholes.
- MV Cable racks shall have porcelain insulators. Loop medium voltage feeders around the inside of the manhole tied to the insulators.
- Manhole covers shall be manufactured with inscriptions for “Electrical” and “Communications” and be weld-bead inscribed with U of A. This welding shall be performed by a certified MIG (GMAW) welder with the proper approved skills.
- Manhole steel rings, frames and covers shall be “NIKKO.” No exceptions.
- Acceptable cable looping shall be maintained. As detailed in Figure below
- Ring additions require mastic and no grout.



F3 TYPICAL CABLE PULLS THROUGH MANHOLES
NOT TO SCALE

1. PROVIDE CABLE SUPPORTS FOR EVERY 3 FEET AROUND MANHOLES AS REQUIRED.
2. FOR MAIN FEEDERS PROVIDE ENOUGH CABLE SLACK OF AT LEAST MIN. OF 10' OR ONE LOOP WHERE IT IS NOT CONGESTED IN MANHOLE.
3. FOR TRANSFORMER TAPS, PROVIDE AT LEAST MIN. OF 3' TO 5' CABLE SLACK IN MANHOLE.
4. ALL CABLES MUST BE SUPPORTED ON RACKS IN MANHOLES. PROVIDE NEW RACKS IF REQUIRED.

- All installations shall be inspected by UFS Engineer, UFS Inspectors, and FM Medium Voltage shop prior to energization.

End of Section 16115