SECTION 27 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 PURPOSE

A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 **LESSONS LEARNED AND DESIGN CONSIDERATIONS**

A. Telecommunications Contractor shall review and adhere to all of University of Texas at Arlington Standards of Installation for Network Cabling.

1.3 SUMMARY/OVERVIEW

A. This section includes underground communications duct banks, hand-holes and maintenance holes.

B. Related Sections

1. Section 27 00 00 – Communications
2. Section 27 05 26 – Grounding and Bonding for Communications Systems
3. Section 27 05 28 – Pathways for Communications Systems
4. Section 27 11 00 – Communications Equipment Room Fittings
5. Section 27 13 00 – Communications Backbone Cabling
6. Section 27 15 00 – Communications Horizontal Cabling

1.4 REFERENCES

A. Refer to Section 27 00 00.

B. Conflicts

1. Refer to Section 27 00 00.

C. Codes and Standards:

1. National Electrical Manufacturers Association (NEMA):
   a. RN1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Electrical metallic Tubing
   b. TC2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
   c. TC3 PVC Fittings for Use with Rigid PVC conduit and tubing
2. Underwriters Laboratories (UL):
   a. 651 Schedule 40 and 80 Rigid PVC Conduit
   b. 651A Type EB and A Rigid PVC Conduit and HDPE Conduit
3. Standard for Riser Application for Optical Fiber Raceway
4. Telecommunications Industry Association/Electronic Industries Association: ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces.
5. Telecommunications Industry Association/Electronic Industries Association: ANSI/TIA/EIA-758-A Customer-owned Outside Plant Telecommunications Standard.
6. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual.
7. BICSI Customer Owned Outside Plant (CO-OSP) Design Manual
8. Local, county, state and federal regulations and codes in effect as of date of installation.
9. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

D. Related Documents:

1. Refer to Section 27 00 00.

1.5 SUBMITTALS

A. Refer to Section 27 00 00.

1.6 QUALITY ASSURANCE
A. Refer to Section 27 00 00.
B. Follow Annex B of National Electrical Code (NEC)
C. Items of the same classification shall be identical. This requirement includes equipment, assemblies, parts, and components.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Refer to Section 27 00 00.
B. Clearly mark containers "For Communications Duct Banks Only".

1.8 WARRANTY
A. Refer to Section 27 00 00.

1.9 MAINTENANCE
A. Refer to Section 27 00 00.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Ducts:
1. Use owner approved solution.
B. Hand-holes:
1. Unless otherwise shown, hand-holes shall be at least 48-inch wide by 48-inch long and constructed of 2-inch thick cement covered with .375-inch steel plate with a 35-pound lift to open and close.
2. All Hand-holes shall have a hasp and locking plate installed so they can be locked with padlock.
C. Concrete and Reinforcing Steel for Encasement:
1. The Contractor shall:
a. Furnish products following Division 03, except strengths as follows:
b. Compressive Strength: 2500 psi at 28 days, class A
c. Flexural Strength: 500 psi at 28 days.
d. Dye concrete encasement “orange” to identify communications conduit.

2.2 MATERIALS
A. Continuous Tape for Underground Conduit:
1. The Contractor shall use orange warning ribbon, PVC tape (detectable, i.e., containing metallic tracings), three inches wide, permanently imprinted with "CAUTION--BURIED COMMUNICATIONS LINE BELOW" in black letters, minimum one-inch high.
B. Labeling
1. Refer to section 27 00 00.
C. Firestopping
1. Refer to section 27 00 00.

PART 3 – EXECUTION

3.1 EXAMINATION
A. Where necessary, Contractor shall provide all excavation, boring, trenching, backfill and restoration of grounds for all OSP pathways. In addition, Contractor shall include all labor, materials, and equipment.
B. The owner of the property has the option to obtain a testing laboratory to ensure proper soil compaction.
C. All work shall comply with all city, county and State Codes, NEC, ANSI/TIA, OSHA, and BICSI-Telecommunications Distribution Methods Manual (TDMM) requirements, codes and standards.
D. The above referenced codes and standards are to be considered as a minimum requirement. If the plans or specifications call for material and/or methods of construction higher than the standard, the plans or specification shall govern.
E. All holes, trenches and/or any other excavation shall be covered, fenced, and/or taped off to make the area safe at all times. Conform to general Contractor requirements.
F. The Contractor will visit the job site prior to submitting a proposal to determine existing conditions.

Contractor shall evaluate the site for materials, and any other information that may affect the work to be performed.

G. The Contractor shall locate and protect all existing conduits. Also, operate in a safe manner. Should damage occur notify the appropriate utility. Damage costs are the responsibility of the Contractor.
H. The Contractor shall CALL BEFORE YOU DIG, One Call Directory Telephone Numbers (Texas: 1-800-245-4545, 1-800-344-8377) to locate any existing conduits (Power, Gas, Telephone, and other utilities) prior to start of work.
I. Any proposed re-routing of all trenches/pole lines shall be reviewed and approved by the owner/consultant.

3.2 PREPARATION:

A. Refer to section 27 00 00.
B. The Contractor shall verify materials are on-site in proper condition and of sufficient quantity.
C. The Contractor shall verify proper excavation depth (minimum 48 inches below finished grade), width, route and support of work. Verify proper location of hand-holes and maintenance holes (minimum every 350 feet). Communications facilities must be placed in separate hand-holes and maintenance holes from electrical facilities.
D. Trenches greater than or equal to five feet deep:
    1. Shall be shored to prevent cave-in.
    2. Shall have two feet clearance from the dirt pile.
E. Directional boring is a suitable option when trenching is impractical or impossible. Locating existing underground utilities is crucial when directional boring is planned because of the potential for the drilling unit to encounter high voltages. Although directional boring machines are manufactured with electrical strike sensing capabilities, which can warn the operator of any contact with a high voltage source, accidents may still occur. Operators of directional boring machines require special protection due to the potential for exposure to high voltage. Therefore, operators must always have a ground mat grid underfoot as insulation protection. In addition, operators must wear insulating boots and gloves, along with hard hats and safety glasses.
F. Minimum separation between electrical and communications underground cable (measured from conduit sidewall:
    1. Concrete: 3 inches
    2. Masonry: 4 inches
    3. Well-tamped earth: 12 inches
G. Before encasement, the Contractor shall verify ducts are free of debris and properly installed in support and spacer system, are properly fitted together and hold-down hardware is properly installed.

3.3 INSTALLATION

A. Refer to section 27 00 00.
B. The Contractor shall install conduit in excavations following drawings. If directional boring is utilized, cable or flexible conduits can be attached to the unit and pulled back to the origination point (after the drilling unit reaches its destination).
C. Hand-holes shall be at least four feet by four feet and shall be constructed of two-inch thick cement covered with three-eighths-inch steel plate. The hand-hole or maintenance hole shall rest on a four-inch blanket of sand, and four inches around the sidewalls shall be filled with sand.
D. Each hand-hole or maintenance hole which contains a pedestal shall have four bollards installed 18 inches diagonally from each corner, with a cross member welded at thirty inches connecting the four corners. These barriers will be constructed of four-inch ridged conduit filled with concrete, driven four feet in the ground and extending 36-inches above the protective cover.
E. The Contractor shall install watertight penetrations through foundation, hand-hole and maintenance hole walls. Wherever a hand-hole is used to simply pass through, the conduit entrances and exits will be situated at opposite ends of the hand-hole instead of 90° angles.
F. The Contractor shall assemble duct banks with non-magnetic saddles, spacers and separators. Position separators for two-inch minimum concrete separation between outer surfaces of adjacent ducts, and:
    1. Make uniform required bends with a minimum 24-inch radius for conduits less than three- inch diameter, and a minimum 48-inch radius for conduits three inches and larger.
    2. Maintain vertical or horizontal separations of 12 inches of well-packed topsoil from any electrical service conduit run parallel to communications conduits.
G. The Contractor shall

1. Install concrete encasement fully surrounding reinforcing steel and ducts
2. Unless otherwise noted on the drawings, reinforce with longitudinal #5 steel bars placed at each corner and along each face at maximum parallel spacing of 12 inches on center, and #5 tie-bars transversely placed at 12 inches on center maximum longitudinal. Maintain maximum clearance of two inches from bars to edge of forms and ducts.
3. Add orange colorants at mixing site at the rate of 10 pounds per cubic yard for voice and data cable.
4. Place concrete with minimum three-inch cover surrounding ducts and reinforcement.
5. Maintain ducts in proper place during concrete placement.
6. Transition from nonmetallic to metallic conduit where duct banks enter structures or turn upward for continuation above grade.
    a. Where ducts enter structures such as hand-holes, maintenance holes, pull boxes, or buildings, terminate ducts in proper end bells, insulated L-bushings, Meyers hubs or couplings on steel conduits.
    b. Ducts shall be sealed to prevent water and debris from entering the building.
7. Extend below grade conduits to four inches above the finished floor inside a building. Cover or temporarily seal open conduit ends to prevent water and other foreign matter from entering conduit.
8. Tag conduits entering pull boxes with stamped stainless steel tags following cable and conduit schedule.
9. Backfill after concrete cures 24 hours.

H. Duct banks shall be grounded with a #3/0 (#000) AWG bare stranded copper ground wire that is run within the duct bank (not inside conduit) and is bonded and grounded at each maintenance hole ground wire loop. Originating/first maintenance hole and terminating/last maintenance hole ends shall be connected to the nearest communications ground bus bar.
    1. Conduit shall not be used as the ground conductor.
    2. All bonding shall be exothermically welded at connecting ends.
    3. All communications shall be a separate and independent ground.

I. The Contractor shall pull a 12-inch long mandrel (one-quarter inch smaller than duct diameter) through ducts. Pull a rag swab or sponge through to remove debris, until it shows clean.

J. Where fiber optic cables will be used and/or where indicated in the drawings, innerduct shall be provided.

K. The Contractor shall provide a metered pull tape in all underground conduits and innerduct:
    1. Pre-lubricated, woven polyester, low friction, and high abrasion resistant yarn.
    2. Minimum average tensile strength shall be 1130 lbs. for one and one-half inch and smaller conduits and innerduct.
    3. Minimum average tensile strength shall be 1800 lbs. for conduits larger than one and one-half inch.

3.4 CLEANING

A. Refer to section 27 00 00.

END OF SECTION