

**SECTION 16730  
UNDERGROUND STRUCTURES-TELECOMMUNICATIONS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Publications and Standards
- B. Work Sequencing and Coordination
- C. Telecommunications Submittals
- D. Quality Assurance

**1.2 PUBLICATIONS AND STANDARDS**

- A. National Electrical Code (NEC) (ANSI/NFPA 70):
  - 1. Chapter 8: "Communications Systems"
  - 2. Article 250: "Grounding"
- B. Electronics Industry Alliance/Telecommunications Industry Association (EIA/TIA): EIA/TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
- C. Federal Communications Commission (FCC) Part 15 and Part 68
- D. Rural Utilities Services (RUS), formally REA
- E. Lightning Protection Code - ANSI/NFPA 780
- F. American Society for Testing Materials (ASTM) Publications
- G. National Electrical Manufacturer's Association (NEMA) Publications
- H. State of California Administrative Code, Title 24, Part 3, CCR, 1994 California Electrical Code
- I. State of California Public Utilities Commission (Cal. P.U.C.) Publication: G.O. 128 Rules for Construction of Underground Electrical and Communications Systems
- J. Underwriter's Laboratories Inc. (U.L.) Publications
  - 1. 6-1981 (R86) Rigid Metallic Conduit
  - 2. 514B-1982 Fittings for Conduit and outlet Boxes
  - 3. 651-1981 Schedule 40 and 80 Rigid PVC Conduit
  - 4. UL 467 "Grounding and Bonding Equipment"
  - 5. UL 497,497A, and 497B "Communications Circuit Protectors"
- K. California State University, Office of the Chancellor - Telecommunications Infrastructure Planning (TIP) Guidelines - 1999

**1.3 RELATED SECTIONS**

- A. Contract Terms and Conditions
- B. Section 16710 - Telecommunications General Requirements

- C. Section 16715 - Telecommunications Acceptance Testing
- D. Section 16720 - Telecommunications Basic Materials and Methods
- E. Section 16725 - Telecommunications Cable
- F. Section 16760 - Telecommunications Bonding and Grounding

#### **1.4 SUBMITTALS**

- A. Submittals shall be made as defined in Section 16710.

#### **1.5 QUALITY ASSURANCE**

- A. For products or workmanship specified by association, trade, Federal, or State Standards, the Contractor shall comply with the requirements of the standard. When more rigid requirements are specified, the Contractor shall comply with the most stringent code.
- B. The Contractor shall conform to reference standard by date of issue current on final design documents.

### **PART 2 - PRODUCTS**

#### **2.1 COMMUNICATIONS UTILITY VAULTS**

ALL UTILITY VAULTS TO BE INSTALLED SHALL BE SPECIFICALLY DESIGNED FOR TELECOMMUNICATIONS APPLICATIONS, WITH NO EXCEPTIONS.

- A. Materials
  - 1. The Contractor shall provide pre-cast utility vaults meeting ASTM C 478 with 28 day 5500 psi minimum compressive strength concrete and designed for AASHTO H-20 loading per AASHTO HB 14. See conduit construction drawings for vault sizes.
  - 2. Utility vaults shall have tongue-and-groove double sealed joints on mating edges of pre-cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer's installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer's printed instructions.
  - 3. Conduit Entrances
    - a. For conduit installed on this project, knockout panels or pre-cast individual conduit openings may be used.
    - b. For existing utility vaults, new ducts shall enter the utility vault with factory-formed bell end of the conduit, and a seal around the conduit shall be applied after installation. Existing utility vaults that shall be re-used to install new copper and fiber cables shall be retrofitted with the required racking and grounding and bonding per the TIA/EIA Bonding and Grounding Standards.
  - 4. Covers
    - a. The Contractor shall provide solid covers (traffic rated), with a 76.2 cm (30 in.) diameter clear opening.
    - b. Heavy-duty type 10" high cast iron frame and 30" cover suitable for H-20 loading, and having machined bearing surfaces shall be used.
    - c. The covers shall be of indented type with solid top design.

- d. The upper side of each cover shall have the letters "Communications" cast or burned by welder, in integral letters no less than 2 inches high. The ring of the casting shall be field stamped with utility vault or pull box numbers as indicated on the conduit drawings in volume 1 of 3. (1" high numbers)
- e. Double lids are required for vaults over 12 feet in length as per OSHA.

B. Manufacturers: Utility Vault Company, Jensen Precast, New Basis Greenline®

## **2.2 COMMUNICATIONS PULL BOXES**

- A. Pre-cast pull boxes shall meet the standards defined in Subsection 2.1.A. (1).
- B. Joints and seals shall be provided and installed as defined in Subsection 2.1.A. (2).
- C. Conduit entrances shall be provided as defined in Subsection 2.1.A. (3).
- D. Pull boxes shall be equipped with a minimum of approved cable racking on one long wall suitable to support large copper cables as called for on the design documents.
- E. All pull boxes shall be equipped with traffic-rated spring loaded hinged lids with a locking mechanism. All lids shall have the identification marking of "Communications" permanently affixed to the cover. The upper side of each cover shall have the letters "Communications" cast or burned by welder, in integral letters no less than 2 inches high. The cover shall also be field stamped with two inch high pull box identification numbers as indicated on the conduit drawings.

## **2.3 COMMUNICATIONS UTILITY VAULT/PULL BOX HARDWARE**

- A. Materials
  - 1. Pulling irons shall be provided, as required for the size of utility vault/pull box (minimum of 4 per utility vault: 2 Installed on each end wall, top and bottom). Pulling irons shall be installed opposite the terminators. All pulling irons shall be constructed of 2.2 cm (7/8 inch) hot-dip galvanized steel.
  - 2. A sump of 30cm (12 in.) in diameter shall be provided in each utility vault, per the manufacturer's specifications. Four 1-inch diameter holes shall be drilled in sump to allow water level to fluctuate within the vault.
  - 3. Heavyweight cable racks with adjustable arms shall be provided for all cables in each utility vault. The racks shall be attached with adjustable inserts set in the concrete walls (bolts or studs embedded in concrete will not be used). Racks and inserts shall be centered on the side walls that are utilized for the racking of splice cases in the utility vault, arranged so that all spare conduit ends are clear for future cable installation. The racks shall have a sufficient number of arms to accommodate cables for each conduit entering or leaving the utility vault.
  - 4. Corner standoff brackets 15cm to 20cm (6 in. to 8 in. from wall) shall be provided if the utility vault is equipped with center exit conduits. The bracket shall extend from 15cm (6 in.) off floor to 15cm (6 in.) below roof.
  - 5. All utility vault and pull box hardware shall be steel that is hot dip galvanized after fabrication.
  - 6. Each utility vault shall have a detachable galvanized steel ladder per opening that can be removed to facilitate future work in the utility vault. The ladder shall be secured to a top support arm in the utility vault opening or chimney.

- B. Manufacturers
  - 1. Hardware: Alhambra Foundry (Model No. A-3382 ladder with A-3383 support bar), Inwesco Products, or an approved equal.
  - 2. Utility vault: Utility Vault, Jensen Precast, NewBasis Greenline®

## **2.4 COMMUNICATIONS DUCT-BANKS**

- A. Materials
  - 1. Conduit
    - a. Schedule 40 PVC - 4 inch inside diameter.
    - b. Type C telephone conduit - 4 inch inside diameter.
    - c. Inner-ribbed orange innerduct, 1 inch in diameter, will be installed for fiber optic cable protection. A minimum of 4 innerducts shall be installed in a 4-inch conduit. See manhole detail drawings for innerduct requirements.
  - 2. Conduit shall have a factory formed bell on one end for interconnecting segments.
  - 3. All conduits shall be installed in an encased steel pipe where a boring method is utilized. Grout shall be pumped in between conduits inside the steel pipe to fill voids.
  - 4. Spacers: High impact spacers shall be used in all multi-duct systems, for both solely-owned or joint telecommunications/power constructions. They shall conform to NEMA TC-2, TC-6, TC-8, and ASTM F 512 dimensions.
  - 5. All fittings shall be designed specifically for use with the type of conduit installed.
  - 6. All conduits shall be equipped with seal plugs in all utility vaults/pull boxes and expansion rubber seal plugs within all buildings.
- B. Manufacturer: (CONDUIT) PW pipe, Vikimatic, (PLUGS) Vikimatic, Tyco Jack Moon, or approved equal.

## **2.5 COMMUNICATIONS ENTRANCE CONDUIT**

- A. Conduit entering a building shall be galvanized iron pipe (rigid steel). Conduit shall transition from PVC to GRC at a distance of 24 inches beyond the exterior of the foundation to two inches AFF in the entry room. The conduits shall slope downward away from the building to reduce the potential of water entering the building. All metal conduits shall be equipped with a plastic grommet to prevent cable damage during installment. All entrance conduits shall be seal with molded expansion type plugs. All metal conduits shall be wrapped with a corrosion inhabiting tape for the entire length of the metal conduit.

## **2.6 DUCT-BANK LOCATING CABLE (DETECTABLE WARNING TAPE)**

- A. Warning tape shall be a minimum of 3" wide, orange in color, and shall have a nondegradable imprint as follows:
  - 1. "Caution Telephone Cable Buried Below"
  - 2. "Caution Fiber Optic Cable Buried Below"
- B. The tape shall be detectable.

- C. Manufacturer:
  - 1. Carlon
    - a. MAT3T61 "Caution Telephone Cable Buried Below".
    - b. MAT3061 "Caution Fiber Optic Cable Buried Below".
  - 2. Equivalent manufacturer's type and style is acceptable.

## **2.7 PULL ROPE**

- A. Pull rope shall be new ¼" polypropylene over polyester rope with a minimum 1700 lb. tensile strength.
- B. Manufacturers: CARLON: Part No.SB14105, or approved equivalent.

## **2.8 BONDING/GROUNDING**

- A. The reinforcing steel in the walls of the utility vault shall be bonded together and brazed to the bronze inserts of each section of the utility vault per the manufacturer's utility vault specifications. The ground inserts shall be attached to the steel rebar to provide a point of attachment for the ground wires or bonding ribbon. The inserts shall be bronze, flush mounted, and brazed to the rebar cage of all the sections of the utility vault (bottom, intermediate, and roof sections).
- B. Materials
  - 1. Bonding Ribbon: Shall be made of annealed solid copper 3/8 inch wide x 1/16 inch thick, tin plated. Manufacturer: INWESCO Cat.12A55 or approved equivalent.
  - 2. Bonding Ribbon Clamp: Shall be made of soft lead ½ inch wide by 1/16 inch thick and shall accept ¼ inch diameter bolt. Manufacturer: INWESCO Cat. 12A56 or approved equivalent.
  - 3. Fargo Clamp: Shall be cast from copper, silver plated, furnished with copper bolt. Manufacturer: INWESCO Cat.12A57 or approved equivalent.
  - 4. Ground Inserts: Shall be made of Cast Bronze W/1/4 Copper Rod. Manufacturer: INWESCO Cat.12H69 or approved equivalent.

## **2.9 CONDUIT AND RACEWAY TAGS**

- A. All conduits and other raceways shall be labeled with permanent type tags. Tags shall include destination engraved onto the tag. Adhesive or taped-on type markers shall not be permitted.

## **PART 3 - EXECUTION**

### **3.1 COMMUNICATIONS UTILITY VAULTS AND PULL BOXES**

- A. General
  - 1. The Contractor shall obtain all required permits and notifications before commencing any work operations.
  - 2. All state and local ordinances shall be complied with at all times.
  - 3. All federal, state, and local safety rules, including OSHA, will be enforced at all times during the duration of the project. It is the responsibility of the Contractor to inspect the job site to ensure compliance.

- B. Final location of all communications utility vaults and pull boxes shall be determined by Engineer of Record. All manholes to have a minimum cover of 2 ft. measured from final grade to top of manhole and be set in 6 inches of compacted road base material. Compaction shall be 90% or better to prevent settlement of the Utility Vault.
- C. All conduits entering a utility vault or pull box shall be installed at right angles to the short walls and shall be sealed to prevent seepage unless otherwise specified on the construction documents.
- D. Excavation dimensions shall be verified with the utility vault supplier in advance so as to prevent delays in setting schedule.
- E. Shoring shall be in accordance to prevailing underground construction codes, i.e., OSHA, G. O. 128, NESC, and all applicable local, state and federal statutes.
- F. All utility vaults shall be equipped with pulling irons.
- G. Finish grade shall be established prior to placing structures.
- H. The Contractor and the Inspector of Record shall inspect all utility vaults prior to backfilling.
- I. Backfill materials shall have been sifted to provide a sand equivalent of not less than 20, and a sieve size of No.4 Backfill material shall be mechanically compacted to a minimum relative compaction of 90 percent to a level six (6) inches above final grade. The excess material shall be excavated to the final grade upon acceptance of compaction.
- J. Existing and/or new communications utility vaults/pull boxes may be installed near the existing power and signal vault system. The Contractor shall either Install new or enlarge existing utility vaults/pull boxes and conduits in such a manner as to not disturb existing utilities while maintaining specified clearances from all obstructions. This may require clearing much of the area around the vaults by hand. The final Installment and depth shall be determined by the Contractor and Engineer/Inspector of Record.
- K. The Contractor shall locate all existing utilities within 20 feet of the new and/or enlarged utility vault/pull box system. The Contractor and Engineer/Inspector of Record shall review and approve any revised coordination schematics. Caution shall be used when working in this area. The University's existing high power electrical conductors may be transported in the primary electrical duct structure directly adjacent to the secondary electrical and signal ducts.
- L. The Contractor shall excavate around existing vaults using caution to identify and preserve all utilities in the area.

### **3.2 DUCT BANKS AND CONDUITS**

- A. All communications conduit banks shall be encased in concrete with at least 2 inches of concrete at the top and bottom and 2 inches on each side. A horizontal and vertical separation of 2 inches between the ducts shall be maintained by installing high impact spacers with horizontal and vertical locking intervals of ten feet. The top surface of the concrete encasement shall include an orange color dye for future identification.
- B. All communications conduit shall be installed in a uniform manner between vaults. The conduits shall be placed commencing from bottom most openings. Conduit in position #1 at one utility vault shall maintain its position within the duct run and terminate in the #1 position at the next utility vault. The position of all conduits between utility vaults shall be maintained.

- C. Long radius bends (over 30 feet) shall be used whenever possible to make changes in direction. If it is found to be necessary to Install a 90 degree bend in the conduit run, a factory-made sweep of no less than 48 inch radius shall be used. No conduit run shall exceed a total of 180 degrees of bend between any two points (such as utility vaults or buildings) considering both vertical and horizontal sweeps. Cold formed trench bends shall have a radius of not less than 40 feet and shall pass mandrel integrity. Bend radius criteria are 2" or less 6 times the diameter of the conduit and, for any conduit larger than 2", 10 times the diameter of the conduit.
- D. The length and destination of all conduits shall be identified in each utility vault, pull box, and building. Embossed metal or heavy plastic tags strapped to each conduit shall be used.
- E. After installation of communications conduit and after the concrete encasement has cured, the Contractor shall prove all conduits by pulling a mandrel with a diameter ¼ inch smaller than the conduit and 6 inches long through each conduit end-to-end. The Inspector of Record shall be notified 24 hours before this procedure. Each conduit shall be cleaned with a bristle brush to remove any debris.
- F. All utility vault and pull box entrances shall be shear-blocked with standard concrete extending no less than 15 inches from the entry wall. All entering ducts shall be completely encased.
- G. Utility marking tape shall be buried 12 inches below the surface directly above the conduit.
- H. All conduit structures shall be built with the telecommunications conduits Installed above the power conduits with a minimum of 12 inches of separation unless otherwise called out on the construction drawings. If this type of construction is required, it shall receive prior approval of the Engineer of Record.
- I. All entrance conduits shall be securely fastened to the building. The end of the conduit located inside the building shall be sealed with expandable plugs to prevent rodents, water, or gases from entering the building.
- J. New telecommunications conduits shall cross above existing central piping. Schedule 40 PVC conduit shall be used for these crossings. They shall not be encased in concrete from 5 ft. before crossing to 5 ft. beyond.

### **3.3 LOCATING DUCT BANK CABLE**

- A. Underground detectable warning tape shall be installed in all trenches at one foot below the final grade after the conduit and encasement is complete. The tape shall indicate the type of cable that will utilize the substructure system, e.g., fiber optic or copper cables. The detectable warning tape shall be installed according to manufacturer's specifications to ensure access to the tape for locating purposes.

### **3.4 PULL ROPE**

- A. Pull rope shall be new material that is free of knots, kinks, and abrasions.
- B. Pull rope shall be installed as a single continuous length in every new conduit.
- C. Pull rope shall be secured at each end.

**END OF SECTION**