

SECTION 16301 – UNDERGROUND ELECTRICAL WORK**PART 1 – GENERAL****1.01 SUMMARY**

- A. Section 16010 - ELECTRICAL applies to this section with the additions and modifications specified herein.

1.02 APPLICABLE PUBLICATIONS

- A. The publications listed within this specification form a part of this specification to the extent referenced. Unless otherwise indicated, most recent edition of publication with current revisions and amendments will be enforced.

PART 2 – PRODUCTS**2.01 MATERIALS AND EQUIPMENT**

- A. Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated:
 - 1. Conduit:
 - a. Rigid Plastic Conduit: UL 651, Schedule 40 and 80 PVC.
 - 2. PVC Fittings: UL 651
 - 3. Pullstring: Pullstring shall be nylon pullstring having a minimum tensile strength of 200 lbs in each empty duct except those intended for telephone cabling.
 - 4. Grounding and Bonding Equipment: Shall conform to UL 467.
 - 5. Plastic Marking Tape: Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be red for electric power system ductlines and orange for telephone/television/fire/communications systems ductlines.

PART 3 – EXECUTION**3.01 INSTALLATION**

- A. Underground cable installation shall conform to NFPA 70 and ANSI C2.

1. Concrete: Concrete for electrical requirements shall be at least 3000 psi concrete with one-inch maximum aggregate conforming to the requirements of Division 3 of these specifications
2. Earthwork: Excavation, backfilling, and pavement for repairs for electrical requirements shall conform to the requirements of Division 2 of these specifications.
3. Underground Duct Direct Buried: Construct underground ductlines of individual conduits direct buried in trench. The conduit shall be of Schedule 80 PVC construction. The bank surrounding shall be rectangular in cross-section and shall provide at least 12 inches of earth between power duct and signal ducts.
 - a. Top of the conduit shall not be less than 24 inches below grade
 - b. Duct lines shall have a continuous slope downward toward handholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter or larger.
 - c. Terminate conduits in end-bells where duct lines enter handholes. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. Stagger the joints of the conduits by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. As each section of duct line is completed from handhole to handhole, draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel; then immediately install conduit plugs.
4. Cable Pulling: Pull cables down grade with the feed-in point at the handhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through the handhole opening and into the duct runs. Cable slack shall be accumulated at each handhole or junction box where space permits by training the cable around the interior to form one complete loop. Minimum allowable bending radii shall be maintained in forming such loops.
 - a. Lubricants for assisting in the pulling of jacketed cables shall be those specifically recommended by the cable manufacturer. The lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.
 - b. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

5. Grounding: Non-current carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid "earth" ground not exceeding the following values:
 - a. Grounds in handholes: 10 ohms
 - b. Grounded secondary distribution system neutral and non-current carrying metal parts associated with distribution systems and grounds not otherwise covered: 25 ohms
6. When work in addition to that indicated or specified is directed in order to obtain the specified ground resistance, the provisions of the contract covering "Changes" shall apply.
 - a. Grounding electrodes shall be cone pointed driven ground rods driven full depth less 6 inches, installed when indicated to provide an earth ground of the value before stated for the particular equipment being grounded.
 - b. Make grounding connections which are buried or otherwise normally inaccessible, and excepting specifically those connections for which access for periodic testing is required by exothermic type process. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. No mechanical connector is required at thermit weldments.
 - c. Grounding conductors shall be bare soft-drawn copper wire No. 6 AWG minimum unless otherwise indicated or specified.
7. Pullstring: Provide all empty conduits with a nylon rope or mule tape. Leave 48 inches of spare at each end of the pull.

3.02 UNDERGROUND CABLE IDENTIFICATION

- A. Cables shall be labeled at both ends.

3.01 FIELD TESTS

- A. Ground Rods: Test ground rods for ground resistance value before any wire is connected. Use a portable ground testing megger to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one copy of the megger manufacturer's directions for use of the ground megger indicating the method to be used.
- B. Test Report: Provide three copies of each test report to the Contracting Officer.
 1. Grounding Electrodes and Systems (identify electrodes and systems, each test).

END OF SECTION