

SECTION 630 CONDUIT

630-1 Description.

Install conduit for traffic control signals and devices, and other electrically powered or operated devices as shown in the Plans and Design Standards.

630-2 Materials.

Use materials that have been tested and listed as defined in the National Electrical Code (NEC) for the specific use to meet the following industry standards:

Schedule 40 and 80 Polyvinyl Chloride (PVC) ¹	UL 651
Fiberglass Reinforced Epoxy ²	UL 2420
Intermediate Metal ³	ASTM A135/A135M, ASTM A513,ASTM A568/A568M
Rigid Galvanized Metal ³	UL 6
Rigid Aluminum ⁴	UL 6A
PVC Coated Intermediate Metal ⁴	ASTM A135/A135M, ASTM A513, ASTM A568/A568M, NEMA RN1-2005
High Density Polyethylene (HDPE) Standard Dimension Ratio (SDR) 9-11 ⁵	ASTM F2160

1 Use conduit with solvent type slip-fit plastic couplings unless approved by the Engineer.

2 Use conduit having a minimum stiffness value of 250. Ensure that each section has a duct bell with an integral gasket on one end and a duct spigot on the other end.

3 Use conduit that is hot-dipped galvanized, with both ends reamed and threaded.

4 Use conduit with both ends reamed and threaded.

5 Can be used with preassembled cable and rope-in-conduit.

630-3 Installation Requirements.

630-3.1 General: Install the conduit in accordance with NEC or National Electrical Safety Code (NESC) requirements. Consider the locations of conduit as shown in the Plans as approximate. Construct conduit runs as straight as possible, and obtain the Engineer's approval of all major deviations in conduit locations from those shown in the Plans.

Do not place more than the equivalent of four quarter bends or 360 degrees of bends, including the termination bends, between the two points of termination in the conduit, without a pullbox. Obtain the Engineer's approval to use corrugated flexible conduits for short runs of 6 feet or less.

Use only intermediate metal conduit, rigid galvanized metal conduit, rigid aluminum conduit or PVC coated intermediate metal conduit for above-ground electrical power service installations. Meet the requirements of Section 562 for coating all field cut and threaded galvanized pipe.

Use Schedule 80 PVC or fiberglass reinforced epoxy conduit on bridge decks.

Use HDPE with an SDR number less than or equal to 11, Schedule 80 PVC or Schedule 40 PVC, for underground installations in earth or concrete for traffic control signal and device applications.

Install underground conduit as shown in the Design Standards, Index No. 17721. Install conduit on bridges and approach slabs as shown in Design Standards, Index No. 21210.

When a conduit installation changes from underground to above-ground, make the change a minimum of 6 inches below finished grade.

Install a No. 12 AWG pull wire or polypropylene cord inside the full length of all conduits. Ensure that a minimum of 24 inches of pull wire/cord is accessible at each conduit termination.

Ensure the conduit includes all required fittings and incidentals necessary to construct a complete installation.

When earth backfill and tamping is required, place backfill material as per Section 120 in layers approximately 12 inches thick, and tamp each layer to a density equal to or greater than the adjacent soil.

When backfilling trenches in existing pavement, use a commercially available sand-cement (approximately 10:1 mix ratio).

Provide a standard clearance between underground control cable and electrical service cable or another parallel underground electrical service cable that meets NESC requirements.

Prevent the ingress of water, dirt, sand, and other foreign materials into the conduit prior to, during, and after construction. Exclude water and debris from buried conduit and from the top riser assembly of above-ground conduit using a foam-sealing material, rubber plug, or other device designed for this application and approved by the Engineer.

Ensure the conduit fill ratio (outer cable diameter to inner conduit/duct diameter) does not exceed 50%.

630-3.1.1 Fiber Optic Cable Conduit: Install the conduit system so the fiber optic cable maintains a minimum bend radius of 20 times the cable diameter. Use approved methods for connecting inner duct or conduit within or between plowed portions, trenched portions, and bored portions. Submit the conduit manufacturer's coupling method and material to the Engineer for approval.

630-3.1.2 Fiber Optic Cable Locate Wire: Ensure that the locate wire is a single copper conductor with a minimum gauge of #12 AWG. Furnish locate wire that is insulated using a 45 mil minimum thickness polyethylene sheath that is orange in color and marked to identify the manufacturer and the conductor size. Bury locate wire along the centerline of the top outer surface of installed conduit, as shown in the Plans, or as directed by the Engineer. Install locate wire in the trench or bore with all underground conduits to provide end-to-end electrical continuity for electronically locating the underground conduit system. Do not install locate wire in a conduit with fiber optic cable.

Do not run locate wires into field cabinets. Terminate locate wires at the first and last pull boxes in the conduit run or as shown in the Plans. Ensure that wire termination occurs only at the top of a pull box.

In a trenching operation, install the locate wire no more than 3 inches above the conduit. Ensure that the locate wire enters all pull boxes and splice boxes, and that a minimum of 10 feet of slack locate wire is coiled and neatly stored in each box.

In a boring operation, install the locate wire in an encasement.

Drill a hole in the pull box or splice box for wire entry as shown in the Plans. Fill any gaps between the locate wire and the hole it passes through with nonshrink grout or a similar sealant suitable for the application and approved by the Engineer.

Perform continuity tests and insulation resistance tests on all locate wires. Provide the Engineer with all test results. Replace or repair defective locate wire at no additional cost.

Make locate wire splices in a flush grade-level box. Ensure that locate wire splices are waterproof and suitable for direct burial. Ensure that locate wire splices at the pull box meet NEC requirements. Ensure that locate wire splices are constructed of and in the following order: a mechanical crimp connection with a butt sleeve, an oxide-preventing aerosol lacquer, mastic electrical splicing tape, and standard electrical tape using methods and materials approved by the Engineer. At the completion of the installation, provide the Engineer with as-built drawings that document all splice locations.

630-3.2 Conduit Sizes: Size the conduit to be used on all installations, unless otherwise shown in the Contract Documents. Use conduit of sufficient size to allow the conductor to be installed without any damage and meeting NEC requirements. Use conduit that is at least 1 inch in diameter, except for the conduit protecting the ground wire on the side of a pole, use conduit that is at least 1/2 inches in diameter.

630-3.3 Conduit Joints: Make conduit joints using materials as specified by the manufacturer. When conduit crosses an expansion joint of a structure and where shown in the Plans, install an expansion or expansion/deflection fitting as specified by the manufacturer. Certify that expansion/deflection fittings are rated to accommodate a minimum rotation of 30° and that both the expansion and expansion/deflection fittings are rated to accommodate the anticipated longitudinal movement (minimum 2 inches for deflection fittings and 0.7 inches for expansion/deflection fittings). Ensure that all installed joints are waterproof. As an exception to the threaded coupling for intermediate metal conduit, at locations where it is not possible to screw the threaded coupling properly, the Contractor may use a waterproof slip-joint coupling approved by the Engineer. Secure the joint, and tighten threaded connections.

Prior to insertion into the coupling; clean, prime and coat the ends of PVC conduit with a solvent-type cement as specified by the manufacturer.

630-3.4 PVC Coating: Apply the PVC coating to the entire surface of the conduit, except for the threads, to attain a nominal thickness of 40 mils. Ensure that the coating is free of sags or drips.

Attach the coupling to the conduit prior to the application of the coating for conduit of 1 inch diameter or less.

Use a coupling with sleeve extensions on conduit larger than 1 inch. Ensure that the sleeve extensions on all threaded female openings have a length equal to the diameter of the conduit up to and including size number 53.

630-3.5 Conduit Terminations: Fit the terminating ends of all metal conduit and metal conduit sleeves with an appropriate bushing.

For conduit to be encased in concrete, wrap with tape or otherwise protect all terminations to prevent the entrance of concrete.

Connect new underground conduits to existing underground conduits with a pull box.

Install conduit terminating in a concrete strain pole through the cable entry hole and up the center of the pole to a location approximately 6 inches below the handhole.

Seal conduits terminating in a controller base, pole, pull box, junction box, or pedestal base with duct seal, or an equivalent moisture resistant sealant approved by the Engineer.

For a controller base, pole or pedestal base, and junction boxes, terminate conduit runs into the center of the base or box at least 2 inches above the surface of the base.

630-3.6 Existing Underground Facilities: Coordinate with any potential conflicting underground utilities prior to starting all excavating, boring or jacking operations at the project site.

630-3.7 Restoration of Trench Areas: Restore the conduit trench construction area to an acceptable condition. Such work includes repair or replacement of all pavement areas, sidewalks, curbs, structures, landscaping or grass areas disturbed by the conduit trench.

630-3.8 Jacking Conduit: Use either intermediate metal conduit or rigid galvanized metal conduit as the sleeve when installation of a conduit requires jacking under paved surfaces, railroads, etc., with either PVC or fiberglass reinforced epoxy conduit installed in the jacked sleeve. Do not disturb any pavement without the approval of the Engineer.

630-3.9 Above-Ground Installation: Use conduit designed and manufactured for use in long-term above-ground applications with UV stabilization to prevent material deterioration. Securely attach above-ground conduit installations to the surface of the supporting structure using conduit straps. As a minimum, use conduit straps located on 5 foot centers. Use galvanized metal conduit straps when installing intermediate metal conduit, fiberglass reinforced epoxy conduit, rigid galvanized conduit, rigid aluminum conduit or PVC coated intermediate metal conduit above ground.

Use the same PVC coating for the metal straps as the conduit, when using PVC coated intermediate metal conduit.

630-3.10 Elbows: Use only preformed or field constructed conduit elbows. The radius of curvature of the inner edge of any bend shall not be less than shown below:

Size	Standard Radius
1/2 inch	4 inches
3/4 inch	4 1/2 inches
1 inch	5 1/2 inches
1 1/4 inches	7 1/4 inches
1 1/2 inches	8 1/4 inches
2 inches	9 1/2 inches
2 1/2 inches	10 1/2 inches
3 inches	13 inches
3 1/2 inches	15 inches
4 inches	16 inches
5 inches	24 inches
6 inches	30 inches

630-4 Method of Measurement.

630-4.1 General: Measurement for payment will be in accordance with the following work tasks.

630-4.2 Furnish and Install: The Contract unit price per foot of conduit, furnished and installed, will include furnishing all hardware and materials as specified in the Contract Documents, and all labor, trenching, backfilling, and restoration materials necessary for a complete and accepted installation.

Payment for conduit placed in the ground or attached to bridges will be based on the horizontal path of the installed conduit measured in a straight line between the centers of pull boxes, cabinets, poles, etc. No allowance will be made for sweeps or vertical distances above the ground or within the structure, or below the ground.

Furnishing, installing, and testing the locate wire is included in the cost of the conduit. Furnishing and installing pull wire/cord is included in the cost of the conduit.

630-5 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 630- 1- Conduit - per foot.