

## SECTION 652 ELECTRICAL CONDUIT

### 652.1 Description

- (1) This section describes furnishing and installing rigid metallic or rigid nonmetallic conduit for traffic signals, lighting, and other electrical work, and rigid nonmetallic conduit for traffic signal detectors.

### 652.2 Materials

#### 652.2.1 General

- (1) Use materials conforming to the class of material named and specified below.
- (2) Furnish electrical conduit with a UL or NRTL label on each length delivered and used.
- (3) While the WSEC conduit classification for rigid non metallic (RNC) includes PVC, HDPE and RTRC, under department specifications, RNC refers to PVC only.

#### 652.2.2 Rigid Metallic Conduit

- (1) Furnish conduit and fittings conforming to ANSI C 80.1 for rigid metallic conduit.

#### 652.2.3 Rigid Nonmetallic Conduit

- (1) Furnish PVC electrical conduit conforming to UL 651, for schedule 40 heavy wall type, or schedule 80 extra-heavy wall type.
- (2) If installing rigid nonmetallic conduit in an exposed location, use schedule 80 conduit.

#### 652.2.4 Reinforced Thermosetting Resin Conduit

- (1) Furnish reinforced thermosetting resin conduit (RTRC) electrical conduit marked type AG conforming to UL 1684. Ensure that wall thickness, coupling type or method, all fittings, and hanger system conform to manufacturer recommendations for installation on the outside of structures.

#### 652.2.5 Loop Detector Conduit

- (1) Furnish one inch schedule 40 PVC electrical conduit conforming to [652.2.3](#). Furnish fittings and attachments required to join and terminate conduits of the same material as the conduit except as the plans show and in the next paragraph, and designed specifically for the conduit furnished.
- (2) Use approved PVC terminal adaptor fittings to connect the cast iron T-condulet to PVC conduit. Furnish cast iron T-condulets made by a department-approved manufacturer. For the covers for cast iron condulets, use domed-type, wedge-nut style, steel cover, with neoprene gasket.

### 652.3 Construction

#### 652.3.1 Installation of Conduit

##### 652.3.1.1 General

- (1) Under the Conduit Special bid item, the contractor may use either rigid metallic or rigid nonmetallic conduit.
- (2) Use conduit of the nominal inside diameter the plans show and make each run of conduit the distance the plans show or as the engineer directs. Install each run of conduit between adjacent access points using one size for its entire length. A run is the conduit from pull box to pull box, junction box to junction box, or pull box to junction box. If the engineer approves, the contractor may substitute a larger size of conduit than the contract shows for that run.
- (3) Furnish approved electrical conduit fittings.
- (4) Pitch all conduit for drainage as the plans show. If unable to slope PVC or RTRC conduit for draining, drain by drilling one 1/4-inch diameter hole in the underside of the conduit at each low point. Then place a drain sump under the drilled drainage hole as the conduit standard detail drawing shows.
- (5) A 12 AWG. XLP insulated, stranded, copper, 600 volt AC, pull wire shall be installed in each run of conduit, as laid, which is to receive future conductors, unless the contract provides for the installation of wire or cable. The wire shall be approximately 4 feet longer than the run of conduit and shall be doubled back at least 2 feet at each raceway access point. The pull wire shall be anchored at each access point in a manner acceptable to the project manager.
- (6) Ream and thread the ends of all rigid metallic conduit.
- (7) Use WSEC-approved bushings on rigid metallic conduit.

- (8) If not installing wire or cable in the rigid metallic conduit, then cap with engineer-approved threaded protective caps. Lubricate the threads with an approved anti-seize compound.
- (9) Cap or plug all rigid nonmetallic conduit immediately after installation, unless the conduit terminates in a pull box, and keep capped or plugged until installing the wire or cable.
- (10) Install end bells on all rigid nonmetallic conduit raceway access points before installing wire or cable, or both. Ream non-metallic conduits to eliminate internal sharp edges before installing the end bells.
- (11) If required to connect nonmetallic conduit to rigid metallic conduit, use only UL or NRTL listed adapter fittings.

#### **652.3.1.2 Installing Underground**

- (1) Unless the plans specify otherwise, install conduit in trenches excavated with vertical sides and of a depth and width sufficient to accommodate the outside diameter of the conduit couplings. Lay the conduit at the depth below grade specified the plans. Backfill the trench with select material passing a one-inch sieve.
- (2) Excavate trenches true to line and grade to provide the conduit uniform bearing throughout its length. Do not backfill the trench before inspecting the conduit. Carefully tamp the backfill in place as specified for placing backfill in layers in [651.3](#). Place at least 0.7 cubic feet of size No. 2 coarse aggregate, as specified in [501.2.5.4.4](#), directly under each drainage hole.
- (3) If cinders are present when laying rigid conduit, encase the conduit in at least 2 inches of concrete, or remove for at least 12 inches below the conduit and backfill the excavation with suitable material.
- (4) Zinc coat all field thread not covered by fittings, and all other areas of rigid metallic conduit that has the zinc coating removed or damaged by construction operations or otherwise, in a manner, and with an engineer-approved zinc-rich paint. Thoroughly clean the damaged and adjacent areas before coating.

#### **652.3.1.3 Installing Conduit Special Underground**

- (1) Under the Conduit Special bid items, conform to [652.3.1.2](#) except install by jacking, boring, auguring, or other engineer-approved methods that do not disturb the existing overlying pavement, curb and gutter, or sidewalk. Use conduit suitable for the installation method used. Repair all pavement, curb and gutter, or sidewalk that the engineer determines damaged by the installation.

#### **652.3.1.4 Installing on Structures**

- (1) Install conduit on structures as the plans show either by embedding in concrete or mounting on the outside of the structure. Unless specifically provided otherwise, do not leave openings in the structure for subsequent conduit placement. Install engineer-approved expansion fittings where the conduit crosses an expansion joint in a structure. Install additional expansion fittings conforming to the WSEC and adjust for the ambient temperature at the time of concrete pour.
- (2) If embedding conduit in concrete, hold it rigidly in place while pouring the concrete. Provide drainage for embedded raceways.
- (3) If mounting on the outside of the structure, use reinforced thermosetting resin conduit (RTRC) and hardware conforming to manufacturer recommendations. Use only manufactured bends and sweeps. Do not make field bends. Ensure that the installer is certified by the manufacturer of the conduit and conforms to manufacturer recommendations for installation on the outside of structures. Provide evidence of installer certification to the engineer before installation.

#### **652.3.1.5 Constructing Loop Detector Slots**

- (1) Under the Loop Detector Slots bid item, construct slots in existing asphalt or concrete pavement for loop detector conduit, as the plans show or the engineer directs.
- (2) Construct by sawing the full width and depth of the slot, or by sawing both edges of the slot full depth and removing the remainder by chipping, or other engineer-approved methods. Clean the slots with jets of water and compressed air; remove all dirt, dust, and debris; and thoroughly dry before installing the detector loop conduit. Remove and dispose of all surplus material.

#### **652.3.1.6 Installing Loop Detector Conduit**

- (1) Under the Conduit Loop Detector bid item, furnish and install loop detector conduit and related fittings as the plans show.
- (2) After installation, protect the loop detector conduit from any damage that could occur. Repair or replace damaged loop detector conduit at no expense to the department. The engineer will approve the replacement or repair method, and the resulting finished work.

### 652.3.2 Marking and Inspecting

- (1) Mark the location of each conduit as the plans specify.
- (2) After the conduit installation is complete, inspect each installed conduit before any wire is pulled. During this inspection, ensure that the conduit raceway is fully open for its entire length. Replace any conduit that the engineer determines crushed, damaged, or unsatisfactory, without at no expense to the department, before the department accepts the work. Furnishing all tools, equipment, and labor necessary to make the inspections is incidental to conduit installation.
- (3) At the discretion of the engineer, at one randomly selected conduit arrow mark, the conduit shall be exposed. If the distance from the centerline of the exposed conduit to a plumb line projected down from the tip of the arrow mark, is more than six-inches then all arrow marked conduits shall be exposed. Any arrow mark, not meeting the six-inch limit shall be destroyed and conduit shall be remarked. All this work shall be incidental to the conduit installation.

### 652.4 Measurement

- (1) The department will measure the Conduit Rigid Metallic, the Conduit Rigid Nonmetallic, and the Conduit Reinforced Thermosetting Resin bid items by the linear foot acceptably completed. The measured quantity will equal the linear feet of each size of each type, based on the distance along the centerline of the conduit from the centerline of fittings or, where there are no fittings, from the free ends of the conduit. The department will include engineer-specified drain duct measured from the pull box to a ditch or sewer.
- (2) The department will measure the Conduit Special bid items by the linear foot acceptably completed. The department will measure the extension of special conduit, to roadside pull boxes beyond the limits of existing pavement, curb and gutter, or sidewalk as Conduit Rigid Metallic or Conduit Rigid Nonmetallic.
- (3) The department will measure Conduit Loop Detector by the linear foot acceptably completed, measured around the loop and from the loop to the nearest pull box.
- (4) The department will measure Loop Detector Slots by the linear foot acceptably completed.

### 652.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
652.0100 -0199	Conduit Rigid Metallic (size)	LF
652.0200 - 0399	Conduit Rigid Nonmetallic (schedule) (size)	LF
652.0400 - 0599	Conduit Reinforced Thermosetting Resin (size)	LF
652.0600 - 0699	Conduit Special (size)	LF
652.0800	Conduit Loop Detector	LF
652.0900	Loop Detector Slots	LF

- (2) Payment for the Conduit Rigid Metallic, Conduit Rigid Nonmetallic, Conduit Reinforced Thermosetting Resin, and Conduit Special bid items is full compensation for providing the conduit, conduit bodies, and fittings; for providing all conduit hangers, clips, attachments, and fittings used to support conduit on structures; for pull wires or ropes; for expansion fittings and caps; for excavating, bedding, and backfilling, including any sand, concrete, or other required materials; for disposing of surplus materials; and for making inspections.
- (3) Payment for the Conduit Special bid items also includes repairing overlying pavement, curb and gutter, or sidewalk the contractor disturbs or damages.
- (4) Payment for Conduit Loop Detector is full compensation for providing all materials, including conduit, compacted backfill, surface sealer if required, pull wire if required, condulets, and conduit fittings.
- (5) Payment for Loop Detector Slots is full compensation for all sawing; for chipping if required; for removing and disposing of surplus material; and for cleaning the slot.
- (6) The department will not pay extra for conduit larger than the contract size the contractor substitutes under [652.3.1.1](#).