

## CONDUITS AND FITTINGS



### GENERAL

A conduit is defined as a tube or duct for enclosing electrical wires or cables.

Mn/DOT uses two types of conduits in signal construction:

**Rigid Steel Conduit - Specification 3801.**

**Non-Metallic Conduit - Spécification 3803.**

Mn/DOT allows the use of either Polyvinyl Chloride (PVC) conduit (rigid sectional lengths) and High Density Polyethylene (HDPE) (continuous length) conduit. All PVC and HDPE conduit and fittings must be listed by a Nationally Recognized Testing Laboratory (NRTL). See Contract documents for the specific requirements for all non-metallic conduit.

**STANDARD SPECIFICATIONS**

- All conduits and fittings must be the size and type specified in the contract documents.
- If conduit size is not specified, the minimum conduit size must be 3/4 inch (21 millimeters).
- Conduit installation must be in accordance with the Code.
- The conduit in a run must be the same size and type, and must be continuous from outlet to outlet.
- Conduit must be installed in as straight a run as practicable and will enter handhole and foundations in line with the general direction of the conduit run.
- Conduits with sharp kinks or reduced cross section will be rejected.

The damage occurs if:

- a. The conduit is bent without using the proper equipment.
- b. An attempt is made to relocate the end of the conduit so that it lines up with the handhole or foundation.

**CONDUIT BENDS — 2565.3D**

Conduit bends, other than those done in the factory, must have a radius no less than 6 times the normal diameter of the conduit. Bends must not damage the conduit or effectively reduce its internal diameter. In addition, bends must not exceed 360 degrees, of bend, per conduit run between handholes or foundations.

**ABOVE GROUND — 2565.3D**

All cables must be run in conduits except as otherwise specified in the contract documents.

When conduits are attached to wood poles, the conduit must be secured with two hole appropriate type conduit straps that meet the current edition of the National Electrical Code (NEC). The conduit straps must not be more than 4 feet (1.2 meters) apart, and Conduit must be supported within 3 feet (900 millimeters) of the termination point or fitting.



Conduits attached to metal poles require a minimum of 3/4 inch (19 millimeters) stainless steel bindings that are spaced not more than 5 feet (1.5 meters) apart.



Conduits attached to other structures must be secured as indicated in the Contract documents to the satisfaction of the Engineer.

**UNDERGROUND — 2565.3D**

Underground conduits must be placed no less than 18 inches (460 millimeters) below the surface of any ground area and not less than 24 inches (610 millimeters) below any roadway surface. It should be noted that the depth of the conduit is measured to the top of the pipe. For example; a trench for a 4 inch (100 millimeter) conduit is 22 inches (560 millimeters) from the finished ground to the bottom of the trench.



Conduits placed under railroad tracks must be placed no less than 42 inches (1.10 meters) below the bottom of the ties, or as required by the railroad company.



For rigid steel conduit (RSC) and rigid non-metallic conduit (NMC), trenching is the accepted method of conduit installation except when the conduits are being installed under existing roadways. Conduits must not be placed until the trench has been inspected.

Except for under existing pavements, HDPE Continuous Non-metallic Conduit must be placed by trenching, vibratory plow, or other method approved by the Engineer.

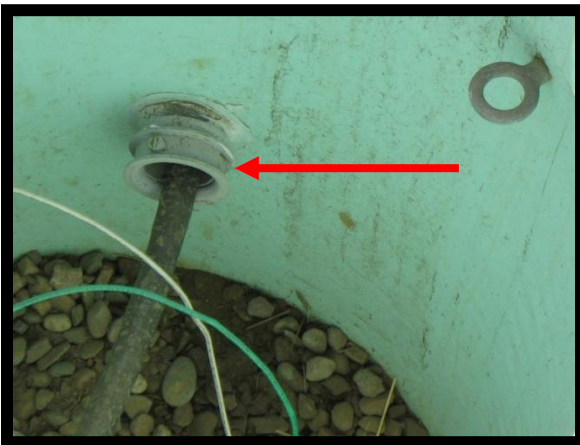


Conduit must be placed by the trenching method, except that the Engineer may direct the Contractor to place conduit under existing pavement by the directional boring, or other method approved by the Engineer.

If a method other than trenching is used and a distortion in excess of one quarter-inch (6 mm) is created in the existing roadway surface, the Contractor must remove the distortion and must restore, at no expense to the Department, the roadway surface to its original condition.



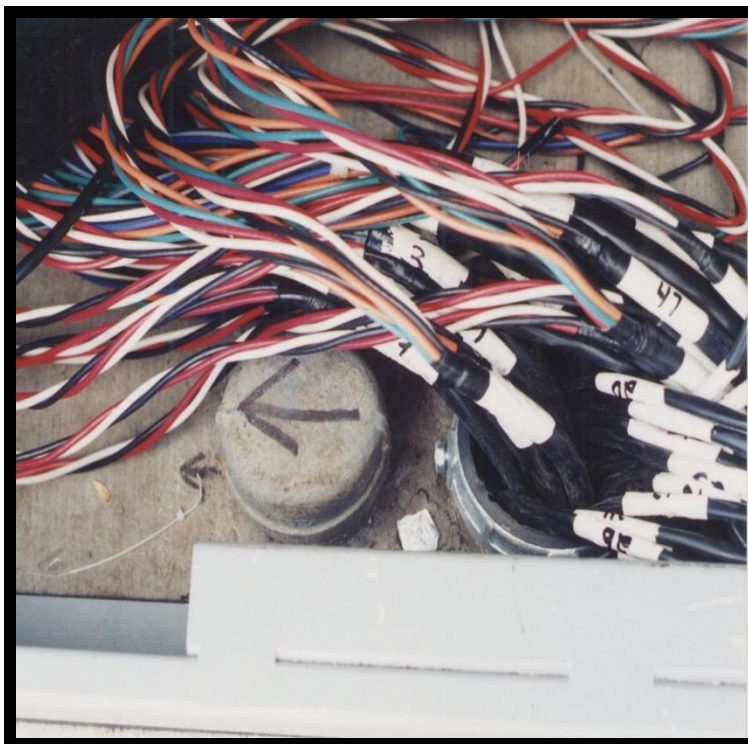
If boring operations through a roadbed are abandoned for any reason, the voids must be grouted, at the contractor's expense, to the satisfaction of the Engineer.



The Contractor must install a rigid non-metallic conduit stub out with the appropriate bell ends for all entering armored cable.



Position conduit, terminating in handholes or concrete foundations, so the conduit extends inside the handholes, pole bases, or structure bases by 2 (50 mm) to 3 inches (75 mm). Slope the conduit out of the foundation, toward the handhole opening for drainage.



Conduits that are stubbed out of the foundation for future use must extend 18 inches to 24 inches (460 millimeters to 610 millimeters) beyond the foundation or sidewalk in the direction specified by the Engineer, and be capped on both ends with standard pipe caps. After the cap is secured, a permanent marker should be used to draw an arrow, on the cap, indicating the direction of the conduit.

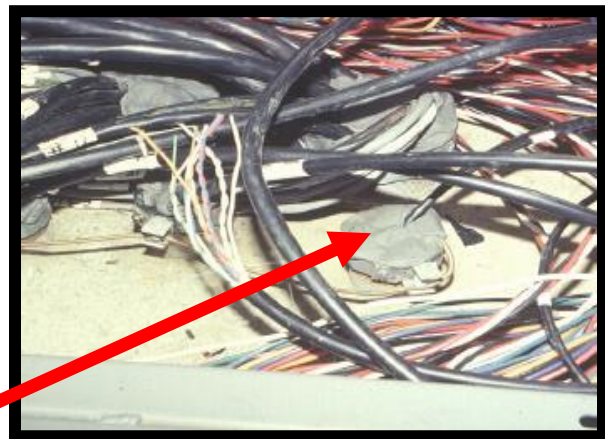
**OPEN ENDS — 2565.3D**

The open ends of conduits that are located in handholes or those that extend above foundations must be capped until the wiring is installed.



When the RSC caps are removed, an appropriate ground bushing (UL Std. 467) must be installed with a lug compatible with a solid bare No. 6 copper bonding conductor. Each bushing must be covered with a corrosion inhibiting compound.

The open ends of conduits in a cabinet or pole foundation must be sealed, after the installation of the cables and conductors, using paraffin or other approved sealing compounds. This prevents moisture from entering the cabinet or signal pole. The sealant also helps in preventing rodents from entering the foundation through the conduit system.



**R.S.C. JOINTS — 2565.3D**

When standard length conduit is cut, the end must be threaded and reamed to remove burrs and rough edges. Field cuts must be made square and true so that all ends joined by coupling must butt together, for the full circumference, and provide an electrical bonding and grounding connection throughout the entire length of the conduit run.



If the coating on the conduit is damaged during handling or installation, the damaged areas must be painted with rust preventative paint to the satisfaction of the Engineer.

**EXISTING CONDUITS — 2565.3D**

If the existing underground conduit is incorporated into a new signal system, it must be cleaned and blown out with compressed air before the new wires are installed. If a new handhole is installed into an existing conduit run, the conduit



must be cut, threaded and extended into the new handhole as directed by the Engineer. A new bushing and ground wire must be installed and the sides of the handhole must be made water tight before the installation of

any new wires. Threadless couplings and bushings are not permitted unless otherwise authorized by the Engineer.

**NON-METALLIC CONDUITS — 2565.3D**  
[Rigid PVC Sectional and Continuous Length (HDPE)]



All non-metallic conduit must be listed by a Nationally Recognized Testing Laboratory (NRTL) as being compliant with the requirements of UL 514B and UL 651 for underground use.

All non-metallic conduit must be Schedule 80.

Cut ends, of sectional conduit, must butt or come together for the full circumference thereof.

All non-metallic conduit must be either RED or Grey color.

HDPE continuous length conduit must not be spliced under roadway surfaces.

When rigid PVC conduit sections are installed using the directional boring method, the rigid PVC conduit “sections” must be pre-glued at least 6 hours prior to installation under roadway surfaces.

Long-line couplings must be used when rigid PVC conduit sections are installed under roadway surfaces.

The Contractor must trim the inside and outside of cut ends to remove rough edges.

All open ends of non-metallic conduit must be immediately capped to keep moisture and debris out.

Before cables and conductors are installed, standard non-metallic conduit bell ends must be installed to prevent damage to the cables and conductors.

The Contractor must pull cables and conductors through the N.M.C. conduit, in such a manner, as not to damage the conduit due to pull rope abrasion.

The Contractor will be required to pull a ground wire through the conduit system as required by the Contract documents.

HDPE Continuous length conduit must not be used between concrete foundations and the nearest handhole.

### CONDUITS ATTACHED TO A BRIDGE — 2565.3D



Because bridges are subjected to flexing, expansion and contraction, special conduit fittings and hangers are required (see special details for the installation procedure). Improper installation of conduits can cause severe damage to the electrical system and may cause damage to the bridge structure itself.

All conduit must be attached to bridge as specified in the Contract documents.