

FURNISH AND INSTALL MULTI-DUCT CONDUIT SYSTEM

**** From Waterbury IM 089-2(43)(Re-advertised)**

xx. DESCRIPTION. This work shall consist of furnishing and installing a multi-duct conduit (MDC) system of the type(s) and size(s) shown on the Plans.

xx. GENERAL REQUIREMENTS. The MDC system shall be suitable for an outdoor and underground environment.

MDC is a pre-manufactured conduit with PVC, galvanized rigid metal, or fiberglass conduit as outer duct, and 1¼ inch conduits as inner ducts.

xx. MATERIALS. Provide new materials that are Underwriters Laboratory, Inc. (UL) Listed and meet National Electrical Manufacturers Association (NEMA), American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), and National Electrical Code (NEC) most recent requirements.

The material used to construct the underground system shall conform to the material and performance requirements of the Bellcore Specification TR-NWT-000356, Issue 2, October 1992, "Generic Requirements for Optical Cable Innerduct".

All components of the MDC system shall be provided by the same manufacturer.

The MDC system consists of outer duct, inner ducts, warning tape, pull tape, bends, couplings, adapters, and other accessory fittings.

The MDC system shall provide mechanisms to ensure that conduit expansion and contraction stresses are normalized.

(a) Outer Duct. Provide 4 inch outer duct unless otherwise shown on the Plans.

Unless otherwise noted on the Plans, provide schedule 40 polyvinyl chloride (PVC) conduits for outer duct when the MDC system is buried. PVC outer conduit shall meet the requirements of NEMA TC-2 "Electrical Polyvinyl Chloride Conduit" or TC-6 "PVC Plastic Utilities Duct for Underground Installations", UL 651 "Standard for Safety Schedule 40 and 80 Rigid PVC Conduit and Fittings", and the NEC.

Provide galvanized rigid metal conduit for outer duct when the MDC system is hung under a bridge.

(b) Inner Duct. The inner duct assembly shall consist of four ribbed 90% virgin high-density polyethylene (HDPE) color-coded ducts. Each duct shall have a minimum inside diameter of 1.25 inches and a minimum wall thickness of 0.075 inches. The four ducts shall be pre-assembled in the factory and inserted into the outer duct/conduit or manufactured multi-duct conduit as an integrated multi-duct conduit.

Provide flat profile, low stretch polyester, 5/8 inch 2500 lb minimum tensile strength pull tape with sequential markings in each empty inner duct.

The inner ducts shall be uniquely defined by the extrusion of a different color for each of the inner ducts.

The inner ducts will be held together by a system of spacers. The internal spacers shall be factory installed to hold the inner ducts in proper spacing and alignment to prevent free twisting. Spacers shall be molded from a high impact plastic, and be factory certified to withstand all handling pressures and stresses.

The inner ducts shall be the same type within the bends and within the straight sections.

- (c) Coupling Body. The MDC, including respective bends, couplings, adapters, and other accessory fittings, will contain a coupling body for sealing the outer and inner ducts of adjacent conduit sections in an end to end relationship.

Provide a factory installed primary coupling body that is manufactured as a hard plastic coupling body incorporating conical shaped target areas to accommodate self-alignment of each inner duct field assembly. Provide a coupling body that incorporates sealing devices to facilitate field assembly and prevent water and foreign material leakage from outside MDC and to prevent air leakage from inside the inner ducts. No lubricant is required for field assembly of this conduit system and assembly shall be accomplished solely by hand without use of special tools.

Ensure the coupling body has a plurality of bores containing principal seals which are molded as an integral part of the coupling body.

Ensure the coupling body with its sealing members seals the outer walls of the inner ducts and the inner wall of the outer duct providing airtight seal from within the inner duct system and a watertight seal from the outside of the outer duct.

The gasket or sealing members shall be an anti-reversing design in such that the lengths of conduit stay joined together.

Ensure the field connection end of the internal coupling body incorporate shaped target areas to accommodate self-alignment of the inner ducts with bore openings during field assembly.

The coupling body shall have one of the bore openings on the field assembly side uniquely identified to facilitate proper continuous inner duct alignment during field assembly.

- xx. CONDUIT LOCATE SYSTEM. Place the locate system along any underground conduit installation. Ensure that the locate system includes above ground route markers, warning tape, and tone wire that allow detection of buried conduit and other related underground facilities.

Furnish and install a system as shown in the Plans and as directed by the Engineer. Ensure that the locate system provides:

- (a) Warning Tape. Ensure that the buried cable warning tape is flexible, elastic material 6 inches wide, intended for burial and use as an underground utility warning notice. Ensure that the surface of the warning tape is coated and sealed to prevent deterioration caused by harsh soil elements. Ensure that the warning tape color is orange as required by the American Public Works Association (APWA) Uniform Color Code, and has "CAUTION: FIBER OPTIC CABLE BURIED BELOW", or other wording approved by the Engineer, permanently printed on its surface every 24 inches.

Include buried cable warning tape with all conduits.

Install buried cable warning tape 6 to 8 inches below the finish grade, directly over any installed conduit and cable run.

- (b) Locate Wire. The locate wire shall be one #12 AWG electrical conductor, and shall be buried along the conduit system. It shall be coated to protect against corrosion.

Locate wire shall be buried along the conduit system.

- xx. EXPANSION JOINTS. Provide expansion joints having a material similar to the connecting conduit.
- xx. TERMINATION KIT. Provide special termination kits from the conduit manufacturer for terminating the conduit in pull boxes or manholes. The kits shall provide for a water-tight seal of conduit to structure wall and between inner ducts and outer ducts.
- xx. BENDS/SWEEPS/ELBOWS. Complete conduit rigid bend sections, including outer conduit and high-temperature burn-through resistant inner duct, shall be manufactured, and shall be complete with bell and spigot.

Conduit deflection should not deviate more than 1 inch horizontally and/or vertically per foot of running length of conduit (1:12 rule). Long conduit sweeps should be used wherever possible to change conduit direction in order to reduce the pulling tension required during cable installation.

Where long conduit sweeps are not possible, standard factory made conduit elbows of 11¼, 22½, or 45 degrees with a minimum radius of 42 inches should be specified. 90 degree cumulative turns must be made up of individual elbows. Where complex sites leave no other option, such as into and out of structures, and thus requiring near 90 degree turns, a minimum radius of 42 inches is required. 90 degree elbows should be avoided, as they require additional labor and equipment for cable installation, even on short runs. The smallest degree bend possible should be utilized to minimize cable installation challenges. There shall be no more than 360 degrees of cumulative bends between adjacent ITS pull boxes.

xx. CONSTRUCTION REQUIREMENTS.

- (a) Installation. Place conduit in accordance with the lines, grades, details, and dimensions shown on the Plans or as directed by the Engineer. Install underground MDC system at a minimum of 30 inches below the finished surface or pavement, or natural ground in unpaved areas.

When approved by the Project Manager, the conduit may be placed up to, but not less than, 18 inches below the surface elevation where underground utility conflicts occur at 30-inch depth. Conduit shall be encased in concrete not less than 3 inches on all sides for burial depths of less than 30 inches.

Install conduit in accordance with the requirements of the National Electrical Code (NEC).

Ream all conduit ends to remove burrs and sharp edges. Fasten all conduit placed on structures with conduit straps or hangers as shown on the Plans or as directed. Fit the conduit terminations with bushings or bell ends.

- xx. DOCUMENTATION. Provide manufacturer's cut sheets and product specifications to the VTrans ITS Engineer or designee for review and approval at least 30 days prior to ordering the materials.

- xx. WARRANTY. Ensure that the MDC system has a two-year manufacturer's warranty from the date of final acceptance by the Engineer. If the manufacturer's warranties for the components are for a longer period, those longer period warranties will apply.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Furnish and Install Multi-duct Conduit System) to be measured for payment will be the number of meters (linear feet) of system installed in the complete and accepted work.

- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Furnish and Install Multi-duct Conduit System) will be paid at the Contract unit price per meter (linear foot). Payment will be full compensation for performing the work specified and for furnishing all materials, labor, tools, equipment, and incidentals necessary to complete the work.

Excavation/trenching and backfill for placement of conduit will be paid separately under Contract item 204.20.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.640 Special Provision (Furnish and Install Multi-duct Conduit System)	Meter (Linear Foot)