

MS-5
Model Specification for
HDPE Solid Wall Conduit for
Power and Communications Applications

2018



Foreword

MODEL SPECIFICATION FOR HDPE SOLID WALL CONDUIT FOR POWER AND COMMUNICATIONS APPLICATIONS

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The Plastics Pipe Institute, Inc.

<https://plasticpipe.org/>

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Note 1: The user may choose to adopt part or all of this Model Specification. However, users should ensure that all parts which are used are appropriate for the intended purpose. See Notice above.

Note 2: Users should review PPI TN-50 “Guide to Specifying HDPE Conduit” for more information about conduit products and the standards listed within this Model Specification, as well as other information, such as HDPE conduit guidelines. TN-50 also includes an easy-to-follow flow chart to help guide users in selecting the most appropriate specification for various applications.

1.0 GENERAL TERMS AND CONDITIONS

1.1. Scope:

This specification covers requirements for coilable solid wall high-density polyethylene (HDPE) conduit, innerduct, and duct (“conduit”) for power and communications applications. Applications include telecom, SCADA command and control, highway lighting, Intelligent Transportation Systems (ITS), and underground utilities. Installation types include plowing, trenching, and horizontal directional drilling (HDD).

1.1.1. Configurations:

This specification applies to solid wall high-density polyethylene (HDPE) conduit delivered in coils or straight lengths.

1.2. Engineered and Approved Plans:

When required by regulations and codes, power and communications conduit installation and construction shall be performed in accordance with engineered construction plans for the work prepared under the direction of a Professional Engineer.

1.3. Referenced Standards:

Where all or part of a national or international standard specification (e.g. ASTM, ANSI, CSA, NEMA, UL) is incorporated by reference in these Specifications, the reference standard shall be the latest edition and revision.

1.4. Licenses and Permits:

A licensed and bonded General Contractor or Electrical Contractor shall perform all power and communications conduit construction work. The Contractor shall secure all necessary permits before commencing construction.

1.5. Inspections:

All work shall be inspected by an Authorized Representative of the Owner who shall have the authority to halt construction if, in the representative's opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated, the Project Engineer or his Authorized Representative shall, by written notice, order further construction to cease until all deficiencies are corrected. A copy of the order shall be filed with the Contractor's license application for future review. If the deficiencies are not corrected, performance shall be required of the Contractor's surety.

2.0 HIGH DENSITY POLYETHYLENE SOLID-WALL CONDUIT

2.1. Qualification of Manufacturers:

The conduit manufacturer shall be capable of producing and assuring the quality of the conduit required by the appropriate industry standard specifications listed in section 2.3.

The conduit manufacturer shall have a documented quality management system that defines product specifications, manufacturing procedures, and quality assurance procedures that assure conformance with customer and applicable regulatory requirements.

2.2. Approved Manufacturers:

Manufacturers that are qualified and approved by the Project Engineer are listed below. At the discretion of the Project Engineer, products from unapproved manufacturers may be submitted for approval.

[\(Insert Company Name and Address of approved suppliers.\)](#)

2.3. Materials:

Compounds used for the manufacture of polyethylene conduit shall be high-density polyethylene of minimum cell class 334480C or E, as per ASTM D3350, in accordance with the appropriate industry standard specification listed below (see *Section 5.0 for details on reference standards and specifications*)

- 2.3.1. ASTM F2160
- 2.3.2. ASTM D3485*
- 2.3.3. CSA C22.2 No. 327
- 2.3.4. NEMA TC 7
- 2.3.5. UL 651A
- 2.3.6. UL 1990*

* Standard Specifications for Cable in Conduit

- 2.3.7. Only UV-stabilized materials, in accordance with ASTM D3350, shall be used for above-ground applications.

Note 3: Users should review PPI TN-50 “Guide to Specifying HDPE Conduit” to select the applicable product standard to ensure correct specification of material properties (e.g. ASTM F2160 for fiber optic communications applications). See also Note 1.

2.4. Size and Dimensions:

HDPE conduit shall be manufactured to the dimensions and requirements of the applicable product standard, such as those listed in section 2.3.

- 2.4.1. Other sizes and requirements shall be acceptable by advance mutual agreement between the customer (Owner, Purchaser, or Project Engineer as appropriate) and the manufacturer.

Note 4: Specifier and Purchaser shall select the correct product trade size, wall type (e.g. SDR, SIDR, true-size), color (e.g. stripes, full wall, coextruded), maximum reel size, and length.

2.5. Ovality:

Ovality of nominal size 2 and smaller conduit shall not exceed 7% after removal from the coil. Coiled conduit larger than nominal size 2 through 3 shall not exceed 10% ovality after removal from the coil. Ovality in coiled nominal size 4 and greater diameter conduit is largely a packaging condition; greater than 15% ovality shall be corrected in the field by processing the roundable conduit through re-rounding and straightening equipment during installation.

2.5.1. Calculate the percent Ovality as follows:

$$\% \text{ Ovality} = \frac{(\text{Maximum OD} - \text{Minimum OD}) \times 200}{(\text{Minimum OD} + \text{Maximum OD})}$$

2.5.2. Straight lengths of conduit shall have ovality of 5% or less.

2.6. Colors:

For buried (below-ground) use, solid wall colors or a permanent color identification shall be available either as stripes or as a coextruded skin. The color layer of the stripes or coextruded skin shall be permanently bonded to the main body and exhibit the same chemical and mechanical properties as the underlying material. Colored conduit shall maintain its color for a period of one (1) year when stored outside, or as otherwise agreed to by the specifier and producer.

Striped conduit shall have a minimum of three (3) equally spaced stripes of sufficient width and color intensity to be easily distinguished from a distance of 10 feet (3 m) and from any angle.

2.6.1. **Solid yellow or black with yellow stripes shall not be used for identification of conduit due to risk of misidentification with gas pipe.**

2.7. Friction Reduction:

Friction reduction, if required, shall be available in the form of lubrication or interior ribbing, or both, as specified by the customer. Ribbing shall not be sharp or severe.

Factory pre-lubrication shall be performed with materials or agents that provide a stable treatment and result in a dynamic coefficient of friction less than or equal to (\leq) 0.20, when tested in accordance with Telcordia (Bellcore) GR-356-CORE, section 4.2.5. Lubricants shall be chemically compatible with both conduit and cable jacket materials.

2.8. Pull Media:

Pull media, if required, shall be available pre-installed into the conduit. Media shall consist of high tensile fiber tapes or rope. Tapes shall be pre-lubricated and shall include sequential length marks. Sufficient slack shall be available in the tapes to prevent binding when unwinding the conduit from the coil.

Note 5: Pull media (tape or rope) is available in numerous tensile strength ratings. Specifiers should indicate the tensile strength that is required, in units of pounds of tensile strength.

2.9. Markings:

Conduit shall be marked in accordance with the appropriate industry standard specification.

2.10. Compliance Tests:

In case of conflict with Manufacturer's certifications, the Contractor, Project Engineer, or Owner may request retesting by the Manufacturer or have retests performed by an outside testing service. All retesting shall be at the requestor's expense and shall be performed in accordance with the appropriate industry standard specification.

2.10.1. Standard testing requirements are those noted in the appropriate industry standard specification and include dimensional evaluation, elongation at break, and low-temperature impact.

2.10.2. When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser stating that the conduit was manufactured, sampled, tested, and inspected in accordance with the appropriate industry standard specification and found to meet the requirements.

3.0 JOINING

3.1. Methods:

HDPE conduit shall be joined by the methods listed within this section. Couplers shall be selected in consideration of installation requirements, such as tensile loads encountered during horizontal directional drilling (see 4.3). The coupling manufacturer's recommendations shall be observed when making mechanical connections.

3.2. Mechanical Couplings:

Mechanical couplings, such as those in accordance with ASTM F2176, may be used.

Note 6: Numerous styles of couplers are available with varying levels of performance related to tensile strength, internal pressure capability, and external pressure capability (water-tightness). Specifiers should indicate the performance that is required to ensure satisfactory performance.

3.3. Mechanical Joint Adapters:

Mechanical joint adapters, transition fittings, grooved couplings, threaded couplings, and compression couplings may be used.

3.4. Fusion Type Fittings:

Butt fusion, socket fusion and electrofusion fittings may be used.

3.4.1. Butt-type heat fusion fittings shall comply with ASTM D3261.

Note 7: In butt-fusion joints, internal beads will reduce the inside diameter, and potential restrictions must be considered when installing cables.

3.4.2. Socket-type heat fusion fittings shall comply with ASTM D2683.

3.4.3. Butt fusion and socket fusion fittings for HDPE conduit shall be installed in accordance with ASTM F2620 and the instructions of the conduit and fitting manufacturers.

3.4.4. Electrofusion-type fittings shall comply with ASTM F1055.

3.4.5. Electrofusion fittings for HDPE conduit shall be installed in accordance with the instructions of the conduit and fitting manufacturers.

3.5. Welding:

Extrusion welding and hot gas welding shall not be used.

4.0 CONSTRUCTION AND INSTALLATION

4.1. General:

Conduit sizing and placement shall be consistent with the recommendations provided by the *PPI Handbook of Polyethylene Pipe*, Chapter 14 "Polyethylene Duct and Conduit" and with NEMA TCB 4 *Guidelines for the Selection and Installation of Smooth-Wall Coilable High-Density Polyethylene (HDPE) Conduit*.

4.2. Underground Installation:

Underground installations using open-cut and burial techniques shall be performed in accordance with ASTM Standard Guide F1668 or as specified by the Project Engineer. The contractor shall observe all appropriate safety requirements in accordance with local, state and federal codes and regulations, such as OSHA trenching and excavation safety requirements in 29 CFR 1926.651 and 1926.652.

4.3. Horizontal Directional Drilling (HDD):

HDD applications are to be performed as specified by the Project Engineer and in accordance with ASTM Standard Guide F1962, PPI TR-46 *Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High-Density Polyethylene Pipe*, and *Mini Horizontal Directional Drilling Manual* published by the North American Society of Trenchless Technology (NASTT).

5.0 STANDARDS AND SPECIFICATIONS

ASTM D2321 *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications* www.astm.org

ASTM D2683 *Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing*

ASTM D3261 *Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*

ASTM D3350 *Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*

ASTM D3485 *Standard Specification for Coilable High Density Polyethylene (HDPE) Cable in Conduit (CIC)*

ASTM F1055 *Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing*

ASTM F1668 *Standard Guide for Construction Procedures for Buried Plastic Pipe*

ASTM F1804 *Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation*

ASTM F1962 *Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings*

ASTM F2160 *Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)*

ASTM F2176 *Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct*

ASTM F2620 *Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings*

CSA C22.2 No. 327 *HDPE conduit, conductors-in-conduit, and fittings* www.shop.csa.ca

NEMA TC 7 *Smooth-Wall Coilable Electrical Polyethylene Conduit* www.nema.org

NEMA TCB 4 *Guidelines for the Selection and Installation of Smooth-Wall Coilable High-Density Polyethylene (HDPE) Conduit*

UL 651A *Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit* www.UL.com

UL 1990 *Nonmetallic Underground Conduit with Conductors*

PPI TR-46 *Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High-Density Polyethylene Pipe* www.plasticpipe.org

PPI Handbook of Polyethylene Pipe