PPI MS-5

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

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Plastics Pipe Institute
The Voice of an Industry.

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Foreword

The Plastics Pipe Institute (PPI) has prepared this model specification as a service to its members and the industry. It is offered for use as a starting point and guide in developing appropriate final specifications suited to a particular project's needs.

This Model Specification was developed and published with the technical help and financial support of the members of the Plastics Pipe Institute (PPI). These members have shown their commitment to developing and improving quality products by assisting standards development organizations in the development of standards, and also by developing design aids and reports to help engineers, code officials, specifying groups, contractors and users.

PPI has prepared this Model Specification as a service to the industry. The information in this report is offered in good faith and believed to be accurate at the time of its preparation, but is offered "as is" without any express or implied warranty, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Additional information may be needed in some areas, especially with regard to unusual or special applications. Consult the manufacturer or material supplier for more detailed information. A list of member manufacturers is available on the PPI website. PPI does not endorse the proprietary products or processes of any manufacturer and assumes no responsibility for compliance with applicable laws and regulations.

PPI intends to revise this Model Specification within 5 years, or sooner if required, from the date of its publication in response to comments and suggestions from users of the document. Please send suggestions for improvements to the address below. Information on other publications can be obtained by contacting PPI directly or visiting our website.

The Plastics Pipe Institute, Inc.
www.plasticpipe.org

This Model Specification was first issued in 2008, revised in April 2018 and July 18, 2024.

PREFACE

This preface provides information and direction to the user of this document that is not intended to be incorporated into a specification referenced or published by the user. Using the text here-in within your specification and following the guide will assist in properly specifying HDPE conduit product. Contact PPI for an editable version of the text, if desired.

This publication is intended for use as a guide to support the designer or specifier of HDPE conduit systems. It contains the basic information needed to specify products, conduit, and fittings, that are commercially available and meet industry requirements. It can be used to solicit a quote from a manufacturer or bids from multiple companies. **It should not be used in lieu of the advice of a professional engineer.**

Existing product standards contain the material requirements and necessary performance requirements, so it is sufficient to reference the standard(s) rather than repeating those requirements within your specification. This guide helps you to specify only the options that you may need for your project(s).

The Plastics Pipe Institute (PPI) has made every reasonable effort to ensure the accuracy of this publication, but it may not provide all necessary information, particularly with respect to special or unusual applications or local codes and requirements. This publication may be changed from time to time without notice. Visit https://www.plasticpipe.org for the most current edition.

Note 1: Notes shown in blue highlights provide direction to the specifier for customization of the text. This preface and the blue notes should be deleted from the text of the final specification.

Note 2: 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 above.

Note 3: 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. PPI also offers a free online course covering Selecting and Specifying HDPE Conduit, available at PPI eLearn™.

It is anticipated that the user of this document will need the following information to customize this model specification to their needs:

- Acceptable standard(s) (e.g., ASTM F2160, UL651A,)
- Packaging Information
    - Format: Coiled, reeled or straight lengths
    - Special coil, reel, or banding instructions
    - Footage per coil/reel, stick lengths
- Sizing information (in consideration of the those permitted by the selected standard)
    - Sizing standard (e.g., IPS, Schedule, True Size, SIDR)
    - Wall type (e.g., SDR 11, Schedule 80, etc.)
- Application aerial or buried/encased
- Color or striping requirements
- Friction reduction features such as lubricant or ribbing
- Pull Media requirements, if any
- Acceptable joining methods

Note 4: Construction and installation specifications are not included in this model specification. See Section 4.0 for documents that may be helpful to the specifier.

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MODEL SPECIFICATION FOR HDPE SOLID WALL CONDUIT FOR POWER AND COMMUNICATIONS 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. Also included are requirements of fittings and joining of HDPE conduit.

Applications include telecom, SCADA command and control, highway lighting, Intelligent Transportation Systems (ITS), and underground utilities. Installation methods may include plowing, trenching, and horizontal directional drilling (HDD).

This specification applies to solid wall high-density polyethylene (HDPE) conduit delivered in coils, reels or straight lengths and fittings for use with such conduit.

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, CSA, NEMA, UL, AASHTO) 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. Allowable Conduit Standards

The conduit supplied shall meet all requirements of one of the following acceptable product standards:

- AASHTO R 63
- ASTM F2160
- ASTM D3485*
- CSA C22.2 No. 327
- NEMA TC 7
- UL 651A
- UL 1990*

* Standard Specifications for Cable in Conduit

Note 5: Specifier should review PPI TN-50 Guide to Specifying HDPE Conduit to select the acceptable product standard(s) to ensure correct specification of material properties (e.g., ASTM F2160 for fiber optic communications applications). See also Note 3.

2.2. Certification

Product marked with UL 651A, UL 1990, or CSA C22.2 No. 327 shall be certified by a third-party listing organization.

2.3. Qualification of Manufacturers

The conduit manufacturer shall be capable of producing and assuring the quality of the conduit as required by the product standard marked on the conduit.

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.

2.4. 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.

Note 6: Insert Company Name and Address of approved suppliers.

2.5. Materials

Compounds used for the manufacture of polyethylene conduit shall meet the minimum material requirements in accordance with the product standard marked on the conduit. See Section 4.0 for details on reference standards and specifications.)

Only black material, in accordance with ASTM F2160, shall be used for conduit in aerial applications.

Note 7: Specifier or Purchaser should indicate in the project documentation or purchase order that the product is for aerial applications.

2.6. Trade Sizes and Wall Types

Conduit shall be supplied in the trade size and wall type in the purchase order or project documents.

HDPE conduit shall be manufactured to the dimensions and ovality requirements of the size and product standard marked on the conduit.

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

Note 8: Specifier or Purchaser should include the allowable product trade size and wall type (e.g., SDR, SIDR, true-size) in the project document or purchase order. Alternatively, these can be specified here-in. Detailed dimensions are not required to be included. Sizes specified should be those permitted by the product standard(s) specified in 2.1.

2.7. Colors & Striping

Conduit shall be supplied with the specific colors and stripes as specified by the purchaser or specifier in the purchase order or project documents.

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.

Where stripes or a coextruded outer skin are used to provide color, 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.

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.

Restriction: Solid yellow or black with yellow stripes shall not be used for identification of conduit due to risk of misidentification with gas pipe. See PPI Statement V Position Statement on Recommended Color Code for Solid Wall Plastic Pipe and Conduit, which is based on the American Public Works Association Uniform Color Code.

Note 9: Specifier or purchaser should include the conduit color requirement (e.g., stripes, full wall, coextruded) in the project documentation, purchase order, or here-in. For aerial applications, black material, in accordance with ASTM F2160 aerial applications, should be specified.

2.8. Friction Reduction

Where specified by the purchaser or specifier in the project documentation or purchase order, friction reduction shall be in the form of lubrication or interior ribbing, or both. 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 (≤) 0.20, when tested in accordance with Telcordia (Bellcore) GR-356-CORE, section 4.2.5.

Lubricants, whether factory applied or field applied, shall be chemically compatible with both conduit and cable jacket materials.

Note 10: Specifier or Purchaser should add their specific requirements for friction reduction, if any.

2.9. Joinability

HDPE conduit shall be joinable by the methods listed within Section 3.

2.10. Pull Media

Where specified by the purchaser or specifier in the project documentation or purchases order, pull media shall be 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 11: 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.

2.11. Markings

Conduit shall be marked in accordance with the product standard marked on the conduit.

2.12. Conduit Length & Packaging

Conduit length(s) and packaging form shall be as specified by the purchaser or specifier in the purchase order or project documents.

Note 12: Specifier or Purchase should include in project documentation or purchase order whether conduit should be supplied as straight lengths (sticks), coils or reels. Any special coil, reel or banding requirements should be included. The lengths should be specified (typically X' ft).

2.13. Compliance Tests

Where 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 product standard marked on the conduit and found to meet the requirements.

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.

Note 13: Specifier or Purchase should include in project documentation or purchase order whether a manufacturer's certification is required in writing.

3.0 ALLOWABLE JOINING 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. The conduit and coupling manufacturer's recommendations shall be observed when making connections.

Note 14: Specifier should remove non-acceptable joining methods from those specified below.

3.1. Mechanical Couplings

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

Where NFPA-70 US National Electrical Code or CSA C22.1 Canadian Electrical Code listings are required for fittings, fitting shall be listed to UL514B by a third-party certifier.

Note 15: Numerous styles of couplers are available with varying levels of performance related to tensile strength, internal pressure capability, and external pressure capability (watertightness). Specifiers should indicate the performance that is required to ensure satisfactory performance or, alternatively, specified approved supplier's products.

3.2. Fusion Type Fittings

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

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.

- Butt-type heat fusion fittings shall comply with ASTM D3261.
- Socket-type heat fusion fittings shall comply with ASTM D2683.

Note 16: In butt-fusion joints, internal beads may reduce the inside diameter, and potential restrictions should be considered for when installing cables. If a concern, specify inner bead removal which is possible on stick conduit of

certain sizes and lengths. Otherwise consider alternative joining methods.

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

- Electrofusion-type fittings shall comply with ASTM F1055.

3.3. Adhesive Joining

Adhesive joining of HDPE conduit to fittings may be used. Follow all adhesive bonding material manufacturer's instructions when joining conduit to a fitting.

3.4. Welding

Extrusion welding and hot gas welding shall not be used.

3.5. Solvent Cement Joints

Joining with solvent cement is not permitted.

4.0 STANDARDS, SPECIFICATIONS & REFERENCE DOCUMENTS

These documents are provided for reference only.

4.1. PPI Documents (All PPI Publications)

- Statement V - Position Statement on Recommended Color Code for Solid Wall Plastic Pipe and Conduit
- MAB-7 MAB Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of HDPE (PE4710) Pipe in Municipal Applications
- TN-48 Guidelines for Choosing Wall Thickness for HDPE Conduit Based on "Mini-HDD" (Horizontal Directional Drilling)
- TN-50 Guide to Specifying HDPE Conduit
- TN-58 HDPE Conduit and Duct Handling Guide
- TN-61 Coilable HDPE Conduit Ovality and Coil-Set
- TN-63 Safe Pull Strength Calculations for Conduit
- Statement AC Operating 90 °C and 105 °C Rated Cables with HDPE Conduit

4.2. Handbook of Polyethylene Pipe

- PE Handbook Errata Sheet
- Chapter 3 - Material Properties
- Chapter 5 - Standard Specifications, Standard Test Methods and Codes for PE (Polyethylene) Piping Systems
- Chapter 6 - Design of PE Piping Systems
- Chapter 7 - Underground Installation of PE Piping
- Chapter 8 - Above-Ground Applications for PE Pipe
- Chapter 9 - PE Pipe Joining Procedures
- Chapter 12 - Horizontal Directional Drilling
- Chapter 14 - Duct and Conduit

4.3. ASTM Documents (www.astm.org)

- ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- 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

4.4. CSA Documents (https://www.csagroup.org/store/about-csa-store)

- CSA C22.2 No. 327 *HDPE conduit, conductors-in-conduit, and fittings*

4.5. NEMA Documents (www.nema.org)

- NEMA TC 7 Smooth-Wall Coilable Electrical Polyethylene Conduit
- NEMA TCB 4 *Guidelines for the Selection and Installation of Smooth-Wall Coilable High-Density Polyethylene (HDPE) Conduit*

4.6. UL Documents (https://www.shopulstandards.com/)

- UL 651A High Density Polyethylene (HDPE) Conduit
- UL 1990 Nonmetallic Underground Conduit with Conductors