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Properly Specifying HDPE Conduit for Power and Communications Projects

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Presentation Description

This presentation will assist users and specifiers of high density polyethylene (HDPE) conduit by describing the latest industry product standards for HDPE conduit, and explaining when to use each of these. It will also provide access to a Model Specification provided by the HDPE conduit industry.

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Presentation Outline

By the end of this course, you will be able to:

1. Introduce HDPE conduit **products**, types, and applications
2. Describe the **history** of HDPE conduit standards
3. List seven current industry **standards** for HDPE conduit
4. Explain how PPI Model Specification **MS-5** can assist specifiers
5. Share how PPI is a **resource** to the power & communications industry

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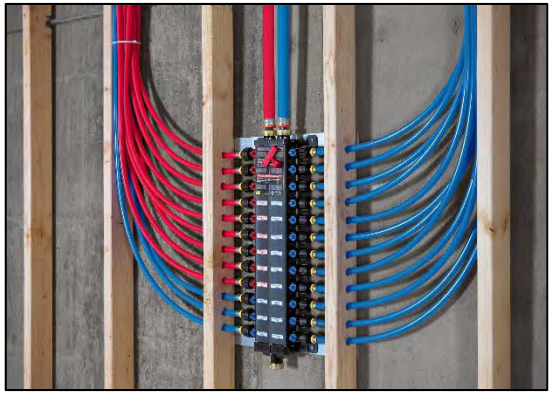
Introduction to the Plastics Pipe Institute

PPI was formed in 1950 to develop test methods for plastic pressure pipe

- PPI's five divisions focus on solutions for multiple applications:
  - Building & Construction Division (BCD)
  - Corrugated Plastic Pipe Association (CPPA)
  - Energy Piping Systems Division (EPSD)
  - Municipal & Industrial Division (MID)
  - **Power & Communications Division (PCD)**



BCD: PEX tubing for plumbing

EPSD: Gas distribution piping

MID: HDPE water mains

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Introduction to the Plastics Pipe Institute

PPI's Power & Communications Division (PCD) Mission Statement:
"To expand the knowledge of the uses and benefits of HDPE conduit for power and communications applications."

PCD collaborates with standards development organizations (SDOs) that set standards for manufacturing practices, quality control, product-testing and installation methods. PCD also educates designers, installers, users and government officials about HDPE conduit; establishes a forum for problem solving and new ideas; and maintains liaison with industry, educational and government agencies.

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Introduction to the Plastics Pipe Institute

Examples of PCD Member Companies…

- Blue Diamond Industries
- Centennial Plastics
- Chevron Phillips
- Dura-Line Corporation
- Dow Chemical
- ETCO Specialty Products
- Four Star Industries
- Flying W Plastics
- Formosa Plastics Corp.
- Jain Irrigation
- Hubron
- JM Eagle
- INEOS
- Infra Pipe Solutions
- IPEX
- LyondellBasell Industries
- Southwire
- Shell Polymers
- Teel Plastics
- United Poly Systems
- Victaulic
- WL Plastics

These are the firms that pioneer, develop and produce HDPE conduit and accessories for power and telecommunications applications across North America.

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1. HDPE Conduit, Types, and Applications

Introduction to High Density Polyethylene (HDPE) Conduit

- High density polyethylene (HDPE) conduit is the preferred material to house and protect electrical power and telecommunications cables
- HDPE offers unmatched corrosion and chemical resistance, is flexible and durable, and is available in long reel lengths to reduce joints and installation time
- HDPE conduit is available in a variety of sizes, colors, dimensions and lengths

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HDPE Conduit, Types, and Applications

HDPE Conduit Types

<u>Outside Plant:</u>

- Smoothwall
- Ribbed
- Innerduct
- Microduct
- Aerial
- Cable-in-Conduit (CIC)

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HDPE Conduit, Types, and Applications

HDPE Conduit Types

- Example: Three-in-One HDPE conduit with innerduct
- Example: Multi-color reel of 2 inch IPS conduit

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HDPE Conduit, Types, and Applications

HDPE Conduit Benefits

- Not susceptible to corrosion
- Moisture-proof and water-tight
- Immune to attack from insects
- Resists brittleness due to aging or cold weather
- Eliminates maintenance common to aerial networks
- Easy installation due to long lengths and high pull strength
- Low coefficient of friction allows easier long-distance cable pulls
- Follows trench contours, can be installed around obstacles underground
- Bends and flexes without breakage, even with ground heaves or shifts, over a wide range of temperatures
- High ductility resists damage during transportation, handling, and installation and retains impact resistance

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HDPE Conduit, Types, and Applications

HDPE Conduit Sizes

- Various sizing systems exist, including IPS types SDR9, SDR11, SDR 13.5, DR 15.5, Schedule 40 and Schedule 80, "True Sized", and SIDR

- For IPS types, wall thickness is described by the **Dimension Ratio** (DR)* which typically ranges from DR 9 to DR 17 for diameters up to 12-inch

- HDPE conduit standards such as **ASTM F2160, NEMA TC 7,** and **UL 651A** specify the exact dimensions for HDPE conduit

**Ratio of outside diameter to wall thickness. The lower the DR number, the thicker the wall, relative to other dimension ratios. Some dimension ratios are "standard" and called "SDR"*

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HDPE Conduit, Types, and Applications

HDPE Conduit Sizes

- Excerpt from ASTM F2160 shows wide range of wall types

TABLE 4 Minimum Wall Thickness and Tolerance for IPS SDR 9, SDR 11, SDR 13.5, DR 15.5, Schedule 40 and Schedule 80 PE Conduit

Nominal Size	DR 15.5		SDR 13.5		SDR 11		SDR 9		Schedule 40		Schedule 80	
	Min. in. (mm)	Tol. in. (mm)	Min. in. (mm)	Tol. in. (mm)	Min. in. (mm)	Tol. in. (mm)	Min. in. (mm)	Tol. in. (mm)	Min. in. (mm)	Tol. in. (mm)	Min. in. (mm)	Tol. in. (mm)
½	0.062	+0.020	0.062	+0.020	0.076	+0.020	0.093	+0.020	0.109	+0.020	0.147	+0.020
	(13.00)	+(0.51)	(1.57)	+(0.51)	(1.93)	+(0.51)	(2.36)	+(0.51)	(2.77)	+(0.51)	(3.73)	+(0.51)
¾	0.068	+0.020	0.078	+0.020	0.095	+0.020	0.117	+0.020	0.113	+0.020	0.154	+0.020
	(1.73)	+(0.51)	(1.98)	+(0.51)	(2.41)	+(0.51)	(2.97)	+(0.51)	(2.87)	+(0.51)	(3.91)	+(0.51)
1	0.084	+0.020	0.097	+0.020	0.120	+0.020	0.146	+0.020	0.133	+0.020	0.179	+0.021
	(2.13)	+(0.51)	(2.46)	+(0.51)	(3.05)	+(0.51)	(3.71)	+(0.51)	(3.38)	+(0.51)	(4.55)	+(0.53)
1¼	0.107	+0.020	0.123	+0.020	0.151	+0.020	0.184	+0.022	0.140	+0.020	0.191	+0.023
	(2.72)	+(0.51)	(3.12)	+(0.51)	(3.84)	+(0.51)	(4.67)	+(0.56)	(3.56)	+(0.51)	(4.85)	+(0.58)
1½	0.123	+0.020	0.141	+0.020	0.173	+0.021	0.211	+0.025	0.145	+0.020	0.200	+0.024
	(3.12)	+(0.51)	(3.58)	+(0.51)	(4.39)	+(0.53)	(5.36)	+(0.64)	(3.68)	+(0.51)	(5.08)	+(0.61)
2	0.153	+0.020	0.176	+0.020	0.216	+0.026	0.264	+0.032	0.154	+0.020	0.218	+0.026
	(3.89)	+(0.51)	(4.47)	+(0.51)	(5.49)	+(0.66)	(6.71)	+(0.81)	(3.91)	+(0.51)	(5.54)	+(0.66)
2½	0.185	+0.022	0.213	+0.020	0.261	+0.031	0.319	+0.038	0.203	+0.024	0.276	+0.033
	(4.70)	+(0.56)	(5.41)	+(0.51)	(6.64)	+(0.80)	(8.11)	+(0.97)	(5.16)	+(0.61)	(7.01)	+(0.84)
3	0.226	+0.027	0.259	+0.031	0.318	+0.038	0.389	+0.047	0.216	+0.026	0.300	+0.036
	(5.74)	+(0.69)	(6.58)	+(0.79)	(8.08)	+(0.97)	(9.88)	+(1.19)	(5.49)	+(0.66)	(7.62)	+(0.91)

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HDPE Conduit, Types, and Applications

Applications addressed by HDPE Conduit

- Power:
  - Low-voltage and medium voltage
  - Site Lighting
  - Signal and Control
- Fiber Optic and Communications
- Renewable Energy
- ITS (Intelligent Transportation Systems)
- SCADA (Supervisory Control and Data Acquisition)

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HDPE Conduit, Types, and Applications

Power

- HDPE conduit is used to protect underground power lines
  - Low voltage: 600 V
  - Medium voltage: 15kV to 35kV
- Underground installation of power distribution cables using HDPE conduit is a reliable, sustainable and economical solution
- Buried power lines are not as susceptible to storm damage and other events as compared to aerial cables
- Underground cables require less maintenance than aerial cables (e.g. tree trimming)
- The resiliency and reliability of utilities is typically improved when buried underground


Courtesy Southwire

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HDPE Conduit, Types, and Applications

Power: Cable-in-Conduit

- HDPE conduit with integrated power lines
  - Reduces installation time, improves productivity
  - Less susceptible to damage than installing power cables in the field

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HDPE Conduit, Types, and Applications

Fiber Optic and Communications

- HDPE conduit is used to protect fiber optic installations serving neighborhoods, schools, industry and government with high-speed data

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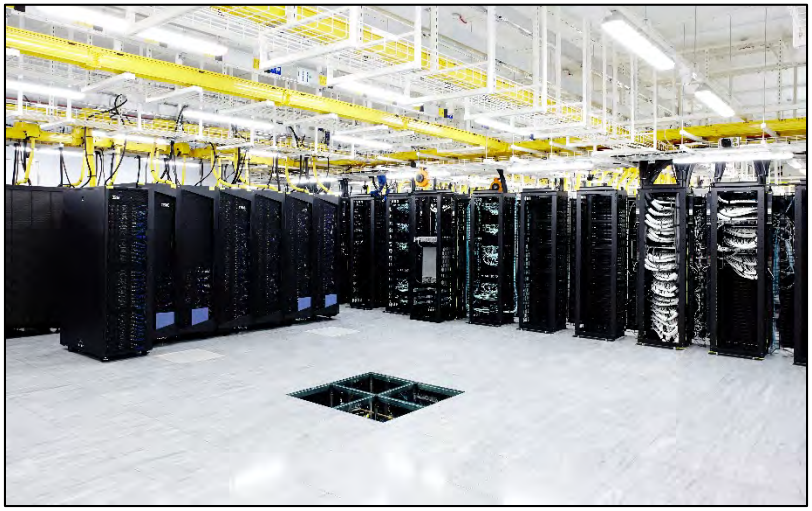
HDPE Conduit, Types, and Applications

Fiber Optic and Communications

- HDPE conduit is used to protect fiber optic installations connecting data centers to neighborhoods, schools, industry, and government with high-speed data
- Protecting the Information Superhighway



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HDPE Conduit, Types, and Applications

Fiber Optic and Communications

- When new roads are constructed or rebuilt, HDPE conduit is one of the first utilities to be installed, often for future fiber optic cable (“Dig once”)

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HDPE Conduit, Types, and Applications

Renewable Energy

- Solar and wind power projects utilize HDPE conduit for command & control

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HDPE Conduit, Types, and Applications

ITS - Intelligent Transportation Systems

- HDPE conduit protects fiber optic & copper communication cables and power cables

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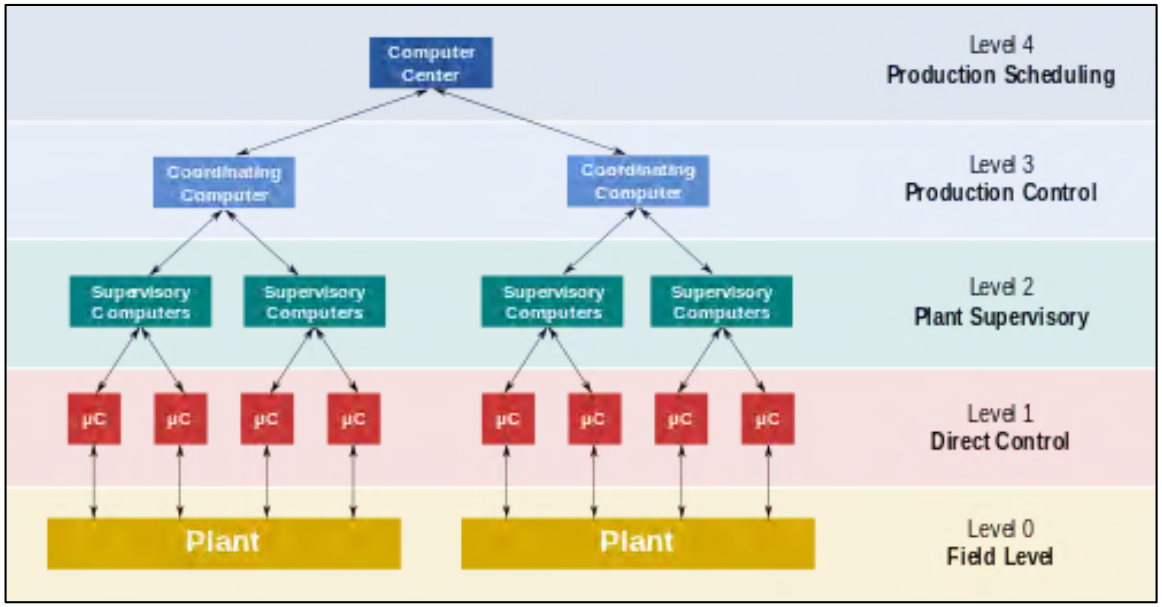
HDPE Conduit, Types, and Applications

SCADA - Supervisory Control and Data Acquisition

- Examples are command/control systems for water treatment plants, oil and gas pipelines, factories, control of solar farm panels, control of wind power propellers, etc.



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HDPE Conduit, Types, and Applications

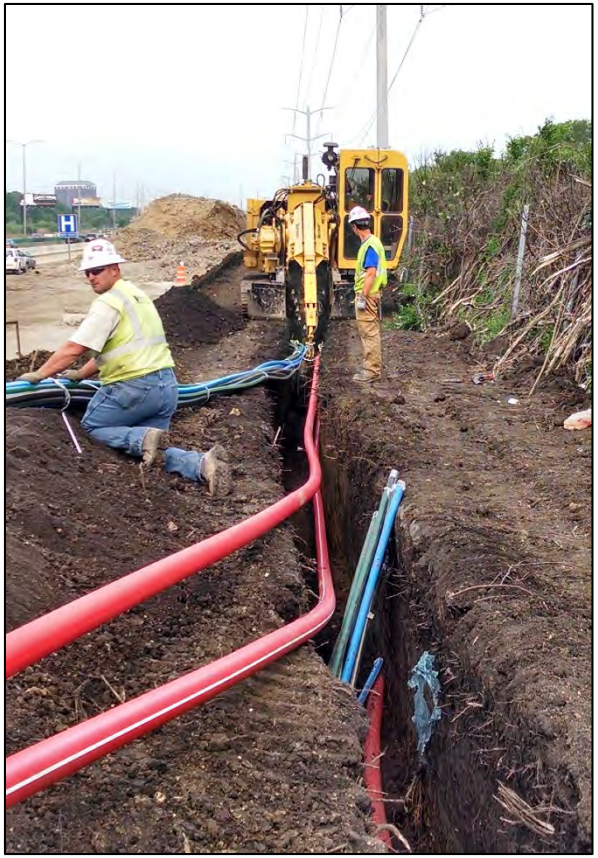
Summary

- HDPE conduit and cable in conduit is available in a wide variety of types and sizes

- Used for many critical applications to protect power and fiber optic cables to connect our modern world

- Proven to be reliable and dependable

- May be installed using trenching, plowing, and horizontal directional drilling (HDD)



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2. History of HDPE Conduit Standards

History of HDPE Conduit Standards

- The early driver behind the use of conduit produced from high-density polyethylene (HDPE) was for deploying and protecting fiber optic (FO) cables placed underground for the telecommunications industry

- Tremendous growth occurred for the installation of fiber optic cables during the early to mid-1980s for linking major metropolitan areas together. In the mid-1980s, fiber optic cable deployment was booming, and multiple manufacturers of HDPE conduit were busy keeping up with demand

- However, there were no third-party product standards in place specifically for HDPE conduit, so the industry adopted existing standards for HDPE water pressure pipes

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History of HDPE Conduit Standards

Examples of typical HDPE water pressure pipe standards:

- **ASTM D3035** "Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter"
- **ASTM D2239** "Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter"
- **ASTM D2447** "Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter" (Withdrawn 2010)
- **ASTM D6070** "Standard Test Methods for Physical Properties of Smooth-Wall, Coilable, Polyethylene (PE) Conduit (Duct) for Preassembled Wire and Cable" (Withdrawn 2016)
- **ASTM F714** "Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter"

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History of HDPE Conduit Standards

Risk of Using Water Pipe Standards for Conduit

- Project specifications that cite inappropriate pressure pipe standards can cause confusion with manufacturers, the supply chain and installers

- While HDPE pressure pipe and conduit standards may appear similar, there are technical differences that are critical to the performance of the products in specific applications

- Specifying a water pipe for a conduit application may even violate requirements of relevant electrical codes while potentially increasing costs, with no value for the customer

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History of HDPE Conduit Standards

Risk of Using "Customized" Specifications for Conduit

- Project specifications that combine inappropriate or incompatible requirements, sometimes pulled from various sources with the best intentions, can create the need for products that don't exist!
- Sometimes referred to as "Frankenstein specs" – "let's use a bit of this, a bit of that"
- This causes confusion with manufacturers, the supply chain, & installers, and can result in the incorrect product being installed

Is this really what was intended?

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History of HDPE Conduit Standards

Importance of Using Current HDPE Conduit Standards

- Industry conduit standards are continuously reviewed, maintained and revised by SDOs* with input from manufacturers through participation in organizations like PPI, which facilitates interface between manufacturers, users, and standards development organizations such as ASTM, NEMA, UL, TIA and others

- This continuous connection ensures that HDPE conduit standards meet the various code and regulatory requirements for the intended uses

**SDO = Standards Development Organization (e.g. AASHTO, ASTM, CSA, NEMA, UL)*

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History of HDPE Conduit Standards

Summary

- Conduit specifications have been specifically developed for the demands of telecomm, power, utility, aerial or underground applications

- An inaccurate or an out-of-date product specification can cause confusion among suppliers or result in an inadequate product being installed

- References to pressure pipe standards should be removed from product or project specifications for HDPE conduit

- In other words, obsolete or inappropriate pressure pipe standards should be replaced with the most appropriate of the current HDPE conduit standards by selecting the single HDPE conduit standard that is the closest match for the application

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3. Industry Standards for HDPE Conduit

Current HDPE Conduit Standards

- The first ASTM standard specification written and approved for HDPE conduit was **ASTM F2160** "Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)"

- F2160 was originally approved in 2001, then revised in 2008, and again in 2010

- In 2016, a significant revision of F2160 expanded the Scope, consolidated 11 dimensional tables into four, clarified test procedures, added pipe stiffness requirements, and revised requirements, such as resistance to slow crack growth

- Revision was published as **F2160-16** in December 2016 www.astm.org

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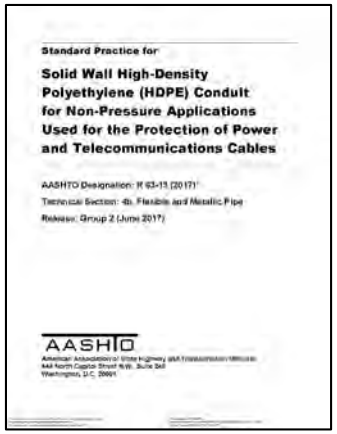
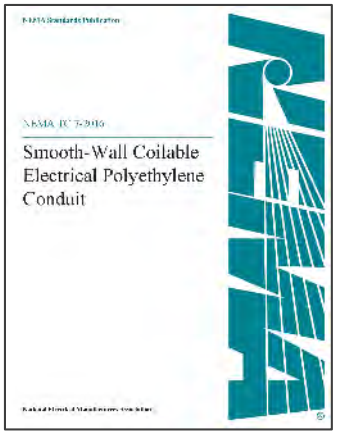
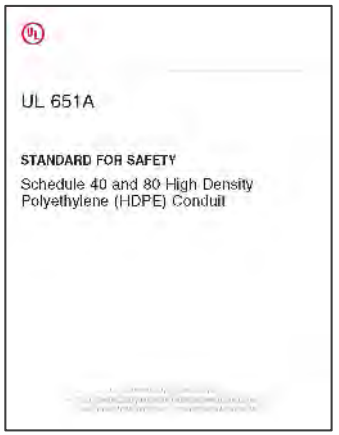
Industry Standards for HDPE Conduit

Current HDPE Conduit Standards

- Today, there are seven (7) recognized standard specifications for HDPE conduit and cable in conduit for various applications, plus one “Guidelines…” document
- HDPE conduit standards specify material properties, dimensions, performance requirements and test methods for evaluating HDPE conduit







Industry Standards for HDPE Conduit

ASTM F2160-16: Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

"This specification covers material, dimensional, workmanship and performance requirements for polyethylene conduit, duct and innerduct manufactured for use in non-pressure applications for the protection of fiber optic and power cables. Applications include telecom, SCADA command and control, highway lighting, ITS (Intelligent Transportation Systems) and Underground Utilities with PE conduit installed using methods such as Horizontal Directional Drilling (HDD),plowing and open trench."

- Originally approved 2001
- Current edition approved in **2016**

Industry Standards for HDPE Conduit

ASTM D3485-15: Standard Specification for Coilable High Density Polyethylene (HDPE) Cable In Conduit

"This specification covers cable in conduit (CIC), which is a smooth-walled, coilable, high-density polyethylene (HDPE) conduit (duct) that contains preassembled wires and cables. The outside diameter of the conduit is controlled and the wire or cable encased within may be comprised of single or multiple configurations consisting of electrical/ power wires or cables, fiber optic, traditional copper communication, coaxial cable, or any combination thereof."

- Originally approved 1976
- Current edition approved in **2015**

Industry Standards for HDPE Conduit

AASHTO R63-2013 (2017): Standard Practice for Solid Wall High-Density Polyethylene (HDPE) Conduit for Non-Pressure Applications Used for the Protection of Power and Telecommunications Cables

"This standard practice provides guidance to engineers in the specification of HDPE conduit used in buried applications for the protection of power cables for use in highways, airport lighting, traffic control, and fiber optic data and command and control applications in State Transportation Projects."

"This standard practice does not include guidelines for installation of HDPE conduit. Typical installation methods include trenching, plowing, and Horizontal Directional Drilling (HDD). Consult the PPI (Plastics Pipe Institute) *Handbook of Polyethylene Pipe* and TN (Technical Notes) on the PPI website, http://plasticpipe.org, for further information and guidance on installation methods."

Industry Standards for HDPE Conduit

CSA C22.2 No. 327: HDPE Conduit, Conductors in Conduit, and Fittings

"This Standard applies to high density polyethylene (HDPE) conduit, HDPE conduit with conductors, and fittings, intended for use at a continuous operating temperature of 75°C or 90°C, for installation in accordance with the Rules of the *Canadian Electrical Code*, *Part I*, for direct burial or encasement in concrete or masonry in ordinary (non-hazardous) locations.."

- Originally published in **2016**

Industry Standards for HDPE Conduit

NEMA TC 7-16: Smooth Wall Coilable Electrical Polyethylene Conduit

"This standard covers several wall types of high-density polyethylene (HDPE) conduit for use in providing a protective raceway for electrical cables or communication cables buried underground or concrete encased."
"Note: Typical applications for HDPE conduit include power distribution, site lighting, signal and control, and Supervisory Control and Data Acquisition (SCADA)."

Includes wall types EPEC-40, EPEC-80, EPEC-11, EPEC-13.5, EPEC-15.5, EPEC 17

- Originally published in 1983
- Current edition approved in **2016**

Industry Standards for HDPE Conduit

NEMA TCB 4-16: Guidelines for the Selection and Installation of Smooth-Wall Coilable High-Density Polyethylene (HDPE) Conduit

"NEMA TCB 4-2016 Guidelines for the Selection and Installation of Smooth-Wall Coilable High-Density Polyethylene (HDPE) Conduit provides recommendations for the selection, handling, and installation of underground HDPE conduit or raceway for power, lighting, signaling, and communications applications. It applies to both direct burial and encased burial installations, and covers topics such as handling, joining methods, separation and mandrelling."

- Originally published in **2016**

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Industry Standards for HDPE Conduit

UL 651A: Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

"These requirements cover straight conduit and coilable, smooth-wall, continuous length conduit with a circular cross section:

a) Extruded straight rigid Schedule 40 high density PE (polyethylene) electrical conduit and the following fittings for use with this conduit type:
   1) Elbows, and
   2) Rigid high density PE couplings;

b) Schedule 40, Schedule 80, EPEC-A, and EPEC-B coilable, smooth-wall continuous length high density PE electrical conduit."

- Originally published in 1981
- Current edition shows as "Fifth Edition – Oct. 26, 2011" but includes **2016** updates

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Industry Standards for HDPE Conduit

UL 1990: Standard for Nonmetallic Underground Conduit with Conductors

"These requirements cover nonmetallic underground conduit with conductors. These products consist of a factory assembly of conductors or cables inside a coilable, smooth-wall, continuous length conduit with a circular cross section. The conduit is Schedule-40, Schedule-80, EPEC-A or EPEC-B High Density Polyethylene (HDPE) in trade sizes 1/2 (16) - 4 (103). This product is intended for installation in accordance with the National Electrical Code, NFPA 70."

- Originally published in 1998
- Current edition shows as "Third Edition – Nov. 22, 2013" but includes **2017** updates

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Industry Standards for HDPE Conduit

To learn more about Conduit Standards

PPI TN-50: Guide to Specifying HDPE Conduit

- *"The purpose of this technical note is to provide general information about the history of the development of high-density polyethylene (HDPE) conduit and the various standards which apply to these products. The technical note may also be used as a guide for selecting appropriate standard specifications for users and specifiers."*
- Maintained annually by industry through PPI
- First published in 2016, revised in **2017**
- Visit www.plasticpipe.org

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Industry Standards for HDPE Conduit

To learn more about Conduit Standards

PPI TN-50: Guide to Specifying HDPE Conduit

- Table 1: HDPE Conduit Diameters Available per Wall Type and Standard Specification

- Note: SIDR sizes are also available

Table 1: HDPE Conduit Diameters Available per Wall Type and Standard Specification

Wall Type	HDPE Conduit Standards with Available Diameters				
	ASTM D3485	ASTM F2160	NEMA TC 7	UL 651A	UL 1990
Schedule 40	1/2" to 3"	1/2" to 12"	1/2" to 8"	1/2" to 6"	1/2" to 6"
Schedule 80	1/2" to 3"	1/2" to 6"	1/2" to 6"	1/2" to 6"	1/2" to 6"
SDR 17	N/A	N/A	1/2" to 2"	1/2" to 6"	1/2" to 6"
DR 15.5	1/2" to 3"	1/2" to 12"	1/2" to 6"	N/A	N/A
SDR 13.5	1/2" to 3"	1/2" to 12"	1/2" to 8"	1/2" to 6"	1/2" to 6"
SDR 11	1/2" to 3"	1/2" to 12"	1/2" to 8"	N/A	N/A
SDR 9	N/A	1/2" to 12"	N/A	N/A	N/A
True-size 9	N/A	13 mm to 2"	N/A	N/A	N/A
True-size 11	N/A	13 mm to 2"	N/A	N/A	N/A

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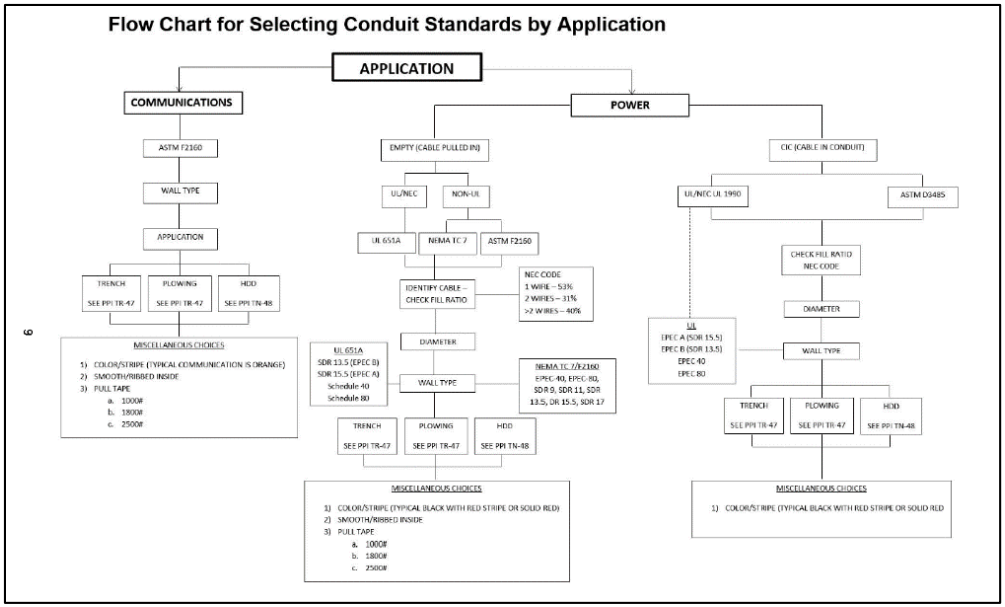
Industry Standards for HDPE Conduit

To learn more about Conduit Standards

PPI TN-50: Guide to Specifying HDPE Conduit

- Flow Chart for Selecting Conduit Standard by Application



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Industry Standards for HDPE Conduit

Summary

- **PPI TN-50 Guide to Specifying HDPE Conduit** is a helpful resource to learn the details about each of the industry standards

- Includes the Flow Chart for Selecting Conduit Standards by Application

- Intended for specifiers, end-users, installers and inspectors

- Compliments of PPI and our Members

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4. PPI Model Specification MS-5

Introduction to PPI MS-5

- Over the decades, PPI has published several model specifications related to the use of plastic pipes for various industries

- **Model Specification-5** is the fifth in this series

- Originally published in 2008, revised in 2018

- Compliments of PPI and our Members

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PPI Model Specification MS-5

Introduction to PPI MS-5

- **PPI MS-5** provides specifiers with a starting point in developing final specifications for a particular project's needs

- It includes reference to various product specifications by SDOs such as ASTM, CSA, NEMA, and UL, and describes when and how to utilize these industry documents

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PPI Model Specification MS-5

Important Notes

NOTICE: This publication is intended for use as a guide to support the designer of HDPE conduit systems, but it should not be used in lieu of the advice of a professional engineer. 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. This publication may be changed from time to time without notice. Visit https://www.plasticpipe.org for the most current edition.

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Important Notes

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.

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General Terms & Conditions

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.

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Qualification of Manufacturers

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.

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Approved Manufacturers

- Specifier can include own list of firms
- Use PPI PCD list of members as a guide
- https://plasticpipe.org/power-comm/pcd-members.php

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.)

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Materials

- Specifier can list the appropriate product standard(s) here (not all)

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

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Materials

- Specifier would list the intended size and wall type here
- E.g. “Trade size 2 IPS SDR11, Orange, manufactured in accordance with ASTM…”

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.

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Colors

- Requirements for how color is applied

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.

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Friction Reduction

- Optional
- Current language used by the conduit industry is provided

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 (≤) 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.

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Pull Media

- Optional
- Current language used by the conduit industry is provided

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.

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Joining

- Section lists various joining techniques; Specifier may allow all, or select only one

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.

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.

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Construction and Installation

- Provides specific language for various installation types (details not shown here)

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:

4.3. Horizontal Directional Drilling (HDD):

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Standards and Specifications

- More than 15 industry Standards/Specifications with sources (abridged list shown)

5.0 STANDARDS AND SPECIFICATIONS

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

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

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

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

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Summary

- PPI MS-5 is current and accurate
- Specifiers are welcome to use all or portions of it
- Use of MS-5 helps to prevent “Frankenstein” specs to which no product can comply
- PPI MS-5 is available at our website www.plasticpipe.org

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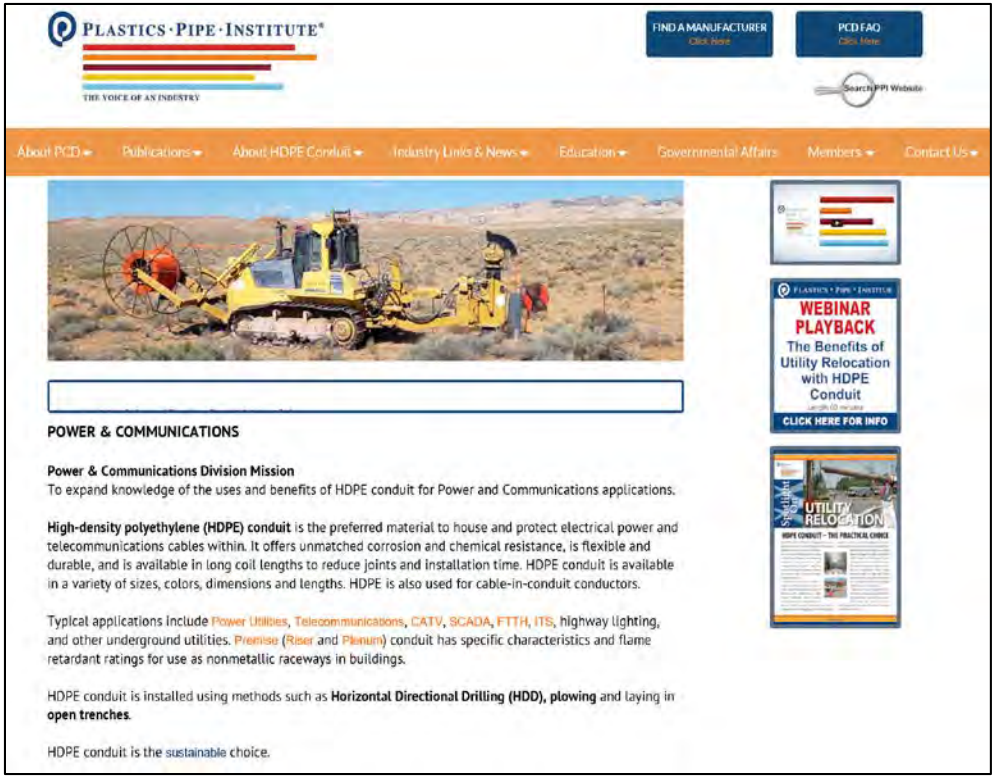
5. PPI Publications

Please visit our website for:

- Product information
- Technical Reports
- Technical Notes
- Case studies
- Position Papers
- Design information
- Educational videos
- Finding a Manufacturer
- Links to other organizations
- Frequently Asked Questions
- www.plasticpipe.org/power-comm



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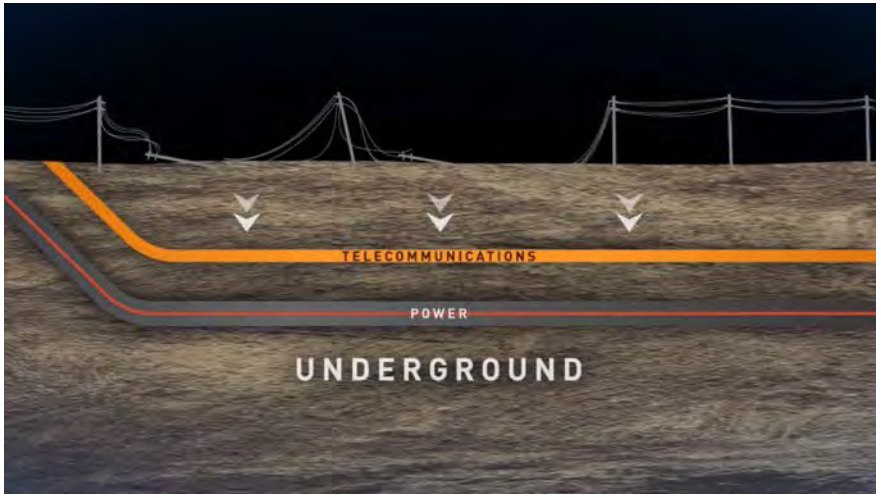
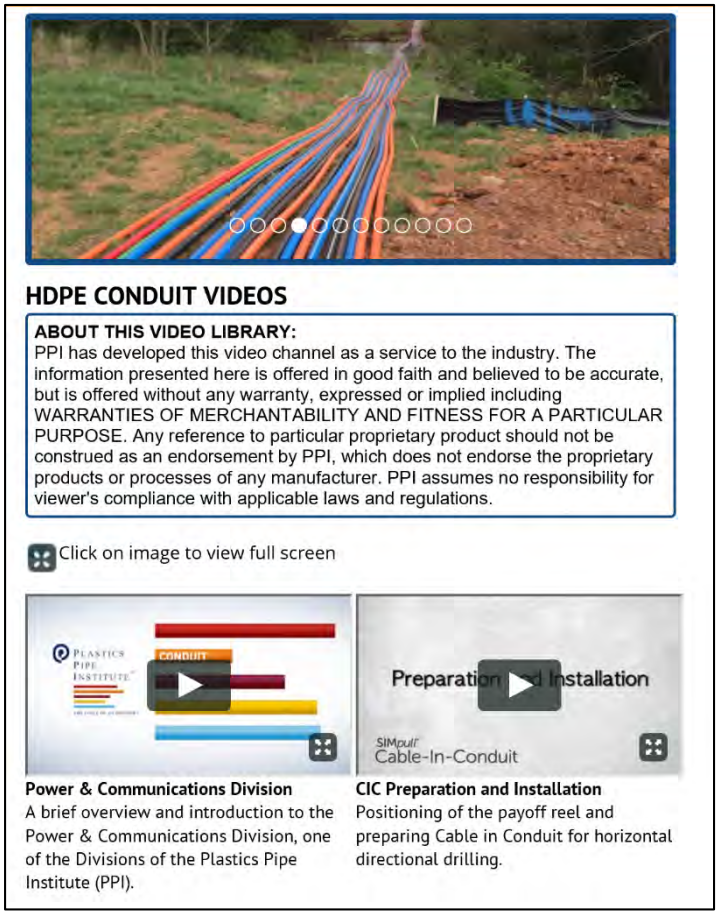
PPI Publications

Educational Videos

- PCD Division video introduces HDPE Conduit
- Instructional videos explain how to work with HDPE conduit for buried applications





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Presentation Summary

This course covered:

1. HDPE conduit products, types, and applications

2. The history of HDPE conduit standards

3. Seven current industry standards for HDPE conduit

4. PPI Model Specification MS-5 and how it can assist specifiers

5. PPI as a resource to the power & communications industry

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Path Forward

Contact PPI's Power & Communications Division at:

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Thank you!

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Properly Specifying HDPE Conduit for Power and Communications Projects