

# COMMUNICATION CONDUITS

FULLY PROTECTED CABLES



## ALROWAD

INDUSTRIAL COMPLEX

### COMMUNICATION CONDUITS



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INDUSTRIAL COMPLEX

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## COMPANY PROFILE

Alrowad company is one of the leading Egyptian companies working in plastic industry specialized in designing and manufacturing HDPE pipes and fitting by using the best raw material and developing the highest technology and quality applied in this field, as It's production capacity reach to 6000 tons per month.

Alrowad company is specialized in manufacturing HDPE pipes from 32mm till 1200mm diameter with different pressure classes, It also offering welding and complementary items for polyethylene networks and supplies its machines and also train on its usage.

**Our company** also develops our products from pipes and

Fitting to serve many sectors such as potable water networks, sewage water networks, infrastructure projects , natural gas, firefighting lines... etc.

We are providing technical support for all stages of the projects

#### Our vision

to be the leading regional manufacturers of HDPE PIPES and one of the largest manufacturers  
As well as contribute in increasing the treatments of potable ,sewage and waste water in Egypt for better living

#### Our mission

to achieve our vision by providing our customers with Distinctive products ,reliable services ,excellence in quality  
through complying with both Egyptian and International standards,



01

**HDPE**  
CONDUITS  
HIGH-DENSITY POLYETHYLENE  
(HDPE) CONDUITS

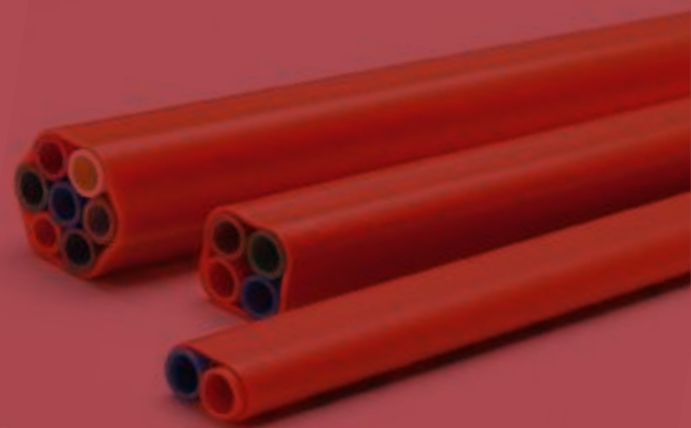
## ADVANTAGES



Telecommunication conduits provide necessary security and protection for telecommunication and electrical cables against harsh and high-pressured environments.

The company also produces customized ducts in coils which provide convenience in installation and for meeting specific construction needs. Alrowad Plastic pipes even provides sequential foot markings for ease of installation.

- High tensile strength to endure heavy external loads.
- Long-term strength for increased life and performance
- Lower installation cost
- Resistance to corrosive chemicals and aggressive soils
- Moisture proof and watertight when fusion welded
- No biological growth
- Low resistance to pulled-in cable
- Color coding for easy identification



## CONDUIT STANDARDS

ALROWAD PLASTIC PIPES ARE UNDER  
INTERNATIONAL STANDARD.

- **HDPE Pipe:** ISO, ASTM D, EN
- **Sizes:** Manufactured up to 630 mm sizes at various standard dimension ratio (SDR).
- **Pipes color:** The color of the PE pipe is black mainly to provide high protection to degradation due to the UV radiation and so there is no limitation on the external use of the PE pipe as they are designed to withstand continuous solar heat for at least 50 years.
- **Pipes Length:** Up to OD 125mm the PE pipes are available in coils of 100 meters standard length. Large diameters supplied in straight rods 12 meters long.
- **Available Customization upon request :** Length, Color, SDR Classes and Variations
- **Thermal Expansion and Contraction:** The coefficient of thermal expansion/contraction for PE Pipe is approximately 0.0002 mm/mm/°C
- **Raw Materials:** Alrowad Plastic pipes Polyethylene pipes are manufactured using:
- **HDPE - High density polyethylene**

The above materials contain high-class chosen polymer and high-quality Carbon-Black to get long life under every working and weather conditions.

Each material has its application field, attractions and particular benefits depending on working and installation condition, equipment available and personal preference.

The raw materials used by Alrowad Plastic pipes are carefully selected among the best available on the market. Produced by the polymerization of ethylene they are the outcome of long exhaustive research carried out by polymer manufacturers in company labs and specialized institutes.

The average system lifetime of polymers is up to 50 years. Carrying out various pressure tests on pipe specimens examines the polymer strength.

In compliance with ISO/EN/ASTM Standards tests are performed at a fixed wall hoop stress  $s$  and temperature  $T$  and their duration recorded on logarithmic graphs (stress  $s$ , lifetime  $t$ , temperature  $T$ ) obtaining a series of lines called regression curves. From such curves, which are different for each material, it is possible to predict a pipe lifetime or, after fixing the working period  $t$  and temperature  $T$ , trace back to the wall stress and therefore calculate a pipe wall thickness.

COLORS AND DIMENSIONS

HDPE CONDUITS



COLOR - STRIPE



Nominal Outside Diameter Da (mm)	Pipe Series																	
	S 20			S 12.5			S 8			S 6.3			S 5			S 4		
	Standard Dimension Ratio																	
	SDR 41			SDR 26			SDR 17			SDR 13.6			SDR 11			SDR 9		
	Nominal Pipe ID mm	Wall Thickness mm	Approx. Weight kg/m	Nominal Pipe ID mm	Wall Thickness mm	Approx. Weight kg/m	Nominal Pipe ID mm	Wall Thickness mm	Approx. Weight kg/m	Nominal Pipe ID mm	Wall Thickness mm	Approx. Weight kg/m	Nominal Pipe ID mm	Wall Thickness mm	Approx. Weight kg/m	Nominal Pipe ID mm	Wall Thickness mm	Approx. Weight kg/m
16																12.4	1.8	0.084
20										16.4	1.8	0.107	16.2	1.9	0.112	15.4	2.3	0.133
25							21.4	1.8	0.137	21.2	1.9	0.144	20.4	2.3	0.171	19.4	2.8	0.200
32							28.2	1.9	0.187	27.2	2.4	0.232	26.2	2.9	0.272	24.8	3.6	0.327
40				36.4	1.8	0.227	35.2	2.4	0.295	34.0	3.0	0.356	32.6	3.7	0.430	31.0	4.5	0.509
50				46.0	2.0	0.314	44.0	3.0	0.453	42.6	3.7	0.549	40.8	4.6	0.666	38.8	5.6	0.788
63	59.4	1.8	0.364	58.0	2.5	0.494	55.4	3.8	0.721	53.6	4.7	0.873	51.4	5.8	1.050	48.8	7.1	1.260
75	71.2	1.9	0.457	69.2	2.9	0.675	66.0	4.5	1.020	63.8	5.6	1.240	61.4	6.8	1.470	58.2	8.4	1.760
90	85.6	2.2	0.643	83.0	3.5	0.978	79.2	5.4	1.460	76.6	6.7	1.770	73.6	8.2	2.120	69.8	10.1	2.540
110	104.6	2.7	0.943	101.6	4.2	1.430	96.8	6.6	2.170	93.8	8.1	2.620	90.0	10.0	3.140	85.4	12.3	3.780
125	118.8	3.1	1.230	115.4	4.8	1.840	110.2	7.4	2.760	106.6	9.2	3.370	102.2	11.4	4.080	97.0	14.0	4.870
140	133.0	3.5	1.540	129.2	5.4	2.320	123.4	8.3	3.460	119.4	10.3	4.220	114.6	12.7	5.080	108.6	15.7	6.110
160	152.0	4.0	2.000	147.6	6.2	3.040	141.0	9.5	4.520	136.4	11.8	5.500	130.8	14.6	6.670	124.2	17.9	7.960
180	171.2	4.4	2.490	166.2	6.9	3.790	158.6	10.7	5.710	153.4	13.3	6.980	147.2	16.4	8.420	139.8	20.1	10.100
200	190.2	4.9	3.050	184.6	7.7	4.690	176.2	11.9	7.050	170.6	14.7	8.560	163.6	18.2	10.400	155.2	22.4	12.400
225	214.0	5.5	3.860	207.8	8.6	5.890	198.2	13.4	8.930	191.8	16.6	10.900	184.0	20.5	13.100	174.6	25.2	15.800
250	237.6	6.2	4.830	230.8	9.6	7.300	220.4	14.8	11.000	213.2	18.4	13.400	204.6	22.7	16.200	194.2	27.9	19.400
280	266.2	6.9	5.980	258.6	10.7	9.100	246.8	16.6	13.700	238.8	20.6	16.800	229.2	25.4	20.300	217.4	31.3	24.300
315	299.6	7.7	7.520	290.8	12.1	11.600	277.6	18.7	17.400	268.6	23.2	21.200	257.8	28.6	25.600	244.6	35.2	30.800
355	337.6	8.7	9.550	327.8	13.6	14.600	312.8	21.1	22.100	302.8	26.1	26.900	290.6	32.2	32.500	275.6	39.7	39.100
400	380.4	9.8	12.100	369.4	15.3	18.600	352.6	23.4	28.000	341.2	29.4	34.100	327.4	36.3	41.300	310.6	44.7	49.600
450	428.0	11.0	15.300	415.6	17.2	23.500	396.6	26.7	35.400	383.8	33.1	43.200	368.2	40.9	52.300	349.4	50.3	62.700
500	475.4	12.3	19.000	461.8	19.1	28.900	440.6	29.7	43.800	426.4	36.8	53.300	409.2	45.4	64.500	388.4	55.8	77.300
560	532.6	13.7	23.600	517.2	21.4	36.200	493.6	33.2	54.800	477.6	41.2	66.900	458.4	50.2	80.800	435.0	62.5	97.000
630	599.2	15.4	29.900	581.8	24.1	45.900	555.2	37.4	69.400	537.4	46.3	84.600	515.6	57.2	102.000	-	-	-

SMOOTH WALL CONDUIT

HDPE CONDUITS

PRODUCT FEATURES AND ATTRIBUTES:



- Cables pre-installed in HDPE
- Standard wall thickness
- Available in sizes
- Sizes: 1200-16 mm
- Low-sliding friction to aid in the pulling and jetting of Micro-Guard and micro-cables
- High tensile strength material for longer pulling distances
- Variety of colors/ stripes for identification - paralleling available
- Sequential-marked meters
- UV-formulated material for outside storage
- Complete line of fittings and accessories

Color Legend:

■ - Plane Color    ■ = ■ (Conduit Color) + ■ (Stripe)

Size	SDR	Available Colors															
12 mm	11	■	■	■	■	■	■										
14 mm	7	■	■		■	■	■	■	■	■							
20 mm	11, 17	■	■	■													
20 mm	13, 17	■	■	■													
32 mm	11,26	■	■	■													
32mm	17	■	■		■	■	■	■	■	■							
32 mm	7,9	■	■	■	■												
50mm	11	■	■	■													
50mm	17	■															

## GROOVED WALL CONDUIT

### HDPE CONDUITS

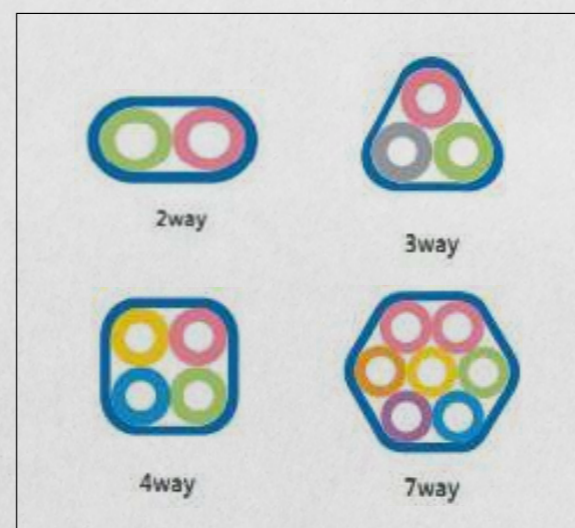
#### PRODUCT FEATURES :

- Cables pre-installed in HDPE
- Standard wall thickness
- Pre-lubricated during assembly process
- Inside diameter groove; available in sizes as per request
- Sizes: 50-16 mm
- Low-sliding friction to aid in the pulling and jetting of Micro-Guard and micro-cables
- High tensile strength material for longer pulling distances
- Variety of colors/ stripes for identification - paralleling available
- Sequential-marked meters
- UV-formulated material for outside storage
- Complete line of fittings and accessories



## BUNDLED CONDUIT

### CONDUIT-IN-CONDUIT



#### Material Specifications

1	Ducts are manufactured with High Grade 100% Virgin HDPE			
2	Melt Flow Index	ASTM D 238-10 ASTM F2160	< 0.35 g/10min	Per Batch
3	Density	ASTM D792-08 ASTM F2160	0.940 -0.958 g/cm <sup>3</sup>	Per Batch

#### PRODUCT FEATURES :

- Cables pre-installed in HDPE
- Eliminating the need to pull cables
- Standard wall thickness
- Available in sizes
- Pre-lubricated during assembly process
- Inner conduit Sizes: 32-13 mm
- UV-formulated material for outside storage

**Note: Custom options and other dimensions or specifications can be produced upon request**

Item	Row x Column	Size Outside/Inside Dimension (mm)	Outer Jacket wt. (mm)
1	Hex Array 7 Pipes	20/15	1.00-1.4
2	1x2	12/08	1.00-1.4
3	1x2	10/06	1.00-1.4
4	2x2	25/20	1.00-1.4
	2x2	20/16	1.00-1.4
	2x2	10/6	1.00-1.4
	2x2	28/24	1.00-1.4
5	Triangle array 3 pipes	28/24	1.00-1.4

## ALROWAD PLASTIC PIPES

### TELECOMMUNICATION PIPES

Alrowad Plastic Pipes has emerged as a renowned name in the piping industry in Egypt and MENA region by offering a range of high-density polyethylene (HDPE) pipes. The company has over thirty years of experience in the manufacturing sector of HDPE products.

The company exports wide range of HDPE Pipes mainly used not only for telecommunication lines but also for irrigations, potable water, drainages, and gas infrastructure. Designed in compliance with ISO and DIN standards, our range finds application in varied industries like Agricultural, Water Sanitation, Firefighting, and chemical industries.

Alrowad Plastic pipes are also widely appreciated for high chemical resistance and better flow characteristic. The company also offers customized telecom pipes, fittings, and accessories.



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02

## SELECTING & SPECIFYING HDPE CONDUIT FOR POWER AND COMMUNICATIONS APPLICATIONS



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## HDPE MATERIAL FOR CONDUIT APPLICATIONS

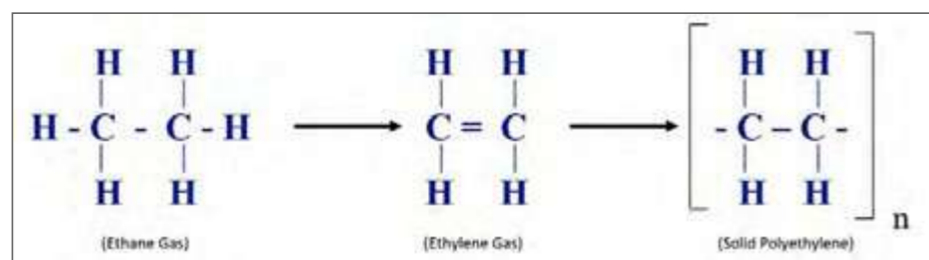
### INTRODUCTION TO HIGH DENSITY POLYETHYLENE (HDPE)

#### PRODUCT FEATURES:

- Pipe for many applications
- Water and sewer
- Gas distribution
- Oil and gas production
- Industrial
- Drainage
- Conduit
- Sheet
- Bottles
- Fuel Tanks
- Cable insulation



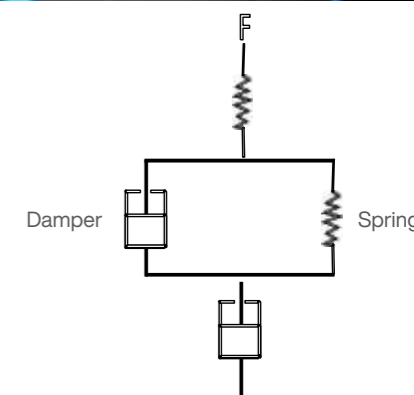
#### WHAT IS PE?



- Polyethylene (PE): A thermoplastic produced from polymerization of ethylene
- Ethylene is a derivative of ethane, a constituent within natural gas or derived from oil
- Ethane is a very clean molecule, energy efficient in production
- PE is non-polar, making it slippery (low surface polarity)
- Saturated bonds resist most chemical attack
- PE is environmentally-friendly

## WHAT IS HDPE?

- This unique polymeric structure of HDPE yields a Visco-Elastic material
- Viscous: Requires time to deform and to recover deformation
- Elastic: Immediate recoverable deformation
- HDPE materials are blended or “tuned” for ideal combinations of material properties
- Typical Max. Operating Temp. is ~140F (~60C) for pressure pipe



HDPE PROPERTIES - CELL CLASSIFICATION  
ACCORDING TO ASTM D3350

HDPE PROPERTIES - CELL CLASSIFICATION  
ACCORDING TO ASTM D3350

- Minimum Cell Classification for HDPE conduit is PE100 or PE80
- This is what that means:

Property	Value/Range	Test Method
Density = 3	> 0.94 g/cm <sup>3</sup>	ASTM D1505
Melt Index = 3	< 0.4 g/10 min.	ASTM D1238
Flexural Modulus = 4	≥ 80,000 psi (≥ 552 MPa)	ASTM D790
Tensile Strength, Yield = 4	≥ 3,000 psi (≥ 21 MPa)	ASTM D638
Slow Crack Growth Resistance = 8	F10 ≥ 96 hours (10% Igepal)	ASTM D1693
Hydrostatic Strength Classification = 0	N/A	ASTM D2837

C = Black using Carbon Black, whereas E = Colored with UV Stabilizer

TYPICAL CONDUIT GRADE

Property	Value/Range	Test Method
- Tensile Elongation to Break	> 400%	ASTM D638
- Brittleness Temperature	< -139°F (-95°C)	ASTM D746A
- Melt Temperature	~ 250°F (121°C)	ASTM D746A
- Auto-Ignition	> 650°F (340°C)	
- Dielectric Strength	500-600 Volts/mil (19 – 23 kV/mm)	
- Coefficient of Friction	0.29	

ASTM D3350 - 14

TABLE 1 Primary Properties<sup>a</sup>—Cell Classification Limits

Property	Test Method	0	1	2	3	4	5	6	7	8
1. Density, g/cm <sup>3</sup>	D1505	Unspecified	0.925 or lower	≥ 0.925-0.940	≥ 0.940-0.947	≥ 0.947-0.955	≥ 0.955		Specify Value	
2. Melt index	D1238	Unspecified	> 1.0	1.0 to 0.4	≤ 0.4 to 0.15	≤ 0.15			Specify Value	
3. Flexural modulus, MPa (psi)	D790	Unspecified	< 138 (< 20 000)	138-276 (20 000 to 40 000)	276-552 (40 000 to 80 000)	552-758 (80 000 to 110 000)	758-1103 (110 000 to 160 000)	> 1103 (> 160 000)	Specify Value	
4. Tensile strength at yield, MPa (psi)	D638	Unspecified	< 15 (< 2200)	15-18 (2200-2600)	18-21 (2600-3000)	21-24 (3000-3500)	24-28 (3500-4000)	> 28 (> 4000)	Specify Value	
5. Slow Crack Growth Resistance										
I. ESQR										
a. Test condition (100% Igepal) <sup>b</sup>	D1693	Unspecified	A	B	C	C			Specify Value	
b. Test duration, h			48	24	102	600				
c. Failure, max. %			50	50	20	20				
II. PENT (hours)	F1473	Unspecified								
Molded plaque, 80°C, 2.4 MPa						10	30	100	500	Specify Value
Notch depth, F1473, Table 1		Unspecified								
6. Hydrostatic Strength Classification										
I. Hydrostatic design basis, MPa (psi), (23°C)	D2837	NPR <sup>c</sup>	5.52 (800)	6.89 (1000)	9.62 (1250)	11.02 (1600)				
II. Minimum required strength, MPa (psi), (20°C)	ISO 12162						8 (1160)	10 (1450)		

- Cell classifications define if a material is low-, medium-, or high-density
- ASTM D3350: "Standard Specification for Polyethylene Plastics Pipe and Fitting Materials"

## HDPE PROPERTIES – CONDUIT MATERIALS ACCORDING TO ASTM /EN/ISO/DIN

PRODUCT STANDARDS SUCH AS ASTM F2160  
DEFINE MATERIALS REQUIREMENTS

# “STANDARD SPECIFICATION FOR SOLID WALL HDPE CONDUIT...”

### 4. Materials

4.1 PE compound shall meet Specification **D3350** requirements and be classified in accordance with Specification **D3350** with a minimum cell classification of PE334480C or PE334480E. Higher classification values for the first four cells and the sixth cell shall be acceptable. The classification value for the fifth cell shall be 8 in accordance with **4.2**.

4.2 *Slow Crack Growth*—The minimum specified ESCR cell class 8 requirement is F10 > 96 h per Test Method **D1693**, condition B, 10 % Igepal. Alternatively, slow crack growth cell classification per Specification **D3350** of 4 or higher is acceptable in meeting this requirement

4.4 *Aerial Applications*—PE material for black conduit in long-term above ground applications, such as aerial suspension, shall be stabilized with a minimum of 2–4 % by weight carbon black having an average particle size less than or equal to 20 nanometers.

## HDPE PROPERTIES – CONDUIT PERFORMANCE ACCORDING TO ASTM F2160

- PRODUCT STANDARDS SUCH AS ASTM F2160  
DEFINE PERFORMANCE REQUIREMENTS  
- EXCERPT FROM

# ASTM F16-2160

# “STANDARD SPECIFICATION FOR SOLID WALL HDPE CONDUIT...”

5.5 *Pipe Stiffness, Compression and Recovery*—Specimens shall achieve the minimum loads given in **Table 5**, **Table 6**, and **Table 7** at 5% deflection when tested in accordance with **6.5**. In addition, during compression and recovery testing specimens shall not split or crack, when tested in accordance with **6.6**.

NOTE 4—The minimum values for Pipe Stiffness (PS) are calculated using the minimum allowable flexural modulus specified of 80,000 psi. The calculated values are derived as outlined in Appendix X2 of Test Method **D2412**. The minimum values shown for (LbsF) force are calculated based on the test requirements of 5% deflection of the average ID at a deflection rate of 0.5 in/minute on a sample six inches long from the minimum PS values.

5.3.1 *Elongation at Break*—When tested in accordance with **6.2**, the minimum elongation at break shall be 400 %.

5.3.2 *Impact*—The conduit shall not fail when three specimen are tested at the low-temperature condition of -4°F (-20°C), in accordance with **6.3 – 6.3.2** or if one out of three specimen fails, then a retest of three additional specimen shall result in no failures.



# COMMUNICATION CONDUITS

FULLY PROTECTED CABLES



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HDPE CONDUIT INTRODUCTION

- 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

HDPE CONDUIT BENEFITS



- Not susceptible to corrosion
- Moisture-proof and watertight
- Can be installed around underground obstacles
- 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
- Accommodates gradual changes in direction and elevation
- 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

HDPE CONDUIT TYPES AND COLORS



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



- Various solid colors and stripe combinations are available

HDPE CONDUIT OD/ID AND WALL OPTIONS

- OD sizing systems include IPS wall types SDR9, SDR11, SDR 13.5, DR 15.5, Schedule 40, and Schedule 80
- ID sizing systems include «True Sized» and SIDR
- Wall thickness is described by the Dimension Ratio (DR)\* which typically ranges from SDR 9 to SDR 17 for diameters up to -12inch
- Standards such as ASTM F2160, NEMA TC 7, UL 651A specify exact dimensions

\*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 NUMERICALLY “STANDARD” AND REFERRED TO AS “SDR”

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.	Tol.	Min.	Tol.	Min.	Tol.	Min.	Tol.	Min.	Tol.	Min.	Tol.
	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
1/2	0.082 (13.00)	+0.020 + (0.51)	0.062 (1.57)	+0.020 + (0.51)	0.076 (1.93)	+0.020 + (0.51)	0.093 (2.36)	+0.020 + (0.51)	0.109 (2.77)	+0.020 + (0.51)	0.147 (3.73)	+0.020 + (0.51)
3/4	0.068 (1.73)	+0.020 + (0.51)	0.078 (1.98)	+0.020 + (0.51)	0.085 (2.41)	+0.020 + (0.51)	0.117 (2.97)	+0.020 + (0.51)	0.113 (2.87)	+0.020 + (0.51)	0.154 (3.91)	+0.020 + (0.51)
1	0.084 (2.13)	+0.020 + (0.51)	0.097 (2.46)	+0.020 + (0.51)	0.120 (3.05)	+0.020 + (0.51)	0.146 (3.71)	+0.020 + (0.51)	0.133 (3.38)	+0.020 + (0.51)	0.179 (4.55)	+0.020 + (0.51)
1 1/4	0.107 (2.72)	+0.020 + (0.51)	0.123 (3.12)	+0.020 + (0.51)	0.151 (3.84)	+0.020 + (0.51)	0.184 (4.67)	+0.020 + (0.51)	0.140 (3.56)	+0.020 + (0.51)	0.191 (4.85)	+0.020 + (0.51)
1 1/2	0.123 (3.12)	+0.020 + (0.51)	0.141 (3.58)	+0.020 + (0.51)	0.173 (4.39)	+0.020 + (0.51)	0.211 (5.36)	+0.020 + (0.51)	0.145 (3.68)	+0.020 + (0.51)	0.200 (5.08)	+0.020 + (0.51)
2	0.153 (3.89)	+0.020 + (0.51)	0.176 (4.47)	+0.020 + (0.51)	0.216 (5.49)	+0.020 + (0.51)	0.264 (6.71)	+0.020 + (0.51)	0.154 (3.91)	+0.020 + (0.51)	0.218 (5.54)	+0.020 + (0.51)
2 1/2	0.185 (4.70)	+0.020 + (0.51)	0.213 (5.41)	+0.020 + (0.51)	0.261 (6.64)	+0.020 + (0.51)	0.319 (8.11)	+0.020 + (0.51)	0.203 (5.16)	+0.020 + (0.51)	0.276 (7.01)	+0.020 + (0.51)
3	0.226 (5.74)	+0.020 + (0.51)	0.259 (6.58)	+0.020 + (0.51)	0.318 (8.08)	+0.020 + (0.51)	0.389 (9.88)	+0.020 + (0.51)	0.216 (5.49)	+0.020 + (0.51)	0.300 (7.62)	+0.020 + (0.51)

Excerpt from ASTM F16-2160 shows wide range of wall types

SUMMARY

- HDPE's physical properties make it ideally-suited for a wide range of installation applications protecting both power and communications cables
- HDPE Conduit is available in a variety of diameters, wall types, colors, configurations
- HDPE Conduit can be supplied with special features including color & stripes, added UV protection for aerial, pull tapes, lubrication and/or cables which are factory-installed



# 03

## SUITABILITY FOR POWER APPLICATIONS

HDPE Conduit is resistant to typical heat experienced in power applications  
Capable of protecting 90 degree C rated power cables



## COMMON APPLICATIONS FOR HDPE CONDUIT

### APPLICATIONS ADDRESSED BY HDPE CONDUIT



### COMMON APPLICATIONS INCLUDE:

- 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)
- Sensing, IOT (internet of things), Security, Healthcare
- 5G wireless

## 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

## HDPE CONDUIT BENEFITS



- CIC is HDPE conduit extruded over cable in the controlled environment of the manufacturing facility
- Reduces installation time, improves productivity
- CIC is less susceptible to damage than installing power cables in the field



## FIBER OPTIC AND COMMUNICATIONS



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

- 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



- 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")

## RENEWABLE ENERGY



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

## ITS - INTELLIGENT TRANSPORTATION SYSTEMS



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

## 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.



## SUMMARY

### COMMON APPLICATIONS INCLUDE:

- 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)
- Sensing, IOT (internet of things), Security, Healthcare
- 5G wireless



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04

## HDPE CONDUIT INSTALLATION TECHNIQUES



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## INSTALLATION TYPES



### HDPE CONDUIT IS INSTALLED VIA THREE PRIMARY METHODS:

- Open Cut : Trenching, backhoe
- Boring : Horizontal Directional Drilling  
Pneumatic stitch boring
- Plowing : Chute plow, pull plow

### OPEN CUT TRENCHING, BACKHOE



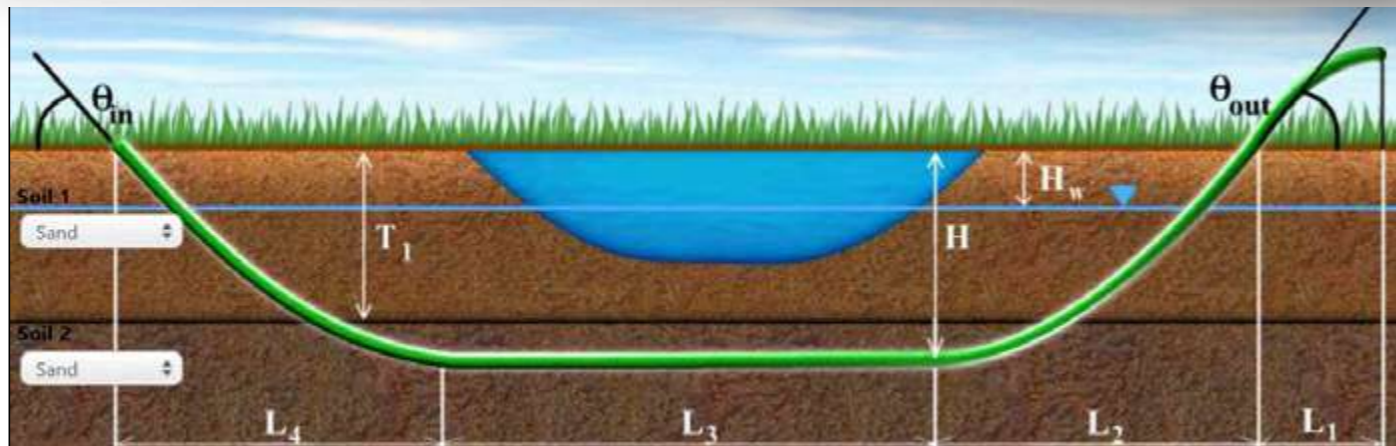
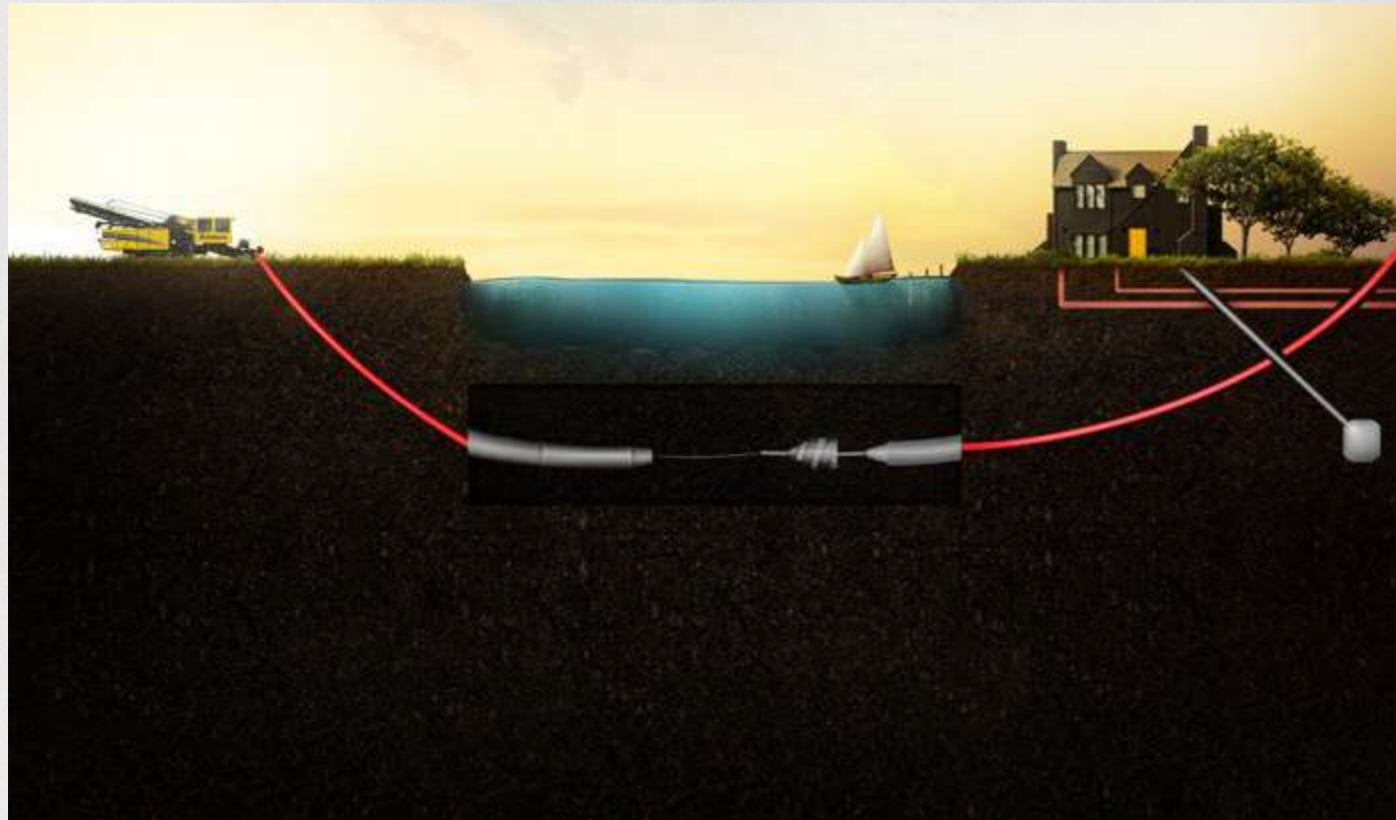
### PLOWING CHUTE PLOW, PULL PLOW



### PLOWING CONTINUOUS LENGTHS +1000 FT



**HORIZONTAL DIRECTIONAL DRILLING (HDD)**  
BORING UNDER ROADWAYS OR WATERWAYS AND PULLING THE CONDUIT  
UNDERGROUND CAN ALSO BE DONE AS SLIP LINING OR PIPE BURSTING



**EXAMPLE: TWENTY 2" DUCTS INSTALLED UNDER A FIELD, A  
RIVER AND A GOLF COURSE – 800 FT**



**EXAMPLE: TWENTY 2" DUCTS INSTALLED UNDER A FIELD, A  
RIVER AND A GOLF COURSE – 800 FT**



## HDPE CONDUIT INSTALLATION TECHNIQUES



### Conduit Installation

- This section reviews various underground installation methods, above ground installation methods (aerial) and installation of inner ducts within existing ducts or casing pipes. Considerations related to the mechanical stresses and limits for each of the methods are discussed. The next section provides information on the installation of cables within ducts. PE conduit can be wound onto reels with conduit lengths several thousand feet long. The length and flexibility allow navigation around unexpected obstructions below ground or within existing ducts and casings. Therefore, manufactured bends or elbows can be virtually eliminated. The few joints that are required can be made reliably through a number of options. HDPE conduit is suitable for all methods of duct and cable installation, including trenching, direct plow and installation into existing populated larger conduits and casing pipes. Also, the flexible nature of HDPE conduit facilitates directional bore installations to traverse under obstacles like rivers or highways. Special HDPE products and accessories are also available for above ground or aerial applications.
- Below Ground**
- Installation Generally, the three primary underground installation (or "OSP/Outside Plant") methods are trenching, plowing and boring, described in general terms below.
- Duct and Conduit Conduits intended for buried applications are commonly differentiated into two classes, rigid and flexible, depending on their capacity to deform in service without cracking, or otherwise failing. HDPE conduit can safely withstand considerable deformation without fracturing and is, therefore, classified as a flexible conduit. Flexible conduits deform vertically under earth load and expand laterally into the surrounding soil. The lateral movement mobilizes the soil's passive resistance forces, which limit deformation of the conduit.

The accompanying vertical deflection permits soil-arching action to create a more uniform and reduced soil pressure acting on the conduit. HDPE stress relaxes over time to decrease the bending moment in the conduit wall and accommodates local deformation (strain) due to imperfections in the embedment material, both in the ring and longitudinal directions. The relationship between pipe stiffness, soil modulus

- The pipe stiffness
- , as measured by ASTM D2412, and Spangler's Iowa formula provide a basis for prediction of conduit deflection as related to dimension ratio and resin modulus. It should be noted, however, the duration of loading affects the pipe stiffness, so the long term modulus should be used.
- Backfilling
- It is best to place the select soil, free of large rocks or clumps and that is easily compacted, directly on and around the conduit to a height of 6 inches over the conduit crown. DO NOT place large rocks directly on the conduit. Allow at least 6 inches (15.3 cm) of clean, uniform soil above the conduit crown, after which the natural backfill can be returned to the trench. The apparent change in soil condition also provides warning as any digging nears the conduit structure. This should not replace the practice of placing warning tape, but rather should serve as a supplement. Fill the trench and compact as required to provide compaction and prevent the trench backfill from settling. During backfill, warning tape should be placed typically 1 to 3 feet above the conduit.
- Direct Plow
- Plowing is the preferred installation for long continuous runs where soil conditions, space and an unobstructed route permit (e.g. in rural areas) plowing installations use a plow blade (pulled by a tractor or mounted to a railroad car) to cut a furrow in the earth and place the conduit at the required depth through the plow's chute.

## SUMMARY



## COMMON APPLICATIONS INCLUDE:

- HDPE conduit is installed via three primary methods
  - Trenching
  - Plowing
  - HDD
- Installation "tools" available



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05

## INDUSTRY STANDARDS FOR HDPE CONDUIT



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## 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 F16-2160 in December 2016

### AASHTO R2017) 2013-63): 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."*

### ASTM F16-2160: 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."



## ASTM D15-3485: 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."

- Includes trade sizes from 1/2 to 3
- Originally approved 1976
- Current edition approved in 2015



## HDPE CONDUIT FULLY PROTECTED CABLES

### 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 °75C or °90C, 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.."

### 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 Schedule40-, Schedule80-, EPEC-A or EPEC-B High Density Polyethylene (HDPE) in trade sizes 2/1 (103) 4 - (16). This product is intended for installation in accordance with the National Electrical Code, NFPA 70."



NEMA TCB 16-4: GUIDELINES FOR THE SELECTION  
AND INSTALLATION OF SMOOTH- WALL COILABLE HIGH-DENSITY  
POLYETHYLENE (HDPE) CONDUIT

“NEMA TCB 2016-4 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.”

PPI TN50-: 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

PPI TN50-: GUIDE TO SPECIFYING HDPE CONDUIT

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
SIDR	N/A	1" to 5"	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

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



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FULLY PROTECTED CABLES