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HDPE Conduit Specification | 2012

General

This specification covers the minimum requirements for HDPE conduit and is based on ASTM F 2160. HDPE Conduit is for use primarily in underground applications as conduit, innerduct, direct buried or concrete encased installations. This specification addresses solid wall types commonly selected for applications in the communications, power utility, transportation, mining, commercial and industrial markets. Sizes ranging from ½" through 8" diameter in a variety of wall thickness designs are available that can be matched to the specific application.

The properties and dimensions shall be in accordance with ASTM F 2160 standard specification for "Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)".

1.0 Materials

1.1 All conduit shall be made from high-density polyethylene (HDPE). The HDPE shall meet or exceed the properties listed in ASTM D-3350 for minimum cell classification of 335480 C (black minimum 2% carbon black) or E (color with UV stabilizer). Properties are listed below in Table 1.

TABLE 1: Material Requirements

Cell	Properties	Requirements	Test Method
3	Density	≥0.940-0.947	ASTM D 792 or 1505
3	Melt Flow Index (190/2.160)	≤0.4-0.15 g/10 minutes max	ASTM D 1238
5	Flexural Modulus	110,000 to 160,000 psi	ASTM D 790
4	Tensile Strength at Yield	3000 - 3500 psi	ASTM D 638
3 or 4	Environmental Stress Crack Resistance	Condition B, F10 Max, 10% Igepal, p6 hrs, minimum	ASTM D 1693
0	Hydrostatic Design Basis	Not Pressure Rated	ASTM D 2837
–	Brittleness Temperature	-75 degrees C	ASTM D 746
–	Elongation	400% minimum	ASTM D 638
C	Class C	Minimum 2% Carbon Black	ASTM D 3350
E	Class E	Colored with UV Stabilizer	ASTM D 3350

Note: ESCR is conducted on incoming certified conduit resin to confirm compliance with minimum standards as set forth by Four Star's conduit resin specification. An accelerated test is conducted using 10% Igepal solution for 96 hours, 10% maximum allowable failure rate in accordance with 4.1.3.3 of ASTM F 2160.

1.2 If certified test reports are required by the purchaser they shall be requested and agreed to at the time of purchase. Certification shall be provided in accordance with this specification unless changes are agreed and authorized in writing by the seller.

1.3 A run code will be printed on each production lot that is traceable to the resin used in the manufacture of the conduit.

1.4 Clean rework material from the manufacturers own production may be used, either alone or blended with virgin compound. The finished conduit made by using a portion of rework material shall meet all of the material and physical requirements of this specification.

2.0 Dimensions and lengths

2.1 All conduit shall meet the dimensional specifications set forth in Appendix-A.

2.2 Standard length tolerances shall be +/-5% for empty conduit and +/-10% of the cable in conduit (CIC) ordered lengths unless otherwise agreed to in writing.

2.3 Average outside diameter (OD) shall be as shown in Appendix-A for standard types.

2.4 Minimum and Maximum wall thickness shall be as shown in Appendix-A for standard types.

2.5 The Ovality shall be measured as defined in ASTM D 2122 and calculated as follows:

$$\% \text{ Ovality} = \frac{\text{Maximum OD} - \text{Minimum OD} \times 100}{\text{Average OD}}$$

Maximum allowable ovality of 3" and smaller conduit shall be less than 10% when conditioned in accordance and measured in accordance with the above formula. Due to shipping limitations and associated coil requirements ovality for 4" and larger conduit may exceed 10%, it is recommended that rerounding/straightening equipment be used to install coiled conduit in 4" and larger diameters.

3.0 Surface Appearance and Workmanship

3.1 There shall be no foreign particles embedded into the plastic surface as a result of the extrusion process.

3.2 There shall not be any surface distortions that penetrate either internally or externally into the conduit wall greater than 10% of the minimum wall thickness.

3.3 There shall not be any holes, visible cracks or defects that could cause damage or compromise the physical strength of the conduit.

4.0 Friction Reduction

4.1 Lubricants shall be available for use in empty conduit for reducing the coefficient of friction between the cable and the inner wall of the conduit.

4.2 Interior lubrication:

4.2.1 Interior lubrication shall be compatible with all cable jacket materials.

4.2.2 The lubricant shall be compatible with the conduit materials.

4.2.3 Where conduit is to be factory lubricated the lubrication shall be a Lubricant that will not loose its lubricity over time.

5.0 Pull Media

5.1 Factory installed pull media shall be available. This will include Tape, Rope, String and or pull line.

5.2 The pull media shall be installed with sufficient slack to assure free payout of the conduit and adequate tape slack when cutting the conduit.

6.0 Required and Optional Conduit Markings

6.1 The required markings on the conduit shall be legible, spaced at intervals not to exceed 5 ft. and include:

- ASTM (letter-Number designation) or applicable standard and material designation HDPE
- Trade size
- Type, wall thickness, schedule or dimensional ratio
- Manufacturer's name or trademark
- Manufacturing run or lot code from which date can be determined
- Month & year of manufacture
- The word “Aerial” or “UV” for above ground applications
- Sequential meter or foot markings with an accuracy of +/-2% shall be made available upon request. Note accuracy should not be confused with cut length tolerances. Start and finish footage markings shall be noted on the product identification tags.

6.2 Optional surface printing
6.2.1 Industry specific markings such as telephone symbols for communication or lightning bolt symbol can be used to indicate conduit is a carrier of electrical conductor(s), etc.

6.2.2 The print line may include special markings as agreed to between the manufacturer and buyer.

7.0 Conduit Color Identification

7.1 Color designations for the conduit shall be accomplished by using one of three methods; complete wall coloring, longitudinally extruded color stripes or a co-extruded color shell.

7.2 Most colors are available, typically orange is used by communication companies, red by power utilities and yellow is no longer available for conduit applications as it is used exclusively for gas pipe.

7.3 The extrusion resins used for color striping or jacketing conduit shall be a co-extruded part of the major wall and shall be materials that will not degrade the conduit wall's performance.

7.4 There shall be a minimum of 3 stripes spaced at approximately equal distance apart longitudinally co-extruded as part of the conduit wall. The stripes shall have a depth of .025" ± .005" and of sufficient width and color intensity to be seen from a distance of 20 feet.

7.5 The co-extruded shell shall be uniform in color and thickness, as commercially practical, for the entire circumference of the conduit. The thickness of the shell shall be .025" ± .005".

8.0 Packaging

8.1 The minimum drum diameter shall be consistent with the following recommendation: Drum Diameter ≤ (Duct Diameter/.0555).

8.1.1 A smaller drum diameter may be used if agreed to between buyer and seller and may be necessary for sizes larger than 3" to accommodate shipping height and width restrictions. If conduit is placed on a smaller drum diameter then use of an approved re-rounding and straightening device during installation of the conduit is recommended.

8.1.2 Coilable conduit shall be available on plastic steel or wooden reels or as individual coils. Reel diameters are available from 30" through 120" diameter.

8.1.3 Coils of conduit are available in most conduit sizes from 1/2" diameter through 6" diameter. See Four Star Industries printed coil tables for a listing of available coil sizes and packaging options.
8.1.3.1 Coils shall be shipped on specially designed cradle pallets to protect the outer wraps from damage.

8.1.3.2 The eye of the coil shall be facing to the side to facilitate field loading onto coil handling equipment.

8.1.4 Reels and Coils are available with multiple lengths paralleled together in 2, 3 or 4 way configurations on single or divided reel configurations.

8.2 Both the inside and outside ends of the conduit shall be capped to protect against water and debris entering the conduit during shipment and storage.

9.0 Tagging and Shipping

9.1 The following tagging information is to be included with any Product shipped. Shipping and product Identification tags shall be printed using indelible ink. Documentation includes the following items:

- Shipping Label - Each reel shall have a label with complete shipping information that shows both a return address and ship to address.
- Product Identification Tag - Each reel shall have a tag that has complete product identification information.
- Packing List - That includes return and destination addresses along with a detailed summary of the reels that are shipping.
- Bill of Lading - A standard commercially acceptable bill of lading shall be prepared for each shipment.

9.2 Other Optional identification markings as agreed to at the time of order.

9.3 Tag shall be affixed to the reels using the following procedure

9.3.1 For wooden reels a shipping and product identification tag shall be attached to each reel.

9.3.2 For steel reels a shipping and product identification tag shall be attached to the plastic placards attached to each side of the reel.

9.3.3 Additional tags such as those identifying the cable in CIC shall be placed adjaceant to the product identification tag.