

SC ELECTRIC COOPERATIVES' SPECIFICATION FOR HDPE ELECTRICAL CONDUIT

1.0 Scope

- 1.1 This specification covers the minimum acceptable requirements for flexible high density polyethylene (HDPE) electrical conduit for above ground use and below ground use by direct burial or trenchless installation.
- 1.2 All characteristics, definitions and terminology, except as covered in this specification, shall be in accordance with the latest revision of the following standards:

ASTM D 638 Test Method for Tensile Properties of Plastics

ASTM D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D 792 Test Methods for Density and Specific Gravity of Plastics by Displacement

ASTM D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

ASTM D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

ASTM D 1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics

ASTM D 2444 Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup

ASTM D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings

ASTM F 2160 Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

NEMA TC 7 Smooth-Wall Coilable Electrical Polyethylene Conduit

Polyethylene Duct and Conduit, Plastic Pipe Institute Handbook of Polyethylene Pipe

2.0 Materials

- 2.1 Conduit shall be made from high-density polyethylene (HDPE). The HDPE shall meet or exceed the properties listed in ASTM D-3350 for cell classification 334470 C (black, minimum 2% carbon black) or E (color with UV stabilizer).
- 2.2 The conduit manufacturer shall be able to provide certified test reports from the resin manufacturer or actual test data showing that the resin used in the manufacture of the conduit meets the physical requirements of the above standards.
- 2.3 A unique run code will be printed on each production lot that is traceable to the resin used in the manufacture of the conduit.

3.0 Dimensions and Lengths

- 3.1 Conduit shall meet the dimensional specifications and wall thicknesses as set forth in the appropriate ASTM and/or NEMA standards and as shown in Table I.
- 3.2 Standard length tolerances shall be +/-5% or as agreed by purchaser and manufacturer.
- 3.3 The Ovality shall be measured as defined in ASTM D 2122 and calculated as follows:

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

Maximum allowable ovality shall be 10% unless a larger value is agreed upon in advance by the purchaser.

4.0 Friction Reduction

- 4.1 If specified by the purchaser on **Attachment "A"**, friction-reducing ribs (either longitudinal or spiral) and/or lubricants shall be placed in empty conduit for reducing the coefficient of friction between the cable and the inner wall of the conduit.
- 4.2 Internal spiral ribs for reducing friction shall oscillate to assure that no unidirectional twist force is introduced during the cable installation and to maximize friction reduction.
- 4.3 Internal ribs shall be no greater than 0.035" in height additional to the standard dimensions and spaced no more than 0.20 inches apart.
- 4.4 Interior lubrication:
 - 4.4.1 Interior lubrication shall be compatible with all medium voltage cable jacket materials.
 - 4.4.2 The lubricant shall be compatible with the conduit materials.
 - 4.4.3 Where conduit is factory lubricated the lubrication shall be a permanent silicone emulsion that will not lose its lubricity over time.

5.0 Surface Appearance and Workmanship

- 5.1 There shall be no foreign particles embedded into the plastic surface as a result of the extrusion process.
- 5.2 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.
- 5.3 There shall not be any holes, visible cracks or defects that could cause damage or compromise the physical strength of the conduit.

6.0 Pull Media

- 6.1 If specified by the purchaser on **Attachment "A"**, factory installed pull media shall be required. This media shall be high tensile woven polyester or aramid fiber tape.
- 6.2 The pull media shall be pre-lubricated with sequential footage markings.

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

7.0 Required Conduit Markings

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

- Manufacturer's name or trademark
- Plant location
- Material (HDPE)
- Trade diameter
- Type, wall thickness, schedule or dimensional ratio
- Month & year of manufacture
- Manufacturing or lot code.
- Sequential foot markings with an accuracy of $-1/+5\%$. Start and finish footages shall be noted on the product identification tags.
- NESC lightning bolt symbol used to indicate conduit is a carrier of electrical conductor(s).

8.0 Conduit Color Identification

8.1 The outside of the conduit shall be solid red or black with three (3) equally spaced red stripes of sufficient width and color intensity to be easily distinguished. The conduit color shall be as specified on **Attachment "A"**. Colors shall be maintained for a minimum period of one (1) year when stored outside.

8.2 Color designations for the conduit shall be accomplished by using a co-extruded color shell or full wall color.

8.3 The extrusion resins used for coloring conduit shall be a co-extruded part of the major wall and shall be materials that will not degrade the conduit wall's performance.

8.4 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 $.025'' \pm .005''$.

9.0 Packaging

9.1 Coilable conduit shall be shipped on steel or wooden reels. The minimum drum diameter shall be consistent with the following: Drum Diameter \geq (Duct Diameter/.0555). If requested by purchaser on **Attachment "A"**, the conduit shall be shipped in coils on a pallet to be used on "break-down" reels.

9.2 A smaller drum diameter may be used if agreed to by purchaser and manufacturer to accommodate conventional shipping limitations for diameters larger than 3". If a smaller drum diameter is to be used it is recommended that an approved re-rounding and straightening device be used during installation of the conduit.

10.0 Tagging and Shipping

10.1 The following tagging information is required. Shipping and product Identification tags shall be printed using indelible ink so as to be weather resistant. Documentation shall include 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 – 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.

10.2 Tag shall be affixed to the reels using the following procedure:

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

10.2.2 For steel reels a shipping and product identification tag shall be attached to the tagging plate on the side of the reel.

10.2.3 For coils, a shipping and identification tag shall be tied around the coil with a suitable tie.

HDPE Conduit Dimensional Table I

Trade Diameter	Outside Diameter	OD Tolerance		Minimum Wall	Wall Tolerance	Nominal Inside Diameter	Weight per Foot
		+	-				
SDR 13.5 ASTM F 2160							
1"	1.315	0.012	0.012	0.097	0.020	1.101	0.167
1-1/4"	1.660	0.012	0.012	0.123	0.020	1.394	0.262
1-1/2"	1.900	0.012	0.012	0.141	0.020	1.598	0.341
2"	2.375	0.012	0.012	0.176	0.021	2.002	0.527
2-1/2"	2.875	0.012	0.012	0.213	0.026	2.423	0.773
3"	3.500	0.012	0.012	0.259	0.031	2.951	1.144
4"	4.500	0.012	0.012	0.333	0.040	3.794	1.891
5"	5.563	0.012	0.012	0.412	0.049	4.689	2.893
6"	6.625	0.012	0.012	0.491	0.059	5.585	4.103
SDR 11 ASTM F 2160							
1"	1.315	0.012	0.012	0.119	0.020	1.057	0.198
1-1/4"	1.660	0.012	0.012	0.151	0.020	1.338	0.312
1-1/2"	1.900	0.012	0.012	0.173	0.021	1.533	0.407
2"	2.375	0.012	0.012	0.216	0.026	1.917	0.635
2-1/2"	2.875	0.012	0.012	0.261	0.031	2.322	0.929
3"	3.500	0.012	0.012	0.318	0.038	2.826	1.377
4"	4.500	0.012	0.012	0.409	0.049	3.633	2.278
5"	5.563	0.012	0.012	0.506	0.061	4.491	3.482
6"	6.625	0.012	0.012	0.602	0.072	5.348	4.938
SCHEDULE 40 ASTM F 2160							
1"	1.315	0.012	0.012	0.133	0.020	1.029	0.217
1-1/4"	1.660	0.012	0.012	0.140	0.020	1.360	0.293
1-1/2"	1.900	0.012	0.012	0.145	0.020	1.590	0.349
2"	2.375	0.012	0.012	0.154	0.020	2.047	0.468
2-1/2"	2.875	0.012	0.012	0.203	0.024	2.445	0.739
3"	3.500	0.012	0.012	0.216	0.026	3.042	0.968

Attachment "A"

HDPE Electrical Conduit

_____ Electric Cooperative Dated _____

I. Size (SDR 13.5 is the recommended size to be used):

Quantity:

1"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
1 ¼"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
1 ½"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
2"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
2 ½"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
3"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
4"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
5"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____
6"	Schedule 40	_____	SDR 13.5	_____	SDR 11	_____	_____

II. Friction Reduction:

- _____ Longitudinal or spiral ribs
- _____ Lubricant

III. Pull Media:

_____ # Tape installed

IV. Color:

- _____ Red Outer
- _____ Black w/ Red Stripes
- _____ Either of above colors

V. Packaging:

- _____ Disposable Reels (Maximum size _____ inches)
- _____ Coils for "break-down" reels
- _____ Returnable Reels

VI. Shipping:

Ship to _____ warehouse in _____, SC to attention of _____, Phone # _____.