



UL 651A

Underwriters Laboratories Inc. Standard for Safety

Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

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UL Standard for Safety for Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit, UL 651A
Fifth Edition, Dated October 26, 2011

Summary of Topics

The following changes in requirements are being issued:

1. New Fifth Edition of UL 651A, Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit, which includes the removal of requirements for underground PVC conduit and addition of requirements for 10-foot and continuous lengths of underground HDPE conduit

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new requirements are substantially in accordance with Proposal(s) on this subject dated June 3, 2011.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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OCTOBER 26, 2011

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UL 651A



ANSI/UL 651A-2011

Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

Prior to the first edition, the requirements for the products covered by this standard were included in the Standard for Rigid Nonmetallic Conduit, UL 651.

Prior to the fifth edition, the requirements for continuous length HDPE conduit covered by this standard were included in the Standard for Continuous Length HDPE Conduit, UL 651B.

First Edition – May, 1981
Second Edition – August, 1989
Third Edition – August, 1995
Fourth Edition – October, 2000

Fifth Edition

October 26, 2011

This ANSI/UL Standard for Safety consists of the Fifth Edition.

The most recent designation of ANSI/UL 651A as an American National Standard (ANSI) occurred on October 26, 2011. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

The Department of Defense (DoD) has adopted UL 651A on November 30, 1984. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 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.

1.2 The conduit and fittings mentioned in 1.1 are intended for use at 50°C (122°F) and lower ambient temperatures. Extruded straight rigid Schedule 40 conduit and fittings, where directly buried or encased in concrete in trenches outside of buildings, may be used with 90°C (194°F) wiring.

1.3 The conduit and fittings covered in these requirements are intended for use as rigid nonmetallic raceway for wires and cables in accordance with the National Electrical Code, NFPA 70.

1.4 Extruded straight rigid Schedule 40, Schedule 40, Schedule 80, EPEC-A, and EPEC-B coilable conduit is for aboveground use where encased in not less than 2 inches (50 mm) of concrete and for underground use by direct burial or encasement in concrete.

2 General

2.1 Units of measurement

2.1.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2 Undated references

2.2.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

CONSTRUCTION

3 General

3.1 All conduit and fittings shall be made and furnished with the degree of uniformity and quality of workmanship that are practicable in a well-equipped factory. The following materials shall be used as specified in the Standard Specification for Polyethylene Plastics Pipe and Fittings Materials, ASTM D 3350:

- a) For straight rigid conduit and couplings and other fittings the material compound equal or exceed the cell classification PE 336620C;
- b) For Schedule 40, Schedule 80, EPEC-A, and EPEC-B coillable conduit, the compound material shall equal or exceed the cell classification PE334420C or E.

3.2 Conduit shall be essentially circular in cross section. The inside surface of conduit shall be without indentations (normal convolutions are not to be considered as indentations), projections, roughness, or other features that could damage or impede wires and cables being pulled into the conduit.

3.3 Conduit and fittings shall provide a smooth raceway for the pulling in of wires and cables. They shall not have any features that can abrade or otherwise damage wires and cables. The outside surfaces of conduit and fittings shall be smooth and without any chips, blister, cracks, or other defects. There shall not be any tendency for conduit or fittings to peel, scale, flake chalk, or crumble.

3.4 Both ends of each length of conduit shall be perpendicular to the longitudinal axis of the conduit.

3.5 Each length of conduit on which measurements are made is to be finished, smooth and clean wherever it is to touch any part of a measuring device or tool. While measurements are being made, the conduit and the air around it are to be in thermal equilibrium with one another at a temperature of $23.0 \pm 2.0^{\circ}\text{C}$ ($73.4 \pm 3.6^{\circ}\text{F}$). All of the average and individual outside diameter measurements are to be performed at the center and at least one end of the conduit.

4 Straight Conduit

4.1 The measurements from which the average outside diameters of a length of finished straight conduit are to be determined for comparison with the limits specified in inches in Table 4.1 or in millimeters in Table 4.2 are to be made by means of a:

- a) Machinist's micrometer caliper that has a flat-ended spindle, a flat anvil and is calibrated to read directly to at least 0.001 inch or 0.01 mm;
- b) Vernier caliper calibrated to read directly to at least 0.001 inch or 0.01 mm;
- c) Vernier wrap tape, calibrated to read directly to at least 0.001 inch or 0.01 mm;
- d) Tapered sleeve gauge accurate to ± 1 percent of its taper and ± 0.001 inch (± 0.01 mm) of its diameter; or
- e) Sleeve window gauge accurate to within ± 1 percent of its tape and ± 0.001 inch (± 0.01 mm) of its diameter.

Table 4.1
Outside diameter and wall thickness of conduit in inches

Trade size	Average	Outside diameters		Wall thicknesses	
		Max	Min	Max	Min
1/2	0.840 ± 0.004	0.855	0.8562	0.129	0.109
3/4	1.050 ± 0.004	1.070	1.030	0.133	0.113
1	1.315 ± 0.005	1.340	1.290	0.153	0.133
1-1/4	1.660 ± 0.005	1.685	1.635	0.160	0.140
1-1/2	1.900 ± 0.006	1.930	1.870	0.165	0.145
2	2.375 ± 0.006	2.410	2.340	0.174	0.154
2-1/2	2.875 ± 0.007	2.910	2.840	0.227	0.203
3	3.500 ± 0.008	3.540	3.460	0.242	0.216
3-1/2	4.000 ± 0.008	4.045	3.955	0.253	0.226
4	4.500 ± 0.009	4.550	4.450	0.265	0.237
5	5.563 ± 0.010	5.618	5.508	0.289	0.258
6	6.625 ± 0.011	6.690	6.560	0.314	0.280

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Table 4.2
Limits on outside diameters and wall thicknesses of conduit in millimeters

Metric designator	Average	Outside diameters		Wall thicknesses	
		Maximum	Minimum	Maximum	Minimum
16	21.34 ±0.10	21.72	20.96	3.28	2.77
21	26.67 ±0.10	27.18	26.16	3.38	2.87
27	33.40 ±0.13	34.04	32.77	3.89	3.38
35	42.16 ±0.13	42.80	41.53	4.06	3.56
41	48.26 ±0.15	49.02	47.50	4.20	4.68
53	60.32 ±0.15	61.21	59.44	4.42	3.91
63	73.02 ±0.18	73.91	72.14	5.57	5.16
78	88.90 ±0.20	89.92	87.88	6.15	5.49
91	101.60 ±0.20	102.74	100.46	6.43	5.74
103	114.30 ±0.23	115.57	113.03	6.73	6.02
129	141.30 ±0.25	142.70	139.90	7.34	6.55
155	168.28 ±0.28	169.93	166.62	7.98	7.11

4.2 In disputes that may arise between measuring techniques, the vernier wrap tape is to act as the referee in determining compliance with the requirements for average outside diameters.

4.3 When employing a tapered sleeve gauge, the entrance and exit diameters of the gauge shall correspond to the maximum and minimum outside diameters for the trade size of conduit being measured.

4.4 When employing a sleeve window gauge, the window shall extend beyond the two scribed marks which shall represent the minimum and maximum permitted diameters.

4.5 The measurements from which the minimum and maximum outside diameters (ovality or out-of-roundness) of a length of finished conduit are to be determined for comparison with the limits specified in inches in Table 4.1 or in millimeters in Table 4.2 are to be made by means of a:

- a) Machinist's micrometer caliper that has a flat-ended spindle, a flat anvil, and is calibrated to read directly to at least 0.001 inch or 0.01 mm;
- b) Vernier caliper calibrated to read directly to at least 0.001 inch or 0.01 mm; or
- c) Out-of-roundness gauge accurate to ±0.001 inch or ±0.01 mm.

4.6 In disputes that may arise between measuring techniques, the vernier caliper is to act as the referee in determining compliance with the requirements for minimum and maximum outside diameters.

4.7 The measurements from which the wall thicknesses of a length of finished conduit are to be determined for comparison with the limits specified in inches in Table 4.1, or in millimeters in Table 4.2, are to be made by means of a machinist's micrometer caliper that has a ratchet, a flat-ended spindle, and a hemispherical anvil and is calibrated to read directly to at least 0.001 inches or 0.01 mm.