



UL 360

STANDARD FOR SAFETY

Liquid-Tight Flexible Metal Conduit

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UL Standard for Safety for Liquid-Tight Flexible Metal Conduit, UL 360

Seventh Edition, Dated January 17, 2013

Summary of Topics:

A non-substantive correction is being issued for paragraph 1.1 of the Standard for Liquid-Tight Flexible Metal Conduit, UL 360:

1. "Motor circuits" is being deleted, since these words were marked for deletion in the original proposal dated November 2, 2012 (Removal of Voltage References from the Scope of UL 360) that obtained consensus. The words were accidentally left in paragraph 1.1 when the Seventh Edition of UL 360 was published on January 17, 2013. This revision is to correct this error.

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 revised requirements are substantially in accordance with Proposal(s) on this subject dated November 2, 2012.

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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that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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ANSI/UL 360-2013

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UL 360

Standard for Liquid-Tight Flexible Metal Conduit

Prior to the seventh edition, this standard was entitled the Standard for Liquid-Tight Flexible Steel Conduit, UL 360.

First Edition – April, 1976
Second Edition – August, 1980
Third Edition – August, 1986
Fourth Edition – August, 1996
Fifth Edition – June, 2003
Sixth Edition – February, 2009

Seventh Edition

January 17, 2013

This ANSI/UL Standard for Safety consists of the Seventh Edition including revisions through May 3, 2013.

The most recent designation of ANSI/UL 360 as an American National Standard (ANSI) occurred on January 17, 2013. 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 360 on January 20, 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 the 3/8 (12), 1/2 (16), 3/4 (21), 1 (27), 1-1/4 (35), 1-1/2 (41), 2 (53), 2-1/2 (63), 3 (78), 3-1/2 (91), and 4 (103) trade sizes (metric designators) of liquid-tight flexible steel, aluminum, brass, bronze, copper, and stainless steel conduit. The conduit covered is intended for installation in accordance with the National Electrical Code (NFPA 70) as raceway for wires and cables.

1.1 revised May 3, 2013

1.2 This conduit is for applications in which flexibility of the conduit is necessary during installation, operation, or maintenance and the contained conductors need protection from vapors, liquids or solids.

1.3 This conduit is circular in cross section, having an outer liquid-tight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core, and is for use in wet, dry, or oily locations in which the conduit is exposed but is not subject to physical damage. Conduit that is not marked with a temperature designation or is marked "60 C" is for use at temperatures not in excess of 60°C (140°F). Conduit that is for use in dry or oily locations at a temperature higher than 60°C (140°F) is marked "____ C dry, 60 C wet, 70 C oil res" or "____ C dry, 60 C wet, 70 C oil resistant" with "80 C" or "105 C" inserted as the dry-locations temperature.

1.4 Conduit that is marked "80 C dry, 60 C wet, 60 C oil res" or "80 C dry, 60 C wet, 60 C oil resistant" is for use at 80°C (176°F) and lower temperatures in air, and 60 °C (140°F) and lower temperatures where exposed to water, oil or coolants – that is, to cutting oils and the like in machine-tool and other industrial applications.

1.5 Conduit marked in accordance with 24.4(g) is limited to use in oil free environments.

1.6 Fittings for conduit are covered in the Standard for Conduit, Tubing, and Cable Fittings, UL 514B.

1.7 These requirements do not cover liquid-tight flexible nonmetallic conduit. Flexible nonmetallic conduit is covered in the Standard for Liquid-Tight Flexible Nonmetallic Conduit, UL 1660, and the fittings for this conduit are covered in the Standard for Conduit, Tubing, and Cable Fittings, UL 514B.

1.8 These requirements do not cover flexible metallic tubing.

1.9 These requirements do not cover electrical nonmetallic tubing (ENT).

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.1.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.2 Units of measurement

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

2.3 Undated references

2.3.1 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 Liquid-tight flexible metal conduit shall be fabricated from metal that will provide the mechanical and electrical properties to comply with the performance requirements of this standard.

3.2 Steel conduit in trade sizes 3/8 – 1-1/4 (12 – 35) shall be provided with a bonding strip wound enclosed by the conduit convolutions throughout the entire length of the conduit. Conduit made from aluminum, brass, bronze, copper, and stainless steel in these trade sizes shall be tested according to the Resistance Test, Section 8 and the Fault Current Test, Section 9 to determine the need for a bonding strip. The material and dimensions of the bonding strip shall result in the finished conduit having the resistance values shown in Table 8.1 before high-current testing and shall not adversely affect the flexibility and minimum bending radii of the finished conduit.

3.3 A metallic braiding material with a minimum wire diameter (O.D.) of 0.005 inches (0.13 mm) may be optionally provided between the metal conduit and the outer jacket. When the conduit core material is aluminum, the metallic braiding material, if present, shall be aluminum or tinned metal.

4 Jacket Thickness

4.1 The thickness of the finished jacket shall not be less than indicated in Table 4.1 when determined as described in 4.2.

4.2 The minimum average thickness of the jacket is to be determined by measuring a specimen of the jacket removed from the finished conduit and buffed to remove any ridges or other irregularities on the inside surface of the jacket. The specimen is to be selected to include the thinnest portion of the jacket as determined visually. Measurements are to be made with a dead-weight dial micrometer having a presser foot 0.250 ± 0.010 inch (6.4 ± 0.2 mm) in diameter and exerting a total of 3.0 ± 0.1 ozf (0.84 ± 0.02 N or 85 ± 3 gf) on the specimen – the load being applied by means of a weight. Five readings are to be taken at different points on the specimen and the average taken as the minimum acceptable average thickness, or by means of an optical device accurate to at least 0.001 inch (0.01 mm).

Table 4.1
Jacket thickness

Trade size of conduit	(Metric designator)	Minimum average thickness of jacket,	
		inch	(mm)
3/8	(12)	0.030	0.76
1/2	(16)	0.030	0.76
3/4	(21)	0.035	0.89
1	(27)	0.035	0.89
1-1/4	(35)	0.035	0.89
1-1/2	(41)	0.040	1.02
2	(53)	0.040	1.02
2-1/2	(63)	0.050	1.27
3	(78)	0.050	1.27
3-1/2	(91)	0.060	1.52
4	(103)	0.060	1.52

5 Conduit Diameters

5.1 Finished metal conduit shall not be larger or smaller in internal and external diameter than indicated in Table 5.1 when determined as described in 5.2.

5.2 Compliance of all trade sizes of conduit with the minimum and maximum internal diameters in Table 5.1 is to be determined by means of a vernier caliper accurate to at least 0.001 inch (0.01 mm).

Table 5.1
Internal and external diameters

Trade size of conduit	(Metric desg.)	Internal diameter				External diameter, over jacket			
		Minimum,		Maximum, ^a		Minimum,		Maximum, ^a	
		inches	(mm)	inches	(mm)	inches	(mm)	inches	(mm)
3/8	(12)	0.484	12.29	0.504	12.80	0.690	17.5	0.710	18.0
1/2	(16)	0.622	15.80	0.642	16.31	0.820	20.8	0.840	21.3
3/4	(21)	0.820	20.83	0.840	21.34	1.030	25.2	1.050	26.7
1	(27)	1.041	26.44	1.066	27.08	1.290	32.8	1.315	33.4
1-1/4	(35)	1.380	35.05	1.410	35.81	1.630	41.4	1.660	42.2
1-1/2	(41)	1.575	40.01	1.600	40.64	1.865	47.4	1.900	48.3
2	(53)	2.020	51.31	2.045	51.94	2.340	59.4	2.375	60.3
2-1/2	(63)	2.480	62.99	2.505	63.63	2.840	72.1	2.875	73.0
3	(78)	3.070	77.98	3.100	78.74	3.460	87.9	3.500	88.9
3-1/2	(91)	3.500	88.90	3.540	89.92	3.960	100.6	4.000	101.6
4	(103)	4.000	101.60	4.040	102.62	4.460	113.3	4.500	114.3

^a Other values are acceptable if the finished conduit is accommodated as intended by all acceptable fittings as determined by investigation.

6 Corrosion Protection

6.1 The corrosion protection of the steel strip from which the steel conduit is formed shall comply with the requirements of the Zinc-Coating Test, Section 15. A coating of zinc is not required on the cut edges.

7 Strip Material

7.1 The strip material used in liquid-tight flexible stainless steel conduit shall be stainless steel having a chromium content of not less than 16 percent.

PERFORMANCE

8 Resistance Test

8.1 The electrical resistance of specimens of previously untested finished conduit shall not exceed the values shown in Table 8.1.

8.2 The jacket is to be stripped from 4 inches (102 mm) at each end of a 10-1/2 feet (3.2-m) length of previously untested finished conduit and the conduit is to be laid out straight on a flat, horizontal, noncombustible, electrically nonconductive surface. Low-resistance connectors are to be secured to each end of the metal conduit and to a low-voltage alternating-current supply circuit.

8.3 No specimen is to be moved or otherwise manipulated during any part of this test.

Table 8.1
Resistance testing

Trade size of conduit	(Metric designator)	Maximum resistance in ohms per 100 feet or in ohms per 30.5 meters
3/8	(12)	5.0
1/2	(16)	2.5
3/4	(21)	2.5
1	(27)	1.5
1-1/4	(35)	1.5

8.4 A current of 10 A is to be passed through the metal conduit and, while the current is flowing, the voltage drop is to be measured between points on the metal conduit that are 10 feet (3.05 m) apart. This voltage is numerically equal to the resistance of the conduit in ohms per 100 feet (ohms per 30.5 m).

9 Fault-Current Test

9.1 The equipment-ground path provided by the conduit and the bonding strip in the conduit, if provided, shall not open when previously untested specimens of the finished conduit are subjected to a current of 470 A for 4 seconds for trade sizes 3/8 (12) and 1/2 (16), and 750 A for 4 seconds for trade sizes 3/4 – 1-1/4 (21 – 35). The thermoplastic jacket on the conduit shall not flame. After the test specimens have cooled to room temperature, the integrity of the jacket shall be such that both of the following are complied with:

- a) The total area(s) of the metal conduit exposed due to openings in the jacket shall not be more than 5 percent of the specimen exterior surface area and
- b) The largest dimension of any single opening in the jacket shall not exceed 7.5 inches (190 mm).

9.2 The test specimens of finished conduit are each to be 6 feet (1.83 m) in length. A liquid-tight flexible metal conduit fitting that is acceptable for the size of conduit being tested and for connecting a test specimen to a solid copper bus bar is to be installed on each end of each test specimen.