

UL 360

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Liquid-Tight Flexible Steel Conduit





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for
Liquid-Tight Flexible Steel Conduit, UL 360

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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UL 360

Standard for

Liquid-Tight Flexible Steel Conduit

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August 16, 1996

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

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.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover the 3/8, 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, and 4 inch trade sizes of liquid-tight flexible steel conduit. The conduit covered is intended for installation in accordance with Sections 351-2 – 351-11 (part A of Article 351) and other applicable parts of the National Electrical Code (NFPA 70) as raceway for wires and cables in motor circuits operating at potentials over 600 volts [NEC 430-123], in electric-sign circuits operating at potentials up through 1000 volts [NEC 600-21(a)] and over 1000 volts [NEC 600-31(a)], and in other circuits operating at 0 – 600 V.

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. This is in accordance with Section 15-8 of the National Fire Protection Association "Electrical Standard for Industrial Machinery" (NFPA 79).

1.5 Conduit marked in accordance with 23.4(g) is limited to use in oil free environments.

1.6 Fittings for liquid-tight flexible steel conduit are covered in the Standard for Fittings for Conduit and Outlet Boxes, UL 514B.

1.7 These requirements do not cover liquid-tight flexible nonmetallic conduit, which is the subject of Sections 351-22 – 351-30 (part B of Article 351) of the National Electrical Code (NFPA 70). 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 Fittings for Conduit and Outlet Boxes, UL 514B.

1.8 These requirements do not cover flexible metallic tubing, which is the subject of Article 349 of the National Electrical Code (NFPA 70).

1.9 These requirements do not cover electrical nonmetallic tubing (ENT), which is the subject of Article 331 of the National Electrical Code (NFPA 70).

1.10 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involve a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

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 need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed 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 recognized rating established for the intended conditions of use.

2.1.4 Specific components are recognized as being 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 for which they have been recognized.

2.2 Units of measurement

2.2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

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 Conduit in trade sizes 3/8 – 1-1/4 inches shall be provided with a bonding strip wound enclosed by the conduit convolutions throughout the entire length of the conduit. The material and dimensions of the bonding strip shall result in the finished conduit having the resistance values shown in Table 7.1 before high-current testing and shall not adversely affect the flexibility and minimum bending radii of the finished conduit.

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 in inches	Minimum average thickness of jacket,	
	inch	(mm)
3/8	0.030	0.76
1/2	0.030	0.76
3/4	0.035	0.89
1	0.035	0.89
1-1/4	0.035	0.89
1-1/2	0.040	1.02
2	0.040	1.02
2-1/2	0.050	1.27
3	0.050	1.27
3-1/2	0.060	1.52
4	0.060	1.52

5 Conduit Diameters

5.1 Finished steel 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 in inches	Internal diameter				External diameter							
					Over conduit				Over jacket			
	Minimum, ^a		Maximum, ^a		Minimum, ^a		Maximum, ^a		Minimum, ^a		Maximum, ^a	
	inches	(mm)	inches	(mm)	inches	(mm)	inches	(mm)	inches	(mm)	inches	(mm)
3/8	0.484	12.29	0.504	12.80	0.594	15.09	0.614	15.59	0.690	17.5	0.710	18.0
1/2	0.622	15.80	0.642	16.31	0.732	18.59	0.765	19.43	0.820	20.8	0.840	21.3
3/4	0.820	20.83	0.840	21.34	0.930	23.62	0.960	24.38	1.030	25.2	1.050	26.7
1	1.041	26.44	1.066	27.08	1.201	30.51	1.226	31.14	1.290	32.8	1.315	33.4
1-1/4	1.380	35.05	1.410	35.81	1.540	39.12	1.570	39.58	1.630	41.4	1.660	42.2
1-1/2	1.575	40.01	1.600	40.64	1.735	44.17	1.770	44.96	1.865	47.4	1.900	48.3
2	2.020	51.31	2.045	51.94	2.180	55.37	2.215	56.26	2.340	59.4	2.375	60.3
2-1/2	2.480	62.99	2.505	63.63	2.640	67.04	2.675	67.93	2.840	72.1	2.875	73.0
3	3.070	77.98	3.100	78.74	3.295	83.69	3.335	84.71	3.460	87.9	3.500	88.9
3-1/2	3.500	88.90	3.540	89.92	3.720	94.49	3.789	96.01	3.960	100.6	4.000	101.6
4	4.000	101.60	4.040	102.62	4.220	107.18	4.280	108.71	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 conduit is formed shall comply with the requirements in the Standard for Flexible Metal Conduit, UL 1, or the strip may be cut from acceptable zinc-coated sheet steel. A coating of zinc is not required on the cut edges. See the Zinc-Coating Test, Section 14.

PERFORMANCE

7 Resistance Test

7.1 The electrical resistance of specimens of previously untested finished conduit shall not exceed the values shown in Table 7.1.

7.2 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.

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