UL 1676

STANDARD FOR SAFETY

Conductive-Path and Discharge-Path Resistors for Use in Radio-, Video-, or Television-Type Appliances

UL Standard for Safety for Conductive-Path and Discharge-Path Resistors for Use in Radio-, Video-, or Television-Type Appliances, UL 1676

Third Edition, Dated September 1, 2000

Summary of Topics

This revision to ANSI/UL 1676 is being issued to reflect the recent reaffirmation of this standard as an American National Standard. No changes have been made to the requirements within this standard.

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.

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UL 1676

Standard for Conductive-Path and Discharge-Path Resistors for Use in Radio-, Video-, or Television-Type Appliances

The First and Second Editions were titled Standard for Discharge Path Resistors.

First Edition – August, 1990
Second Edition – July, 1995

Third Edition

September 1, 2000

This ANSI/UL Standard for Safety consists of the Third Edition including revisions through May 30, 2017.

The most recent designation of ANSI/UL 1676 as a Reaffirmed American National Standard (ANS) occurred on May 30, 2017. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover discharge-path resistors that are intended to be connected between the antenna and the supply circuit of a radio-, video-, or television-type appliance. The resistors are intended to reduce the risk of fire or electric shock due to the buildup of a static electrical charge on the antenna connected to the appliance. These resistors are:

a) Rated 1/2 W or greater,

b) Rated 480 kΩ to 12 MΩ for use in a 50/60 Hz, 125 V or less circuit, and

c) Rated 960 kΩ to 12 MΩ for use in a 50/60 Hz, 126 – 250 V circuit.

1.2 These requirements cover conductive-path resistors, of any rating, intended to be connected between live parts and accessible conductive parts of a radio-, video-, or television-type appliance.

1.3 Deleted October 16, 2001.

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.

3 Glossary

3.1 For the purpose of this Standard, the following definitions apply.

3.2 *Relocated as 3.4 October 16, 2001.*

3.2.1 CLASS I PRODUCT – A construction in which protection provided to reduce the risk of electric shock does not rely on basic insulation only, but which includes an additional means of protection. The additional means of protection provides for the connection of accessible current-carrying parts to the grounding conductor of the equipment so the accessible parts do not present a risk of electric shock due to breakdown of the basic insulation.

3.2.2 CLASS II PRODUCT – A construction in which protection provided to reduce the risk of electric shock does not rely on basic insulation only, but in which additional means of protection, such as double insulation or reinforced insulation, are provided when no provision for grounding is provided.

3.2.3 CLEARANCE – The shortest distance through air between two conductive parts.

3.3 CONDUCTIVE-PATH RESISTOR – A resistor that provides a conductive path between live parts and accessible conductive parts of a radio-, video-, or television-type device.

3.3.1 CREEPAGE DISTANCE – The shortest distance along the surface of an insulating material between two conductive parts.

3.4 DISCHARGE-PATH RESISTOR – A resistor that provides a discharge path between the supply circuit and a terminal or lead provided for the connection of an external antenna or cable-system input.

3.2 relocated as 3.4 October 16, 2001

3.5 INSULATION, BASIC – Insulation applied to live parts to provide basic protection to reduce the risk of electric shock.

3.6 INSULATION, DOUBLE – Insulation comprised of both basic insulation and supplementary insulation.

3.7 INSULATION, REINFORCED – Single insulation applied to live parts which provides a degree of protection to reduce the risk of electric shock equivalent to double insulation. The insulation is not required to be one homogeneous piece. Insulation comprised of several layers that are not tested singly as supplementary or basic insulation is included.

3.8 INSULATION, SUPPLEMENTARY – Independent insulation applied in addition to basic insulation in order to provide protection to reduce the risk of electric shock in the event of breakdown of the basic insulation.

CONSTRUCTION

4 General

4.1 A discharge-path resistor shall be constructed such that the resistor complies with Sections 5, 7 – 9, 10, and 11.

4.2 A conductive-path resistor shall be constructed such that the resistor complies with Sections 6, 10, and 11. A conductive-path resistor intended for use in equipment that complies with the Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use, UL 6500, shall also comply with Section 4A.

4A Creepage Distances and Clearances for Conductive Path Resistors

4A.1 With reference to 4.2, a conductive-path resistor that is used in a Class I product, as specified in 3.2.1, shall have the following internal and external creepage distances and clearances between end-lead termination assemblies:

a) A minimum of 1.5 mm for voltages in the range of 105 – 130 V, and

b) A minimum of 3.0 mm for voltages in the range of 220 – 250 V.

4A.2 With reference to 4.2, a conductive-path resistor that is used in a Class II product, as specified in 3.2.2, shall have the following internal and external creepage distances and clearances between end-lead termination assemblies:

a) A minimum of 3.0 mm for voltages in the range of 105 – 130 V, and

b) A minimum of 6.0 mm for voltages in the range of 220 – 250 V.

4A.3 Creepage distances and clearances between end-lead termination assemblies and dead-metal parts or current-carrying parts shall comply with the spacing requirements of the end-product standard.

PERFORMANCE

5 Discharge-Path Resistor Tests

5.1 Resistance test

5.1.1 The initial resistance of 20 as-received, discharge-path resistors is to be measured. The initial resistance of each resistor:

a) Shall be 480 kΩ to 12 MΩ for a resistor to be used in a 125 V or less circuit, or

b) Shall be 960 kΩ to 12 MΩ for a resistor to be used in a 126 – 250 V circuit.

5.2 Humidity test

5.2.1 Following the resistance measurements specified in 5.1.1, the discharge-path resistors are to be subjected to humidity conditioning as described in 5.2.2. Within 5 minutes after the conditioning, the resistance of each resistor:

a) Shall be 12 MΩ or less, and

b) Shall be within ±50 percent of the initial resistance measured. See 5.1.1.

5.2.2 Each resistor is to be conditioned for 21 days at a temperature of 40 ±2°C in a chamber maintained at 90 – 95 percent relative humidity. The chamber is to be constructed so that:

a) Condensed water is continuously drained from the chamber, and

b) Condensed water from the walls and roof of the chamber does not fall on the resistor.

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5.3 Discharge test

5.3.1 Each resistor tested as specified in 5.1.1 – 5.2.2 is to be subjected to discharges from a capacitor as described in 5.3.2. The resistance of each resistor, measured at least 15 min after the conditioning and not more than 1 h after the conditioning:

a) Shall be 12 MΩ or less, and

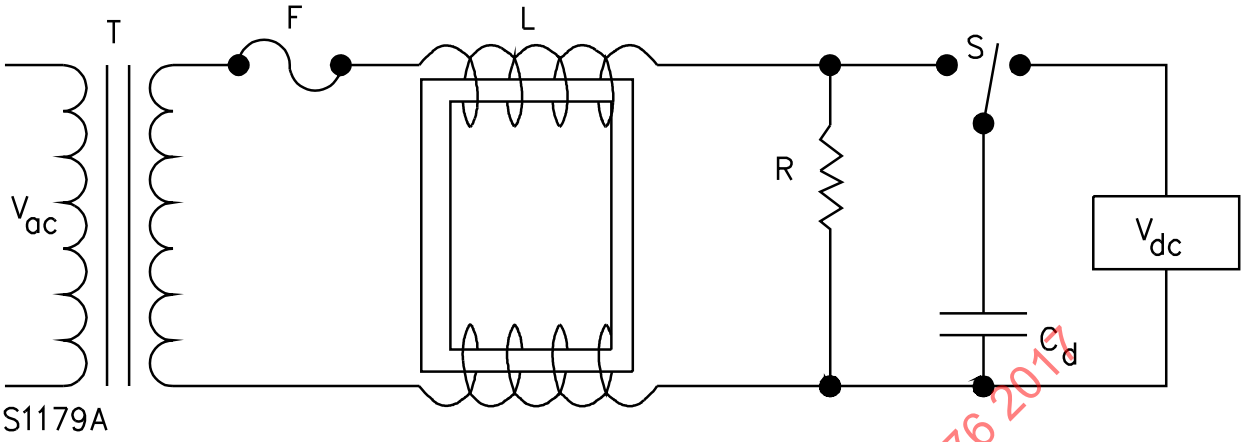
b) Shall be within ±50 percent of the initial resistance measured. See 5.1.1.

5.3.2 Each resistor is to be subjected to ten discharges from a dump capacitor that has been charged to a potential of 10 kV. The discharge is to be applied across the resistor leads. The interval between successive discharges is to be 5 s. Figure 5.1 illustrates the circuit to be used when performing this test.

Table 5.1
Supply source potential

Intended resistor circuit potential, volts	Supply source potential, volts
125 or less	120
126 to 250	240

Figure 5.1
Test circuit for discharge-path resistors



V_{ac} – The supply source is to have:

a) A potential as specified in Table 5.1;

b) A frequency of 60 Hz; and

c) A sufficient capacity to supply 30 A to the test circuit.

T – Optional isolation transformer for pulse blocking, having a 1:1 turn ratio and output capability of at least 25 A.

F – Fuse rated 30 A, 250 V.

L – Choke – Consists of two coils of No. 16 AWG (1.3 mm^2) solid film-coated copper wire wound on insulating tubes placed on a 82.5 by 88.9 by 15.9 mm ferrite core. Each coil is to consist of 2.3 m of wire wound into 30 turns. The two coils are to be connected so that the magnetic flux is aiding, thereby producing an effective inductance and resistance of each coil of approximately 3 mH and 0.03 Ω, respectively.

R – Resistor under test.

S – High-voltage switch.

C_d – Dump capacitor having a capacitance value of 0.01 µf.

V_{dc} – 10 kV dc source of supply.

5.4 Dielectric voltage-withstand test

5.4.1 Each resistor tested as specified in 5.1.1 – 5.3.2 shall be subject to the test specified in 5.4.2 – 5.4.5. The resistance of each resistor, measured at least 15 min after the test and not more than 1 h after the test:

a) Shall be 12 MΩ or less, and

b) Shall be within ±50 percent of the initial resistance measured. See 5.1.1.

5.4.2 The test potential applied to each resistor is to be 1000 V rms, sinusoidal, 60 Hz, and is to be applied across the resistor leads for 1 min.

5.4.3 The test potential is to be obtained from a transformer that provides a variable output voltage. The applied potential is to be increased at a uniform rate from zero to the specified test value within 5 s. A manual or automatic means shall be used to control the rate of rise.

5.4.4 The sensitivity of the test equipment is to be such that when a resistor having a value of 120,000 Ω is connected across the output, the test equipment indicates that the resistor has performed as intended for any output voltage less than the specified test voltage, and has not performed as intended for any output voltage equal to or greater than the specified test voltage.

5.4.5 In the event a resistor being tested dissipates more than rated power while the dielectric voltage-withstand potential is applied, cooling the resistor by artificial means complies with the requirement.

6 Conductive-Path Resistor Tests

6.1 General

6.1.1 The initial resistance of 10 as-received, conductive-path resistors is to be measured.

6.2 Humidity conditioning

6.2.1 Following the measurements specified in 6.1.1, the conductive-path resistors are to be subjected to the humidity conditioning as described in 5.2.2.