



UL 101

STANDARD FOR SAFETY

Leakage Current for Appliances

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UL Standard for Safety for Leakage Current for Appliances, UL 101

Sixth Edition, Dated July 31, 2017

SUMMARY OF TOPICS

This revision of ANSI/UL 101 includes the following:

Revision To Paragraph 5.3.3 To Align With UL 101 Formal Interpretation

The revised requirements are substantially in accordance with Proposal(s) on this subject dated August 10, 2018.

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Leakage Current for Appliances

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Sixth Edition

July 31, 2017

This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through October 2, 2018.

The most recent designation of ANSI/UL 101 as an American National Standard (ANSI) occurred on October 2, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page. Any other portions of this ANSI/UL standard that were not processed in accordance with ANSI/UL requirements are noted at the beginning of the impacted sections.

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 Purpose

1.1 To minimize the risks associated with the physical reaction of the user, or burns to the user, from exposure to leakage currents from appliances under foreseeable use conditions, this standard provides:

- a) Leakage current limits;
- b) Methods, specifications for measuring equipment, and test conditions for measurement of leakage currents.

2 Scope

2.1 This standard applies to cord- and plug-connected household and similar appliances (see Definitions, Section 3) rated 20 A or less, nominal 50 or 60 Hz, having 3-wire (including equipment grounding conductor) or 2-wire cords, and intended for use on supply circuits not exceeding 150 V to ground.

2.2 This standard does not apply to:

- a) Appliances having a grounding connection made at the factory to the neutral terminal.
- b) Electronic measuring instruments not intended for household use.

The values in this standard do not provide protection against the minute currents which could cause ventricular fibrillation if applied directly to the heart, as via a heart catheter.

3 Definitions

3.1 **APPLIANCE** – (As referred to in this standard) – Utilization equipment that uses electric energy for some function, usually complete in itself, generally other than industrial, normally built in standardized sizes or types which is installed or connected as a unit to perform one or more functions. For example, a toaster, flatiron, washing machine, hand drill, food mixer, air conditioner, gas appliance with electrical controls, kerosene heater with electric blower.

3.2 **APPLIANCE, FIXED** – An appliance that is fastened or otherwise secured at a specific location.

3.3 **APPLIANCE** – An appliance that is actually moved or can easily be moved from one place to another in normal use.

3.4 **APPLIANCE, STATIONARY** – An appliance that is not easily moved from one place to another in normal use.

3.5 **FORESEEABLE USE** – Specified use conditions and other use conditions which a prudent person might assume would cause no immediate hazard. An open ground is considered to be a condition of foreseeable use.

3.6 LEAKAGE CURRENT – Electric current which flows through a person upon contact, between accessible parts of an appliance and:

- a) Ground, and
- b) Other accessible parts of the appliance.

3.7 MIU-MEASUREMENT INDICATION UNIT – Is the output voltage (V3) in millivolts rms from the measurement instrument in Figure 5.3 divided by 500 (the value in ohms of the resistance in parallel with V2 in the measurement instrument circuit). (The indication is essentially the rms value of a 60 Hz sinusoidal leakage current in mA. It may not be a direct indication of the rms or other common amplitude quantifier of leakage current when the leakage current is of complex waveform or frequency other than 50 or 60 Hz.)

3.8 REACTION CURRENT – A threshold current value, above which a substantial portion of the population may be caused to react involuntarily to the sensation of current.

3.9 SHEATHED HEATING EQUIPMENT LEAKAGE CURRENT – Current through insulating material (normally MgO) between the current-carrying conductor and the metallic sheath.

PERFORMANCE

4 Leakage Current Limits

4.1 General

4.1.1 When measured in accordance with the test method covered in this standard, the measurement indication shall not exceed the values shown in Table 4.1.

Table 4.1
Maximum allowable measurement instrument indication based on reaction

Type of appliance	Indication in MIU (for a 60 Hz sine wave leakage current, the values are approximately milliamperes, rms)
Two-wire cord- and plug-connected appliance	0.50 MIU
Three-wire (including grounding conductor) cord- and plug-connected portable appliance	0.50 MIU
Three-wire (including grounding conductor) cord- and plug-connected stationary or fixed appliance	0.75 MIU

4.1.2 In addition to the limits in Table 4.1, to avoid undue risks of severe body tissue burns, the leakage current shall be not greater than 70 mA rms, measured as V2 (volts rms) divided by 0.5 (kilohms), using the measuring instrument of Figure 5.3 with the frequency-sensitive network disconnected. (See Appendix B for the performance specifications of the modified measuring instrument). Because in the low frequency range, the maximum allowable current based on reaction is less than the maximum allowable current based on body tissue burn, the burn current limit generally applies only when high frequencies are involved.

Exception No. 1: For appliances having metal-sheathed heating elements for which the operating conditions and present technology does not permit compliance with the limits in Table 4.1 during heat-up and cool-down, the maximum allowable indication of the measurement instrument for periods not exceeding 5 minutes during heat-up and not exceeding 5 minutes during cool-down is 2.5 MIU. For other periods of operation, the leakage current shall be within the limits specified in Table 4.1. (See 5.4.12 and 5.4.13.)

Exception No. 2: Those conductive parts of an appliance that comply with all of the specifications in Items (a) through (e) below may be permitted by the product standard to have a leakage current from simultaneously accessible parts to the grounded supply conductor higher than specified in Table 4.1, but in no case shall the leakage current be greater than 3.5 MIU. The leakage current between simultaneously accessible parts shall not exceed the values shown in Table 4.1. (See 5.4.2.)

- a) The product requires EMI suppression filtering for compliance with FCC regulations. (See A3.1.)*
- b) The product is equipped with a grounding-type supply cord and plug.*
- c) There is a low probability that a path for available current through the body will exist in the expected environment. If the available current flows to ground, this will involve consideration of the probability that the user will be grounded during the use of the product.*
- d) There is a low probability that high leakage conductive parts will be contacted during normal use, as defined in the product standard.*
- e) The probability of injury resulting from an involuntary reaction is small. (See Rationale.)*

Exception No. 3: For an appliance that upon loss-of-grounding, dependably disconnects all sources that can produce leakage current, the leakage current, when measured in accordance with the test method covered in this standard, shall not exceed 5 MIU with the grounding conductor open and with the loss-of-grounding circuit disabled. (See A5.)

The leakage current, when measured in accordance with the test method covered in this standard, except that the equipment grounding conductor is connected to the grounded supply conductor at the receptacle feeding the appliance, shall not be more than the values shown in Table 4.1. This measurement will typically not involve current between accessible parts and the grounded supply conductor, but will involve currents that may flow from one part of the appliance to another.