



UL 101

STANDARD FOR SAFETY

Leakage Current for Utilization Equipment

UL Standard for Safety for Leakage Current for Utilization Equipment, UL 101

Sixth Edition, Dated July 31, 2017

SUMMARY OF TOPICS

This revision of ANSI/UL 101 dated October 5, 2023 addresses GFCI Interoperability Issues; [1.1](#), [2.1](#), [3.1A](#) – [3.1C](#), [3.5A](#), [3.5B](#), [3.7A](#), [3.7B](#), [3.7.1](#) – [3.7.3](#), [3.9A](#), [Table 4.1](#), [5.1.2](#), subsection [5.2](#), [5.3.1](#), [Figure 5.3](#), [Figure 5.4](#), [Section 6](#), [Section A6](#) (title only), [A7.1](#), [A7.3](#), [Section A8](#), and [Appendix B](#)

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated December 23, 2022 and May 26, 2023.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of ULSE Inc. (ULSE).

ULSE provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will ULSE be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if ULSE or an authorized ULSE representative has been advised of the possibility of such damage. In no event shall ULSE's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold ULSE harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

No Text on This Page

JULY 31, 2017

(Title Page Reprinted: October 5, 2023)

1

UL 101

Leakage Current for Utilization Equipment

First Edition – November, 1970
Second Edition – August, 1973
Third Edition – September, 1986
Fourth Edition – March, 1992
Fifth Edition – April, 2002

Sixth Edition

July 31, 2017

This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through October 5, 2023.

The most recent designation of ANSI/UL 101 as an American National Standard (ANSI) occurred on October 5, 2023. 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 ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

Our Standards for Safety are copyrighted by ULSE Inc. Neither a printed nor electronic copy of a Standard should be altered in any way. All of our Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of ULSE Inc.

COPYRIGHT © 2023 ULSE INC.

No Text on This Page

CONTENTS

INTRODUCTION

1	Purpose	5
2	Scope	5
3	Definitions	5

PERFORMANCE

4	Leakage Current Limits.....	7
4.1	General	7
4.2	Departure from leakage current limits	9
5	Test Method and Instrumentation for Measurement of Leakage Current	9
5.1	General	9
5.2	Characteristics of measurement circuit and instrument.....	9
5.3	Test conditions	9
5.4	Test procedure	10
6	GFCI Interoperability Test	13
6.1	General	13
6.2	Test conditions	14
6.3	Test procedure	14

APPENDIX A

RATIONALE

A1	Rationale for Limits	17
A2	Rationale for Flexible Metal Foil	18
A3	Rationale for Products Requiring EMI Filtering to Meet FCC Requirements	18
A4	Rationale for Humidity Conditioning.....	18
A5	Rationale for Higher Leakage Current Levels	19
A6	Rationale for Choice of Meter, and Alternative Meters for Leakage Current Test.....	19
A7	Rationale for Measurement Circuits.....	21
A8	Rationale for GFCI Interoperability Test	21

APPENDIX B METER DESIGN

B1	General.....	25
B2	Leakage Current Meter.....	25
B2.1	General	25
B2.2	Characteristics of measurement circuit and measurement instrument.....	26
B3	Meter for GFCI-Interoperability Test.....	27

No Text on This Page

INTRODUCTION

1 Purpose

1.1 To minimize the user's risks of physical reaction to electrical shock or inability to let go a live part, or burns, from exposure to leakage currents from utilization equipment 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;
- c) GFCI Interoperability test limits, methods, specifications for measuring equipment, and test conditions for measurement of differential currents.

2 Scope

2.1 This Standard applies to utilization equipment (see Definitions, Section 3) typically rated 50 A or less, nominal 50 or 60 Hz, and intended for use on supply circuits not exceeding 300 V to ground.

2.2 This standard does not apply to utilization equipment having a grounded connection made at the factory to the neutral terminal. 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.

NOTE: Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, appliances used in commercial kitchens, in light industry, and the like, are within the scope of this standard.

3.1A **CORD-AND PLUG-CONNECTED PRODUCT** – Utilization equipment that is connected to the electrical supply by a cord set or by a power-supply cord terminating in an attachment plug.

3.1B **DIFFERENTIAL CURRENT** – The current (I_{Δ}) that is determined to be flowing to earth based upon the difference between all current carrying conductors (e.g. L1, L2, N), excluding any protective earthing conductor.

3.1C **FIXED PRODUCT**– Utilization equipment that is fastened or otherwise secured at a specific location.

3.2 *Revised and relocated to [3.7.1](#)*

3.3 *Revised and relocated to [3.7.2](#)*

3.4 *Revised and relocated to [3.7.3](#)*

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.

3.5A GROUND CURRENT – Current flowing to earth either through via the grounding conductor of the utilization equipment or through an alternate path to earth.

3.5B IIU – INTEROPERABILITY INDICATION UNIT – Is weighted differential current from the measurement instrument in [Figure 6.1](#): IIU is the output voltage (V2) in millivolts rms and complying with all requirements for the measurement instrument specified in GFCI Interoperability Test, Section [6](#).

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.

3.6.1 LET-GO CURRENT – A threshold current value, above which a substantial portion of the population may cause involuntary muscle reaction and not able to let-go of an electrically-energized part(s).

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.)

3.7A PERMANENTLY-CONNECTED PRODUCT – Utilization equipment that is connected to the electrical supply by means other than a supply cord and an attachment plug (e.g. the product is permanently wired to the branch circuit).

3.7B PORTABLE PRODUCT– Utilization equipment that is actually moved or can easily be moved from one place to another in normal use.

3.7.1 *Revised and relocated as [3.1C](#)*

3.7.2 *Revised and relocated as [3.7B](#)*

3.7.3 *Revised and relocated as [3.9A](#)*

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.

3.9A STATIONARY PRODUCT– Utilization equipment that is not easily moved from one place to another in normal use.

3.10 UTILIZATION EQUIPMENT – A product that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

NOTE 1: Throughout this standard the terms "product," and "unit" refer to utilization equipment.

NOTE 2: Utilization equipment covered in this in this standard include appliances, luminaires, information technology and similar equipment.

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](#).