



UL 943B

Underwriters Laboratories Inc.

Standard for Safety

Appliance Leakage-Current Interrupters



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UL Standard for Safety for Appliance Leakage-Current Interrupters, UL 943B

First Edition, Dated May 31, 2001

SUMMARY OF TOPICS:

This revision to UL 943B is being issued to address a correction to the Surge Generator Impedance.

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. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated September 23, 2009.

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Standard for Appliance Leakage-Current Interrupters

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INTRODUCTION

1 Scope

1.1 These requirements cover appliance leakage-current interrupters (ALCIs), intended for use only in 2- or 3- wire alternating-current circuits wherein one of the wires is grounded in accordance with the National Electrical Code, ANSI/NFPA 70. They are intended to interrupt the electric circuit to the load when a fault current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit. An ALCI trips when the current to ground reaches a value in the range of 4 – 6 mA.

1.2 These requirements cover 2-wire appliance leakage-current interrupters for use only in cord-connected appliances intended for connection to alternating-current circuits of 250 V or less. An additional ground conductor may be provided. They are not to be provided with a general-purpose outlet receptacle, cord-connector body, or similar devices. Devices complying with these requirements are acceptable for use as components in an end product where the acceptability of the combination is to be determined.

1.3 The acceptability of an appliance leakage-current interrupter in any particular application depends upon its ability to be used continuously under the conditions that prevail in actual service. Accordingly, for a particular application, an appliance leakage-current interrupter may be affected by the requirements for the equipment it is used in, and it may be necessary to additionally evaluate features or performance characteristics that are not specified in this standard.

1.4 This standard does not cover ground-fault circuit-interrupters, which are covered by the Standard for Ground-Fault Circuit-Interrupters, UL 943.

1.5 *Deleted February 8, 2006*

2 Glossary

2.1 For the purpose of this standard, the following definitions shall apply:

2.2 ACCESSIBLE PART – A part so located that it can be contacted by a person, either directly or by means of a probe or tool.

2.3 AUTOMATIC RECLOSURE – Denotes the act of an appliance leakage-current interrupter resetting itself after having been tripped.

2.4 CORD CONNECTED – Denotes connection to a supply circuit by way of a flexible cord terminating in an attachment plug.

2.5 DOUBLE INSULATION – The insulation system resulting from a combination of functional and supplementary insulation.

2.6 ENCLOSURE – Any surface or surrounding structure intended to minimize access to energized parts or parts presenting real or potential risk of injury to persons.

2.7 ENERGIZED PART – A part at some potential with respect to another part, or to earth.

2.8 FUNCTIONAL INSULATION – The insulation necessary for the proper functioning of the device, and for basic protection against the risk of electric shock.

2.9 INDOOR USE – Use in an indoor location or where exposure to rain is not likely to occur.

2.10 GROUND FAULT – An unintentional electrical path between a part operating normally at some potential to ground, and ground.

2.11 LEAKAGE CURRENT – All currents including capacitively coupled currents which may be conveyed between energized parts of a circuit and ground or other parts.

2.12 ORDINARY TOOLS – Pliers, and flat-bladed and cross recessed-head (Phillips type) screwdrivers.

2.13 RATED CURRENT – The marked value of current.

2.14 RATED VOLTAGE – For devices with a marked voltage within the range of 110 – 125 V, the rated voltage is to be considered to be 120 V. For devices with an additional marked voltage within the range of 190 – 250 V, the rated voltage is considered to be 120/240 V.

2.15 REINFORCED INSULATION – An insulation providing protection against the risk of electrical shock that is equivalent to double insulation.

2.16 RISK OF ELECTRIC SHOCK – A risk of electric shock hazard is considered to exist at a part of an appliance leakage-current interrupter if:

- a) There would be current of 6 mA or more in a resistance of 500 ohms connected between the part in question and the grounded supply conductor, and
- b) The device would not operate to open the circuit to the 500-ohm resistor within the time allowed in 27.1.

2.17 SUPPLEMENTARY INSULATION – An independent insulation provided in addition to the functional insulation to insure protection against the risk of electric shock in the event that functional insulation should fail.

2.18 TRIP – Automatic interruption by the appliance leakage-current interrupter of the electric circuit to the load.

3 Components

3.1 Except as indicated in 3.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

3.2 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.

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

3.4 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.

4 Units of Measurement

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

5 References

5.1 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

6 Mechanical Assembly

6.1 An appliance leakage-current interrupter shall be formed and assembled so that it will have the strength and rigidity necessary to resist abuses to which it is likely to be subjected, without producing or increasing a risk of fire, electric shock or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

6.2 An appliance leakage-current interrupter shall have all parts reliably secured in place.

6.3 An appliance leakage-current interrupter shall be constructed so that it will not be necessary to open or remove the enclosure when used as intended.

6.4 Male contact devices such as plugs, provided with, or as an integral part of, an appliance leakage-current interrupter shall also comply with the applicable construction and performance requirements from the Standard for Attachment Plugs and Receptacles, UL 498.

6.5 Lampholders, switches, and other similar components shall be mounted securely and turning shall be restricted from turning by more than friction between surfaces. For example, the use of a lockwasher is acceptable to restrict the turning of a device having a single hole mounting means.

Exception No. 1: A lampholder of a type in which the lamp cannot be replaced, (such as a neon pilot or indicator light in which the lamp is sealed-in by a nonremovable jewel), is not be prohibited from turning if rotation cannot reduce spacings below the minimum acceptable values or produce stress on a connector.

Exception No. 2: A switch or other similar component shall be securely mounted and turning shall be minimized, unless the turning of such a component is part of the design of the unit and introduces no additional risk of fire or electrical shock, or both, such as reduced spacings below the minimum acceptable values or stress on a connection.

6.6 An indicator light shall be one in which the lamp is sealed-in, such as by a nonremovable jewel.

6.7 A switch shall be located within the unit enclosure in such a manner as not to be accessible or exposed to tampering, nor subject to damage during normal use. This requirement does not apply to the actuating means of a switch.

6.8 The maximum acceptable moment, center of gravity, dimensions, and weight of a direct plug-in unit shall comply with the requirements specified in items (a), (b), (c) and (d). See 6.9, 6.10 and Figure 6.1.

- a) The quotient of WY/Z shall not exceed 48 ounces (1361 g).
- b) The quotient of WY/S shall not exceed 48 ounces (1361 g).
- c) The product of WX shall not exceed 80 ounce-inches (0.56 N·m).
- d) The weight of a unit shall not exceed 28 ounces (794 g).

6.9 Definitions for the symbols used in 6.8 are as follows:

- a) W is the weight of the unit in ounces (g).
- b) Y is the distance illustrated in Figure 6.1 in inches (mm).
- c) Z is the lesser of the two distances, Z_1 or Z_2 , as illustrated in Figure 6.1 in inches (mm).
- d) S is the lesser of the two distances, S_1 or S_2 , as illustrated in Figure 6.1 in inches (mm).
- e) X is the greater of the two distances, X_1 or X_2 , as illustrated in Figure 6.1 in inches (mm).

6.10 The moment and weight specified in 6.8 are to be determined as follows:

- a) For units with an output cord, the cord is to be cut off at the enclosure, or at the strain-relief means if the strain-relief means is outside the enclosure.
- b) For units with directly mounted accessories, the values are to be measured with the accessories in place.

6.11 When inserted in a parallel-blade duplex receptacle, any part of a unit, including output wiring, shall not interfere with full insertion of an attachment plug into the adjacent receptacle. See Figure 6.2.

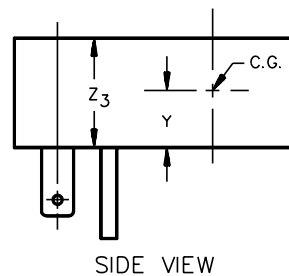
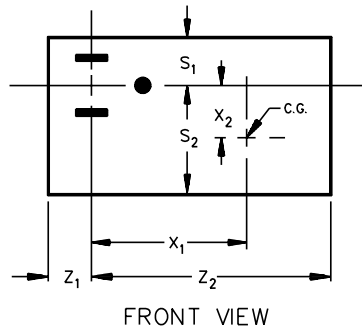
Exception: A unit that renders the adjacent receptacle completely unusable in any one mounting position is considered to comply with this requirement.

6.12 A mounting tab shall not be provided with the unit.

6.13 The enclosure of an attachment plug-type ALCI shall be capable of being gripped for removal from the receptacle to which it is connected. Gripping means include detents on the enclosure, ribs, or other equivalent means to facilitate grasp and removal of the ALCI. The perimeter of the face section from which the blades project shall not be less than 5/16 inch (7.9 mm) from any point on either blade.

Revised 6.13 effective January 4, 2004

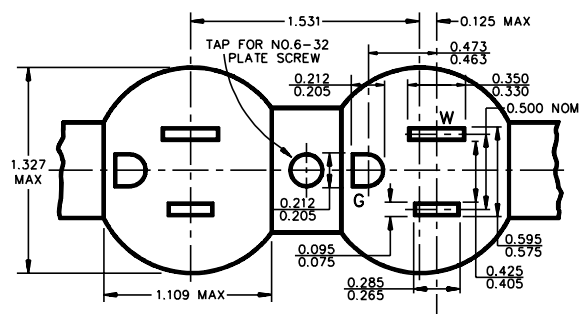
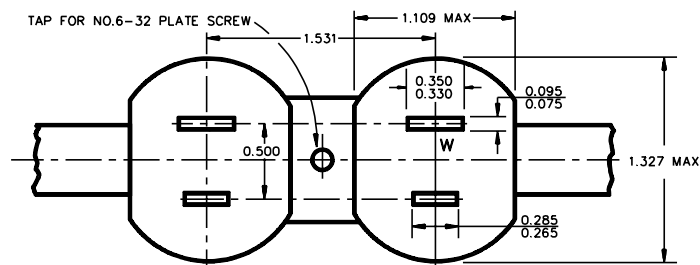
Figure 6.1
Dimensions of a direct plug-in unit



C.G. = Center of Gravity

CP100

Figure 6.2
Parallel receptacle duplex
(All dimensions in inches)



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7 Enclosure

7.1 General

7.1.1 An appliance leakage-current interrupter shall be provided with an enclosure that shall house all current-carrying parts other than primary blades and output leads. The enclosure shall have the strength and properties necessary to reduce the risk of mechanical damage to the various parts.

7.1.2 If access to the interior of a unit can present a risk of fire, electric shock, or injury to persons, seams and joints of the enclosure shall be assembled by welding, riveting, the use of screws or fasteners that are not removable by the use of an ordinary tool, (see 2.12), or the equivalent. For enclosure parts secured together by adhesive, see 7.3.2.

Exception: A unit containing components that may require factory assembly may have the enclosure assembled by screws or other fasteners removable by an ordinary tool, provided there is means to discourage user-tampering such as sealing of one or more of the assembly fasteners. Potting compound, encapsulation, or equivalent means provided to comply with this requirement shall be in place when the units are subjected to the Enclosure Tests outlined in 7.3.1 and Crushing-Resistance Test of Section 38.

Revised 7.1.2 effective January 4, 2004

7.1.3 Cross recessed-head screws (Phillips type), spring clips, and similar devices are considered to be defeatable by an ordinary tool.

7.2 Metal enclosures

7.2.1 An enclosure constructed of sheet metal shall be formed from stock having a thickness not less than that specified in Table 7.2.1. The thickness of enclosure sheet metal, other than steel or aluminum, shall not be less than that specified in Table 7.2.1 for uncoated steel, and shall have the necessary strength and rigidity.

7.2.2 A lanced tab provided for internal component mounting may have a small opening caused by die clearance if:

- a) The opening caused by the tab is substantially closed by the mounted component, and
- b) The tab is located on the surface of the enclosure with the supply-connector pins.

Table 7.2.1
Thickness of sheet metal for enclosures

	Minimum acceptable thickness	
	Inch	(mm)
Uncoated steel	0.026	(0.66)
Zinc-coated steel	0.029	(0.74)
Aluminum	0.040	(1.02)

7.3 Polymeric enclosures

7.3.1 A polymeric enclosure or a polymeric part of an enclosure shall comply with the applicable requirements for enclosures as specified in the Standard for Polymeric Materials-Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 1: The Drop Test of Section 24 of this standard shall be conducted in place of the tests described in Resistance to Impact Test, Section 57, of the Standard for Polymeric Materials-Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 2: For a direct plug-in appliance leakage-current interrupter, the crushing test shall be conducted in accordance with Crushing Test, Section 72 of the Standard for Attachment Plugs and Receptacles, UL 498.

7.3.2 An adhesive used in the assembly of an appliance leakage-current interrupter shall comply with the applicable requirements for adhesives as specified in the Standard for Polymeric Materials-Use in Electrical Equipment Evaluations, UL 746C.

Exception: Methods utilizing fusion techniques, such as solvent cementing, ultrasonic welding, electromagnetic induction, and thermal welding need not be investigated.

7.4 Corrosion resistance

7.4.1 Except as noted in 7.4.2, iron and steel parts shall be protected against corrosion by galvanizing, plating, enameling, or other equivalent means, if the corrosion of such unprotected parts would be likely to result in a risk of fire, electric shock, or injury to persons.

7.4.2 The requirement in 7.4.1 applies to all enclosing cases or to other parts upon which intended mechanical operation may depend. It does not apply to laminations and minor parts of iron or steel, such as washers, screws, and bolts, that are not current-carrying, if the corrosion of such unprotected parts would not be likely to result in a risk of fire, electrical shock or injury to persons, or result in the device not operating as intended. A part made of stainless steel does not require additional protection against corrosion.