

UL 1559

Insect-Control Equipment – Electrocution Type

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UL Standard for Safety for Insect-Control Equipment – Electrocution Type, UL 1559

Fourth Edition, Dated March 1, 2002

Revisions: This Standard contains revisions through and including September 20, 2007.

Summary of Topics

These revisions to ANSI/UL 1559 include the following changes in requirements:

Revision to prohibit use of sheet metal screws as a means to attach connection devices for grounding conductors.

Addition of the Standard for Switches for Appliances - Part 1: General Requirements, UL 61058-1, to the Standards for Components.

Text that has been changed in any manner 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 new and revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated July 6, 2007.

The revisions dated September 20, 2007 include a reprinted title page (page1) for this Standard.

The revisions dated May 19, 2006 editorially replace all references to UL 1020 with the reference to UL 60691.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net/ulforeword.html>

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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 Recognition and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-3	September 20, 2007
4-5	December 23, 2003
6	May 19, 2006
7-19	March 1, 2002
20-22B	September 20, 2007
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UL 1559

Standard for Insect-Control Equipment – Electrocuting Type

First Edition – July, 1982
Second Edition – July, 1987
Third Edition – July, 1995

Fourth Edition

March 1, 2002

The most recent designation of ANSI/UL 1559 as an American National Standard (ANSI) occurred on September 13, 2007.

This ANSI/UL Standard for Safety, which consists of the Fourth edition with revisions through September 20, 2007, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

The Department of Defense (DoD) has adopted UL 1559 on February 25, 1989. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc. and is not part of the ANSI standard.

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. 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 <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover insect-electrocution equipment of the household and commercial types with an input rating of 250 V or less and are intended for use in ordinary locations in accordance with the National Electrical Code.

1.2 These requirements cover products that employ electrocution as the primary means of exterminating insects.

1.3 These requirements assume the use of an isolating type transformer for electrocuting insects. Constructions without such isolation may be investigated in accordance with these requirements and supplemented and modified by other appropriate requirements.

1.4 These requirements do not cover insect exterminators of the type that utilize chemicals, ultrasonic or mechanical trapping devices.

2 Glossary

2.1 For the purpose of this standard the following definitions apply.

2.2 **COMMERCIAL EQUIPMENT** – Equipment intended to be used on commercial, industrial or institutional premises, such as restaurants, motels, schools, public and commercial campsites, public swimming pools and beaches, golf courses, food processing plants, canneries, beverage bottling plants, farms and similar sites.

2.3 **ELECTRODE TRANSFORMER** – A transformer whose primary function is to supply the voltage and current necessary for electrocuting insects.

2.4 **HOUSEHOLD EQUIPMENT** – Equipment intended for use in or around a residence. Portable cord-connected insect-electrocution equipment intended for personal use during camping or similar activities is also considered household equipment.

2.5 **INDOOR-USE EQUIPMENT** – Equipment intended for use in a sheltered area that is not normally subject to dampness or wetness and not exposed to weather.

2.6 **OUTDOOR-USE EQUIPMENT** – Equipment intended for use in locations exposed to weather including partially protected locations under canopies, roofed open porches, barns and similar locations that may be damp or wet.

2.7 **PRIMARY CIRCUIT** – A circuit that is conductively connected to the branch circuit supply source.

2.8 **SECONDARY CIRCUIT** – A circuit that is conductively connected to a secondary winding of an isolating transformer.

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.

4.2 Unless indicated otherwise all voltage and current values mentioned in this standard are root-mean-square (rms).

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 Frame and Enclosure

6.1 Insect-electrocution equipment shall be so formed and assembled that it will have the strength and rigidity necessary to resist the abuses that it is likely to be subjected to, without increasing the likelihood 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 All electrical parts, except a supply cord, that may involve a risk of fire, electric shock, or injury to persons under any condition of use, shall be enclosed in an acceptable enclosure.

6.3 A knockout in a sheet metal enclosure shall be effectively secured and removable without undue deformation of the enclosure.

6.4 A knockout shall be surrounded by a flat surface to provide for seating of a conduit bushing or locknut of the appropriate size.

6.5 Sheet metal to which a wiring system is to be connected in the field shall have a minimum thickness of 0.032 inch (0.81 mm) if uncoated steel, 0.034 inch (0.86 mm) if galvanized steel, and 0.045 inch (1.14 mm) if nonferrous metal.

6.6 Cast metal to which a wiring system is to be connected in the field shall have an average thickness not less than 1/8 inch (3.2 mm).

6.7 The enclosure of insect-electrocution equipment for outdoor use shall be constructed so as to exclude a beating rain. See Water Spray Test, Section 35.

6.8 A gasket or seal relied upon to comply with the requirements in Water Spray Test, Section 35, will be subjected to an investigation.

6.9 A polymeric enclosure, frame, or cover shall be evaluated with respect to mechanical strength, resistance to impact, moisture absorption properties, combustibility, resistance to arcing, dielectric strength, aging characteristics and other environmental conditions to which the enclosure may be subjected.

6.10 To determine compliance with 6.9, a polymeric enclosure, frame, or cover shall be evaluated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and other applicable tests in this standard.

6.11 A polymeric enclosure, frame, or cover of insect-electrocution equipment intended for outdoor use shall additionally be evaluated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, for exposure to ultraviolet light and water.

6.12 An insect catch tray shall be provided with insect-electrocution equipment not marked for “Outdoor Use Only” or the equivalent. The insect catch tray shall be removable without the use of a tool to facilitate insect disposal.

6.13 A polymeric enclosure, frame, cover or insect catch tray shall be classified not less than V-2 in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

6.14 A flame retardant coating on a polymeric enclosure shall not be used, unless the uncoated polymeric material complies with 6.13 and the coating complies with the applicable Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.15 A keyhole slot in the enclosure shall be provided with a barrier to protect against the likelihood of the hanger (nail, screw, or similar fasteners) from contacting live parts or falling into the enclosure, if an increase in the risk of fire or electric shock may result.

7 Protection Against Corrosion

7.1 General

7.1.1 Ferrous metal parts shall be protected against corrosion by enameling, galvanizing, plating, Sherardizing, or other equivalent means.

Exception No. 1: Ferrous parts not relied upon for maintaining the integrity of the product are not required to be protected against corrosion.

Exception No. 2: Parts made of stainless steel are not required to be additionally protected against corrosion.

7.2 Enclosure intended for outdoor use

7.2.1 A sheet steel enclosure intended for outdoor use shall be protected against corrosion by one of the following coatings:

- a) Hot-dipped mill-galvanized sheet steel conforming with the coating Designation G90 in Table 1 of the Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653/A653M, with not less than 40 percent of the zinc on any side, based on the minimum single-spot test requirement in this ASTM designation. See 7.2.5.
- b) A zinc coating, other than that provided on hot-dipped mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00061 inch (0.0155 mm) on each surface with a minimum thickness of 0.00054 inch (0.0137 mm). See 7.2.6.
- c) A zinc coating as specified in 7.2.1 (c)(1) or (2) below and with one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint applied after forming on each side. The acceptability of the paint is to be determined by consideration of its composition or by corrosion tests if these are considered necessary.
 - 1) Hot-dipped mill-galvanized sheet steel conforming with the coating Designation G60 or A60 in Table 1 of ASTM A653/A653M, with not less than 40 percent of the zinc on any side, based on the minimum single-spot test requirement in this ASTM specification. See 7.2.5.
 - 2) A zinc coating, other than that provided on hot-dipped mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00041 inch (0.0104 mm) on each surface with a minimum thickness of 0.00034 inch (0.009 mm).
- d) A cadmium coating not less than 0.0010 inch (0.025 mm) thick on both surfaces. See 7.2.6.
- e) A cadmium coating not less than 0.00075 inch (0.019 mm) thick on both surfaces with one coat of outdoor paint on both surfaces, or not less than 0.00051 inch (0.013 mm) thick on both surfaces with two coats of outdoor paint on both surfaces. The paint shall be as specified in (c). See 7.2.6.

- f) Other finishes, including paints, metal finishes, or combinations of the two may be accepted when comparative tests with galvanized sheet steel – without annealing, wiping, or other surface treatment – specified in (a), indicate they provide equivalent protection.

Among the factors that are taken into consideration when evaluating such coating systems are exposure to salt spray, moist carbon dioxide-sulphur dioxide-air mixtures, moist hydrogen sulphide-air mixtures, ultraviolet light, and water.

7.2.2 An annealed coating on sheet steel that is bent or similarly formed or extruded or rolled at the edge of holes after annealing shall be additionally painted in the affected area if the process damages the zinc coating.

Exception: If the width of the damaged area is less than the thickness of the sheet steel, the area is not required to be additionally painted.

7.2.3 If flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification, the zinc coating is considered to be damaged.

7.2.4 Simple sheared or cut edges and punched holes are not required to be additionally protected.

7.2.5 The weight of the zinc coating specified in 7.2.1 (a) and (c)(1) may be determined by any acceptable method; however, in case of question the weight of coating shall be established in accordance with the Standard Test Method for Weight [Mass] of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90/A90M.

7.2.6 The thickness of the cadmium or zinc coating specified in 7.2.1 (b), (c)(2), (d), and (e) shall be established by the Metallic-Coating Thickness Test described in Section 44.

8 Leakage Current

8.1 Leakage current from any part that is accessible during normal use, shall be within the limit specified in 27.1 if the open-circuit potential between the accessible part and earth ground or any other accessible part is more than:

- a) 42.4 V peak for indoor use only equipment, and
- b) 21.2 V peak for outdoor-use equipment or where wet contact is likely to occur.

9 Electric Shock

9.1 Risk of electric shock is considered to exist at any live part, if the open-circuit potential between the part and earth ground or any other accessible part is more than:

- a) 42.4 V peak for an indoor use only unit or
- b) 21.2 V peak for an outdoor unit or where wet contact is likely to occur, and:
 - 1) The continuous current flow through a 500-ohm resistor is more than 5.0 mA, or
 - 2) The combination of magnitude and duration of peak current flow exceeds the limits specified in 9.2, or
 - 3) The combination of capacitance and voltage exceeds the limits specified in 9.3.

9.2 The duration of a transient current (unidirectional or alternating) through a 500-ohm resistor, connected between any exposed part and earth ground or any other accessible part, shall satisfy the following equation:

$$T \leq \left(\frac{20\sqrt{2}}{I} \right)^{1.43}$$

in which:

I is the peak current in milliamperes; and

T is the duration, measured in seconds, from the time that the instantaneous value of the current first exceeds 7.1 mA peak until the time that the current falls below 7.1 mA and remains so for at least one second. Typical calculated values appear in Table 9.1.

Exception: The peak current shall not exceed 809 mA regardless of duration.

9.3 The maximum capacitance between capacitor terminals or any part conductively connected to the terminals shall satisfy the following equations:

$$C = \frac{88,400}{E^{1.43} (\log_e E - 1.26)} \text{ for } E \text{ equal to or less than } 400V$$

$$C = 35,288 E^{-1.5364} \text{ for } E \text{ greater than } 400V$$

in which:

C is the maximum capacitance of the capacitor in microfarads; and

E is the peak potential in volts across the capacitor measured 5 seconds after the capacitor terminals or uninsulated live parts electrically connected to the capacitor terminals are accessible by the removal or opening of the enclosure. Typical calculated values appear in Table 9.2.

9.4 Polarization of an attachment plug on cord-connected equipment is to be disregarded when evaluating the risk of electric shock.

Table 9.1
Electric shock – transient

Maximum current in milliamperes peak through 500-ohm resistor		Maximum acceptable time in seconds of envelope containing excursions greater than 7.1 milliamperes peak
Less than	7.1	Not applicable
	7.1	7.22
	8.5	5.58
	10.0	4.42
	12.5	3.21
	15.0	2.48
	17.5	1.99
	20.0	1.64
	22.5	1.39
	25.0	1.19
	30.0	0.919
	40.0	0.609
	50.0	0.443
	60.0	0.341
	70.0	0.274
	80.0	0.226
	90.0	0.191
	100.0	0.164
	150.0	0.092

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Table 9.1 Continued

Maximum current in milliamperes peak through 500-ohm resistor	Maximum acceptable time in seconds of envelope containing excursions greater than 7.1 milliamperes peak
200.0	0.061
250.0	0.044
300.0	0.034
350.0	0.027
400.0	0.023
450.0	0.019
500.0	0.016
600.0	0.012
700.0	0.010
809.0	0.0083
Greater than 809.0	See exception to 15.1.2

Table 9.2
Electric shock – stored energy

Potential in volts, across capacitor(s) prior to discharge	Maximum acceptable capacitance in microfarads
5,000	0.0732
4,500	0.0861
4,000	0.103
3,500	0.127
3,000	0.160
2,500	0.212
2,000	0.299
1,500	0.465
1,250	0.616
1,000	0.868
900	1.02
800	1.22
700	1.50
600	1.90
500	2.52
400	3.55
380	3.86
360	4.22
340	4.64
320	5.13
300	5.71
280	6.40
260	7.24
240	8.27
220	9.56
200	11.2
180	13.4
160	16.3
140	20.5
120	26.6
100	36.5

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Table 9.2 Continued

Potential in volts, across capacitor(s) prior to discharge	Maximum acceptable capacitance in microfarads
90	43.8
80	53.8
70	68.0
60	89.4
50	124
45	150
42.4	167
40 ^a	186
30 ^a	319
25 ^a	452
21.2 ^a	625

^a Values less than 42.4 V do not apply to indoor use equipment

10 Accessibility of Parts Involving the Risk of Electric Shock

10.1 An opening in the enclosure is acceptable if the appropriate probe, when inserted through the opening, cannot be made to touch any uninsulated part involving the risk of electric shock or coated-magnet wire that involves risk of electric shock. The probe shall be applied in all possible articulated positions before, during, and after insertion.

10.2 The probe shown in Figure 10.1 is to be used for determining the accessibility of a primary circuit part.

10.3 The probe shown in Figure 10.2 is to be used for determining the accessibility of a secondary circuit part.

10.4 In connection with the requirements in 10.1, a part of the outer enclosure that may be removed without the use of a tool is to be disregarded – that is, it is not to be assumed that the part in question affords protection against electric shock.

11 User Servicing

11.1 The necessary routine maintenance of insect-electrocution equipment, such as removal of insects and replacing lamps and starters, shall not result in a risk of fire, electric shock (see Electric Shock, Section 9) or injury to persons (see Protection Against Injury to Persons, Section 12).

Exception: The requirement does not apply to the contacts of a lampholder or starter holder that is associated with the component being replaced. See 3.1 and 19.5.

11.2 The equipment shall be constructed such that while performing routine maintenance (such as insect removal, changing a lamp or lamp starter, or similar activities), the equipment will remain intact except for an enclosure part(s) that must be removed to perform the maintenance.