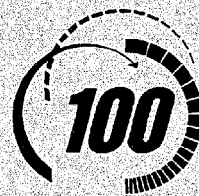


Standard for Safety

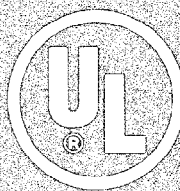
UL 1559

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Insect-Control Equipment- Electrocution Type



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July 31, 1995

Standard for

Insect-Control Equipment – Electrocuting Type

UL 1559, Third Edition

Accompanying this transmittal notice is a copy of the Third edition of UL 1559.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

As indicated on the title page, 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 ANSI/UL 1559-1995.

Attention is directed to the note on the title page of this standard identifying that the Department of Defense has adopted the text of UL 1559.

Revised and/or additional pages may be issued from time to time.

JULY 31, 1995



1

UL 1559

Standard for

**Insect-Control Equipment –
Electrocution Type**

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

Third Edition

July 31, 1995

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated July 31, 1995. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI/UL 1559-1987, April 3, 1987
Approved as ANSI/UL 1559-1995, February 13, 1995

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.

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 published set of revision pages.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

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.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this Standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Standard cannot be judged to comply with this Standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

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 the like.

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 the like 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 need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed 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 recognized rating established for the intended conditions of use.

3.4 Specific components are recognized as being 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 for which they have been recognized.

4 Units of Measurement

4.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

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 94V-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 the like) 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 need not 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 I of Standard Specification for the General Requirements for Sheet Steel Zinc-Coated (Galvanized) by Hot-Dip Process, ASTM A525-83, 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 I of Standard Specification of the General Requirements for Sheet Steel Zinc-Coated (Galvanized) by Hot-Dip Process, ASTM A525-83, 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 need not 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 Methods for Weight of Coating on Zinc-Coating (Galvanized) Iron or Steel Articles, ASTM A90-81.

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:

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

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

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
	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
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.

Figure 10.1
Accessibility probe for primary circuit parts

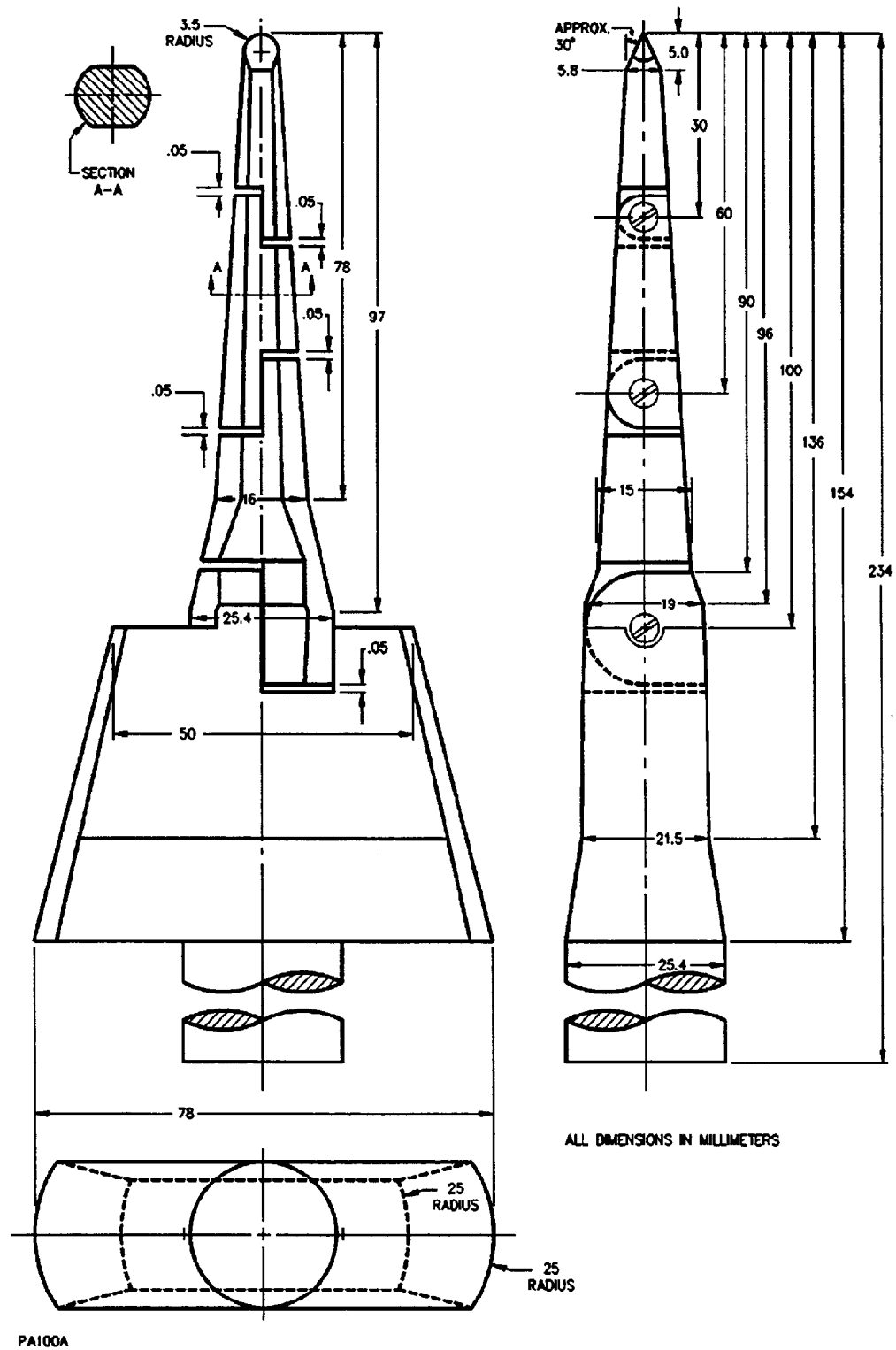
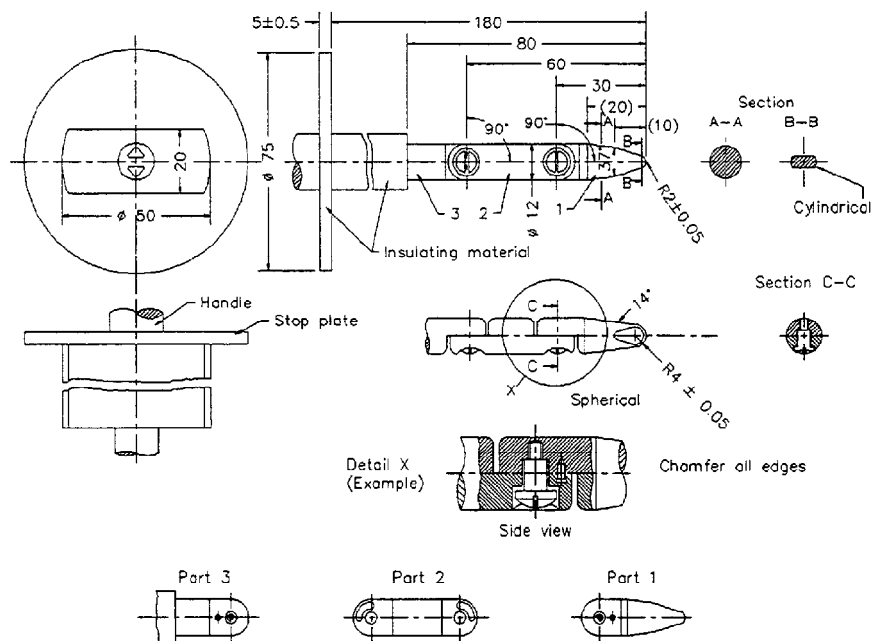


Figure 10.2
Accessibility probe for secondary circuit parts

International Electrotechnical Commission (IEC)
Articulate accessibility probe with stop plate

(All dimensions in millimeters)
Courtesy of IEC



SA1788A

mm	2	4	10	12	20	30
(inches)	(5/64)	(3/32)	(25/64)	(15/32)	(25/32)	(1-5/64)
50	60	75	80	180		
(1-61/64)	(2-23/64)	(2-61/64)	(3-9/64)	(7-3/32)		

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 the like), the equipment will remain intact except for an enclosure part(s) that must be removed to perform the maintenance.

11.3 A part that must be removed during user servicing is to be removed when determining the accessibility of live parts that involve a risk of electric shock.

11.4 An interlock device provided to reduce the risk of electric shock shall be constructed so that it cannot be unintentionally activated to energize the equipment during servicing.

11.5 The interlock device described in 11.4 shall be constructed and installed so as to be reliable, substantial and not easily defeated by improper disassembly or reassembly of the equipment.

11.6 A seal relied upon to preclude rain from entering the enclosure of insect-electrocution equipment intended for outdoor use shall not be adversely affected by opening the enclosure during user servicing. See 35.5.

12 Protection Against Injury to Persons

12.1 An edge, projection, or corner of an enclosure, opening, frame, guard, knob, handle, or the like of insect-electrocution equipment shall be smooth and well-rounded and not sufficiently sharp to cause a cut-type injury when contacted during intended use or user maintenance.

12.2 If the sharpness of an edge is questionable, the requirements for the determination of sharpness of edges on equipment, UL 1439 are to be used.

13 Supply Connections

13.1 General

13.1.1 Insect-electrocution equipment intended for permanent securement to the building structure shall be provided with a means for permanent connection to the branch-circuit supply.