

UL 73

ISBN 1-55989-273-0

Motor-Operated Appliances

Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety
for
Motor-Operated Appliances, UL 73

Eighth Edition, Dated April 16, 1993

Revisions: This Standard contains revisions through and including November 9, 1998.

A change is indicated by a note following the affected item. The note is preceded and followed by an asterisk.

The revisions dated November 9, 1998 include a reprinted title page (page 1) for this Standard.

The revisions dated November 9, 1998 were issued to make editorial changes.

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 (page 1), this UL Standard for Safety has been adopted by the Department of Defense.

The master for this Standard at UL's Northbrook Office is the official document insofar as it relates to a UL service and the compliance of a product with respect to the requirements for that product and service, or if there are questions regarding the accuracy of this Standard.

UL's Standards for Safety are copyrighted by UL. Neither a printed copy of a Standard, nor the distribution diskette for a Standard-on-Diskette and the file for the Standard on the distribution diskette should be altered in any way. All of UL's Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

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 UL.

Revisions of UL Standards for Safety are issued from time to time. A UL Standard for Safety is current only if it incorporates the most recently adopted revisions.

UL 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 UL 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 UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

UL will attempt to answer support requests concerning WordPerfect, Envoy, and Standards-on-Diskette. However, this support service is offered on a reasonable efforts basis only, and UL may not be able to resolve every support request. UL supports a Standards-on-Diskette only if it is used under the conditions and operating systems for which it is intended. UL's support policies may change from time-to-time without notification.

UL reserves the right to change the format, presentation, file types and formats, delivery methods and formats, and the like of both its printed and electronic Standards without prior notice.

Standards-on-Diskette purchasers agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgement (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing a Standard-on-Diskette on the purchaser's computer system.

If a single-user version Standards-on-Diskette was purchased, one copy of this Standard may be stored on the hard disk of a single personal computer, or on a single LAN file-server or the permanent storage device of a multiple-user computer in such a manner that this Standard may only be accessed by one user at a time and for which there is no possibility of multiple concurrent access. The original distribution diskette should be stored in a safe place.

If a multiple-user version Standards-on-Diskette was purchased, one copy of the Standard may be stored on a single LAN file-server, or on the permanent storage device of a multiple-user computer. The number of concurrent users shall not exceed the number of users authorized for the Standards-on-Diskette version. The original distribution diskette should be stored in a safe place.

Standards-on-Diskette are intended for on-line use, such as for viewing the requirements of a Standard, conducting a word search, and the like. Only one copy of the Standard may be printed from each single-user version of a Standards-on-Diskette. Only one copy of the Standard may be printed for each authorized user of a multiple-user version of a Standards-on-Diskette. An employee of an organization purchasing a Standard-on-Diskette can make a copy of the page or pages being viewed for their own fair and/or practical internal use. Because of differences in the computer/software/printer setup used by UL and those of Standards-on-Diskette purchasers, the printed copy obtained by a purchaser may not look exactly like the on-line screen view or the printed Standard.

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

Copyright 1998 Underwriters Laboratories Inc.

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

Page	Date
tr1 – tr4	November 9, 1998
1	April 16, 1993 (Reprinted: November 9, 1998)
2	July 2, 1998
3	January 18, 1996
4	April 16, 1993
5	November 9, 1998
6	April 19, 1993
7, 8	April 16, 1993
9, 10	July 2, 1998
11 – 15	April 16, 1993
16, 17	July 2, 1998
18	April 19, 1993
18A, 18B	July 2, 1998
19 – 22	April 16, 1993
23, 24, 24A, 24B	April 19, 1993
25	January 18, 1996
26	April 16, 1993
27, 28	November 9, 1998
29	April 16, 1993
30 – 32	April 19, 1993
33 – 38	April 16, 1993
39	January 18, 1996
40	April 16, 1993
41, 42	July 2, 1998
43 – 47	April 16, 1993
48, 48A, 48B	January 18, 1996
49 – 56	April 16, 1993
57 – 60	April 19, 1993
A1, A2	July 2, 1998

No Text on This Page

APRIL 16, 1993

(Title Page Reprinted: November 9, 1998)



1

UL 73

Standard for

Motor-Operated Appliances

First Edition – April, 1937
Second Edition – April, 1958
Third Edition – December, 1960
Fourth Edition – February, 1967
Fifth Edition – January, 1972
Sixth Edition – August, 1978
Seventh Edition – September, 1986

Eighth Edition

April 16, 1993

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated April 16, 1993 and January 18, 1996. 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 C33.36-1972, January 20, 1972
Approved as ANSI/UL 73-1980, March 14, 1980
Approved as ANSI/UL 73-1985, April 19, 1985
Approved as ANSI/UL 73-1992, March 20, 1992
Approved as ANSI/UL 73-1998, July 16, 1998

The Department of Defense (DoD) has adopted UL 73 on May 11, 1976. 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 set of revised requirements.

ISBN 1-55989-273-0

COPYRIGHT © 1978, 1998 UNDERWRITERS LABORATORIES INC.

CONTENTS

FOREWORD

INTRODUCTION

1 Scope	5
2 Glossary	5
3 Components	6
4 Units of Measurement	6
5 References	6

CONSTRUCTION

6 General	6
7 Frame and Enclosure	6
8 Adhesives Used to Secure Parts	10
9 Mechanical Assembly	10
10 Protection Against Corrosion	11
11 Accessibility of Uninsulated Live Parts and Film-Coated Wire	12
12 Supply Connections	17
13 Current-Carrying Parts	22
14 Insulating Material	22
15 Internal Wiring	23
16 Separation of Circuits	24
17 Capacitors	24A
18 Grounding	25
19 Heating Elements	26
20 Lampholders	27
21 Motors	27
22 Overload- or Thermal-Protective Devices	29
23 Receptacles	30
24 Switches and Controls	30
25 Spacings	31

PROTECTION AGAINST INJURY TO PERSONS

26 General	33
27 Sharp Edges	33
28 Enclosures and Guards	33
29 Materials	35
30 Rotating or Moving Members	35
31 Parts Subject to Pressure	35
32 Pressure-Relief Devices	36
33 Switches, Controls, and Interlocks	37
34 Specific Appliances	38
35 Stability	38
36 Marking	39

PERFORMANCE

37 Leakage Current Test	40
38 Leakage Current Test Following Humidity Conditioning	42
39 Starting Current Test	42
40 Input Test	42
41 Temperature Tests	43
42 Surface Temperature Tests	48
43 Dielectric Voltage-Withstand Test	48A
44 Continuous Operation Test	49
45 Resistance-to-Moisture Test	50
46 Tests on Switches and Controls	50
47 Strain-Relief Test	51
48 Abnormal Operation Test	51
49 Radiation Test	51
50 Ozone Test	51
51 Operational Test	52
52 Permanence of Marking Test	52

MANUFACTURING AND PRODUCTION TESTS

53 Dielectric Voltage-Withstand Test	53
54 Grounding Continuity Test	54

RATING

55 Details	54
------------------	----

MARKING

56 Details	55
------------------	----

PROTECTION FROM CONTAMINATION

57 Scope	58
58 Construction	58
59 Performance	59
60 Marking	59

APPENDIX A

Standards for Components	A1
--------------------------------	----

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 motor-operated appliances to be employed in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover small utilization appliances, such as vibrators in which motion of an operating part is produced by electrical means.

1.3 These requirements do not cover appliances rated more than 600 volts; nor do they cover appliances involving universal motors rated more than 250 volts.

1.4 These requirements do not cover equipment intended particularly for the control of electric motors; separator motors; nor electric clocks, fans, clothes dryers, washing machines, hair dryers, tools, waste disposers, dishwashers, office appliances and business equipment, refrigerators, air conditioners, vending and amusement machines, hair clippers and shavers, snow movers, automotive and garage equipment, or other motor-operated appliances that are covered by individual requirements.

1.4 revised July 2, 1998

1.5 An appliance that utilizes some other source of energy, such as gas or steam, in addition to electric energy will be investigated under these requirements and under such additional requirements as are applicable to the appliance under consideration.

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

1.6 revised November 9, 1998

2 Glossary

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

2.2 AUTOMATICALLY CONTROLLED APPLIANCE – An appliance is considered to be automatically controlled if:

- a) The repeated starting of the appliance, beyond one complete predetermined cycle of operation to the point where some form of limit switch opens the circuit, is independent of any manual control;
- b) During any single predetermined cycle of operation, the motor is caused to stop and restart one or more times;
- c) Upon energizing the appliance, the initial starting of the motor may be intentionally delayed beyond normal, conventional starting; or
- d) During any single predetermined cycle of operation, automatic changing of the mechanical load may reduce the motor speed sufficiently to reestablish starting-winding connections to the supply circuit.

2.3 LINE-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

2.4 LOW-VOLTAGE CIRCUIT – A circuit involving a peak open-circuit potential of not more than 42.4 volts supplied by a primary battery, by a Class 2 transformer, or by a combination of a transformer and a fixed impedance that as a unit, complies with all performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting a resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low voltage circuit.

2.5 REMOTELY CONTROLLED APPLIANCE – An appliance that is out of sight of the operator who is at the starting device.

3 Components

3.1 Except as indicated in 3.2, a component of an appliance 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 appliances 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 appliance 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.

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.

5.1 effective April 19, 1993

CONSTRUCTION

6 General

6.1 An appliance shall employ materials that are acceptable for the application.

7 Frame and Enclosure

7.1 An appliance shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without increasing the 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.

7.2 For unreinforced, flat surfaces in general, cast metal shall not be less than 1/8 inch (3.2 mm) thick, except that malleable iron may be not less than 3/32 inch (2.4 mm) and die cast metal may be not less than 5/64 inch (2.0 mm) thick. Corresponding thicknesses of not less than 3/32, 1/16 (1.6 mm), and 3/64 inch (1.2 mm), respectively, may be acceptable if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape or size, or both, of the surface is such that the necessary mechanical strength is provided.

7.3 An enclosure of sheet metal shall be judged with respect to its size, shape, thickness of metal, and its application, considering the intended use of the complete appliance. The use of sheet steel having a thickness of less than 0.026 inch (0.66 mm) if uncoated or 0.029 inch (0.74 mm) if galvanized or of nonferrous sheet metal having a thickness of less than 0.036 inch (0.91 mm) is not recommended, except for relatively small areas or for surfaces that are curved or otherwise reinforced.

7.4 Sheet metal to which a wiring system is to be connected in the field shall have a thickness not less than 0.032 inch (0.81 mm) if uncoated steel, not less than 0.034 inch (0.86 mm) if galvanized steel, and not less than 0.045 inch (1.14 mm) if nonferrous.

7.5 Among the factors that shall be taken into consideration when judging a nonmetallic enclosure or an enclosure of magnesium are resistance to:

- a) Mechanical damage,
- b) Impact,
- c) Moisture-absorption,
- d) Combustion, and
- e) Distortion at temperatures to which the material may be subjected under conditions of normal or abnormal use.

7.6 The enclosure of a remotely or automatically controlled appliance shall reduce the risk of molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including the surface upon which the appliance is supported.

7.7 The requirement in 7.6 will necessitate that a switch, a relay, a solenoid, or the like be individually and completely enclosed, except for terminals, unless it can be shown that malfunction of the component would not result in a risk of fire, or there are no openings in the bottom of the appliance enclosure. It will also necessitate the use of a barrier of noncombustible material:

- a) Under a motor unless:
 - 1) The structural parts of the motor or of the appliance provide the equivalent of such a barrier;
 - 2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the appliance when the motor is energized under each of the following fault conditions:
 - i) Open main winding;
 - ii) Open starting winding;
 - iii) Starting switch short-circuited; and

iv) Capacitor of permanent-split capacitor motor short-circuited – the short circuit is to be applied before the motor is energized, and the rotor is to be locked;

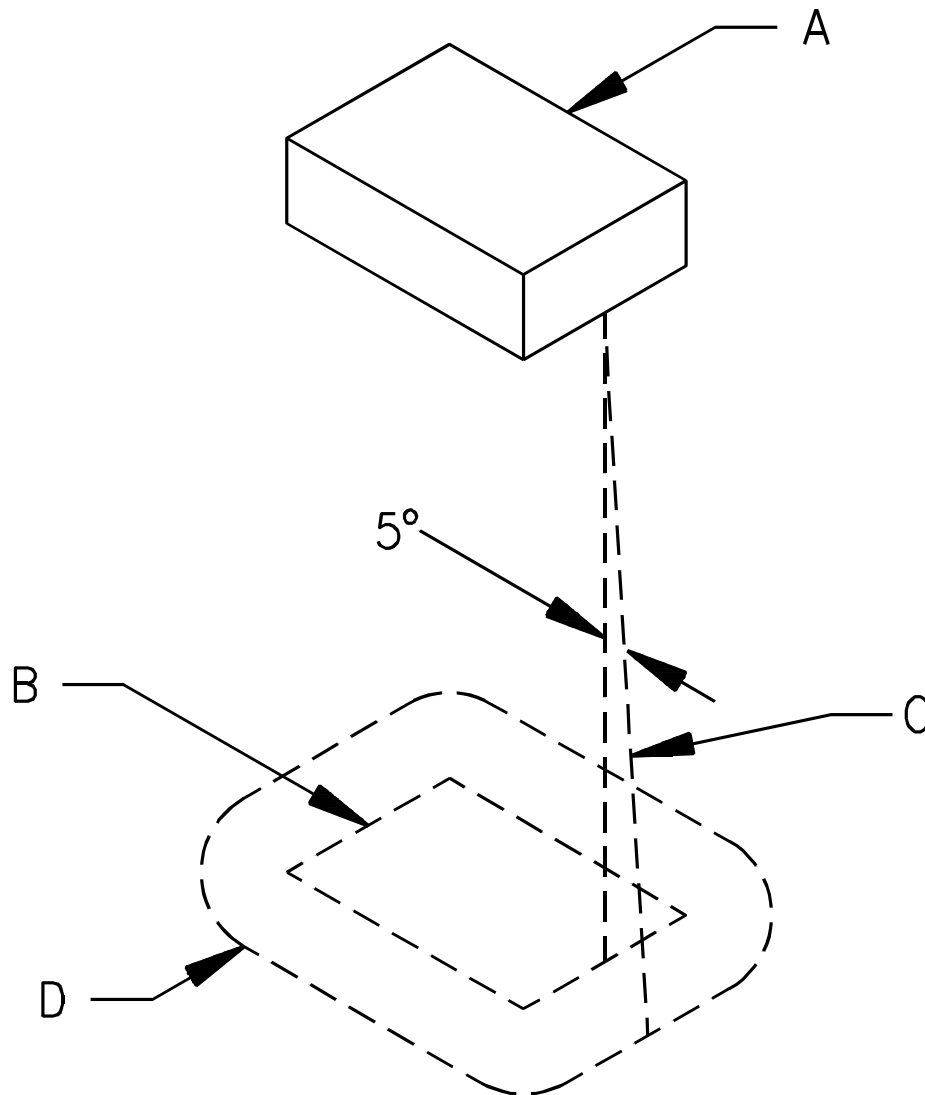
3) The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that will reduce the risk of the temperature of the motor windings from exceeding 125EC (257EF) under the maximum load under which the motor will run without causing the protector to cycle and from exceeding 150EC (302EF) with the rotor of the motor locked; or

4) The motor complies with the requirements in the Standard for Overheating Protection for Motors, UL 2111, and the temperature of the motor winding will not exceed 150EC during the first 72 hours of operation with the rotor of the motor locked.

b) Under wiring, unless it is neoprene, cross-linked polyethylene, or thermoplastic insulated.

7.8 The barrier mentioned in 7.7 shall be horizontal, shall be located as illustrated in Figure 7.1, and shall not have an area less than that described in that illustration. Openings for drainage, ventilation, and the like may be employed in the barrier, provided such openings would not permit molten metal, burning insulation, or the like to fall on combustible material.

Figure 7.1
Location and extent of barrier



SA0604-1

NOTES –

A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded and will consist of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. The line is always (1) tangent to the component, (2) 5 degrees from the vertical, and (3) oriented so that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

Figure 7.1 revised July 2, 1998

7.9 The enclosure of a gum massager or toothbrush shall be such as to reduce the risk of water from contacting uninsulated live parts when the appliance is tested as described in 45.1.1 – 45.1.3 as applicable.

7.10 A door or a cover of an enclosure that provides access to any overload protective device that requires resetting or renewal shall be hinged or otherwise attached in an equivalent manner.

7.11 Means shall be provided for holding the door or cover over a fuseholder in a closed position, and the door or cover shall be tight-fitting.

7.12 A cord-connected appliance that is provided with keyhole slots, notches, hanger holes, or the like, for hanging on a wall shall be constructed in such a manner that the hanging means is not accessible without removing the appliance from the supporting means.

7.13 To determine whether a product complies with the requirement in 7.12, any part of the enclosure or barrier that can be removed without the use of tools to gain access to the hanging means is to be removed.

7.14 An opening in the appliance provided for hanging shall be located or guarded so that a nail, hook, or the like does not displace a part that would create a risk of fire or electric shock, and does not contact one of the following:

- a) An uninsulated live part.
- b) Magnet wire.
- c) Internal wiring.
- d) Moving parts.
- e) Any other part likely to create a risk of fire or electric shock.

8 Adhesives Used to Secure Parts

8.1 An adhesive that is relied upon to reduce a risk of fire, electric shock, or injury to persons shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

8.2 The requirement in 8.1 also applies to an adhesive used to secure a conductive part, including a nameplate, that may, if loosened or dislodged:

- a) Energize an accessible dead metal part,
- b) Make a live part accessible,
- c) Reduce spacings below the minimum acceptable values, or
- d) Short-circuit live parts.

8.3 Whether the conditions mentioned in 8.2(a) – (d) can occur is to be considered with respect to both:

- a) A part inside the device, and
- b) A part on the outside of the device that may affect equipment in which the device is to be installed.

9 Mechanical Assembly

9.1 An appliance shall be assembled so that it will not be adversely affected by the vibration of normal operation. Brush caps shall be tightly threaded or otherwise constructed to reduce the risk of loosening.

9.2 A switch other than a through-cord switch, a lampholder, an attachment-plug receptacle, a motor-attachment plug, or similar component shall be securely mounted and shall be prevented from turning. See 9.4.

Exception No. 1: A switch need not be prevented from turning provided:

- a) The switch is of a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch during normal operation of the switch;*
- b) The means for mounting the switch makes it unlikely that operation of the switch will loosen it;*
- c) The spacings are not reduced below the minimum required values if the switch rotates; and*
- d) The normal operation of the switch is by mechanical means rather than by direct contact by persons.*

Exception No. 2: A lampholder of the type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning if rotation cannot reduce spacings below the minimum required values.

9.3 Uninsulated live parts shall be secured to the base or mounting surface so that they will be prevented from turning or shifting in position, if such motion may result in a reduction of spacings below the minimum acceptable values.

9.4 The means for preventing the turning or shifting mentioned in 9.2 and 9.3 is to consist of more than friction between surfaces – for example, a properly applied lock washer is acceptable as the means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

10 Protection Against Corrosion

10.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, if corrosion of such unprotected parts would be likely to result in a risk of fire, electric shock, or injury to persons.

Exception No. 1: Surfaces of sheet-steel and cast-iron parts within an enclosure may not be required to be protected against corrosion if the oxidation of the metal due to the exposure to air and moisture is not likely to be appreciable. The thickness of metal and temperature are also to be considered.

Exception No. 2: This requirement does not apply to bearings, laminations, or minor parts of iron or steel, such as washers, screws, and the like.

10.2 If deterioration of a liquid container provided as a part of an appliance would result in a risk of fire or electric shock, the container shall be of a material that is resistant to corrosion by the liquid intended to be used therein.

11 Accessibility of Uninsulated Live Parts and Film-Coated Wire

11.1 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part or film-coated wire, an opening in an enclosure shall comply with either item (a) or (b).

- a) For an opening that has a minor dimension (see 11.5) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 11.1.
- b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 11.1.

Exception: A motor other than one used in either a hand-held appliance or a hand-supported portion of an appliance need not comply with these requirements if it complies with the requirements in 11.2.

Figure 11.1
Articulate probe with web stop

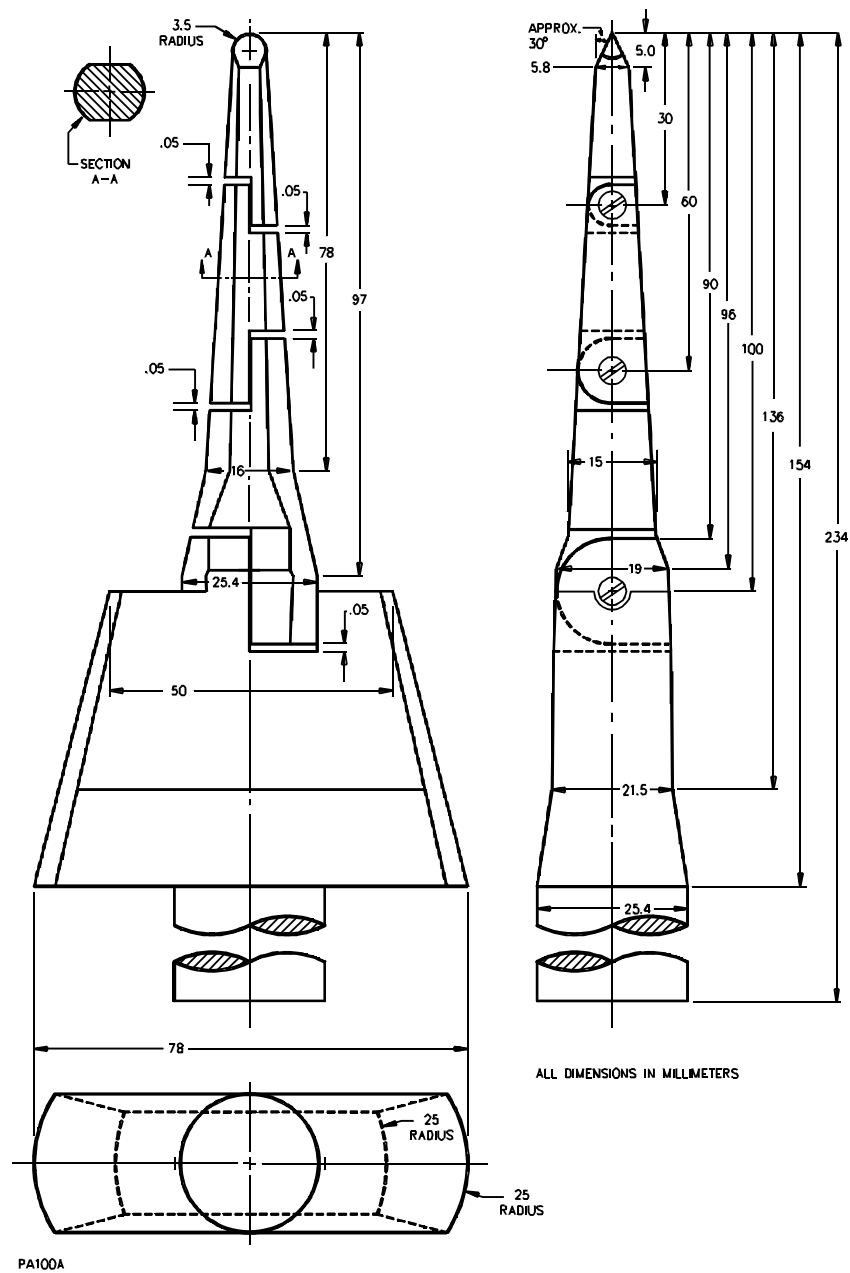


Table 11.1
Minimum acceptable distance from an opening to a part that
may involve a risk of electric shock

Minimum dimension ^a of opening, inches (mm) ^b		Minimum distance from opening to part, inches (mm) ^b	
3/4 ^c	(19.1)	4-1/2	(114)
1 ^c	(25.4)	6-1/2	(165)
1-1/4	(31.8)	7-1/2	(190)
1-1/2	(38.1)	12-1/2	(318)
1-7/8	(47.6)	15-1/2	(394)
2-1/8	(54.0)	17-1/2	(444)
d		30	(762)
^a See 11.5. ^b Between 3/4 and 2-1/8 inches, interpolation is to be used to determine a value between values specified in the table. ^c Any dimension less than 1 inch applies to a motor only. ^d More than 2-1/8 inches, but not more than 6 inches (152 mm).			

11.2 With respect to a part or wire as mentioned in 11.1, in an integral enclosure of a motor as mentioned in the exception to 11.1:

- a) An opening that has a minor dimension (see 11.5) less than 3/4 inch (19.1 mm) is acceptable if:
- 1) Film-coated wire cannot be contacted by the probe illustrated in Figure 11.3;
 - 2) In a directly accessible motor (see 11.6), an uninsulated live part cannot be contacted by the probe illustrated in Figure 11.4; and
 - 3) In an indirectly accessible motor (see 11.6), an uninsulated live part cannot be contacted by the probe illustrated in Figure 11.2.
- b) An opening that has a minor dimension of 3/4 inch or more is acceptable if a part or wire is spaced from the opening as specified in Table 11.1.

11.3 The probes mentioned in 11.1 and 11.2 and illustrated in Figures 11.1 – 11.4 shall be applied to any depth that the opening will permit, and shall be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure. The probe illustrated in Figures 11.1 and 11.4 shall be applied in any possible configuration; and, if necessary, the configuration shall be changed after insertion through the opening.

11.4 The probes mentioned in 11.3 and 11.5 shall be used as measuring instruments to judge the accessibility provided by an opening, and not as instruments to judge the strength of a material; they shall be applied with the minimum force necessary to determine accessibility.

Figure 11.2
Straight probe

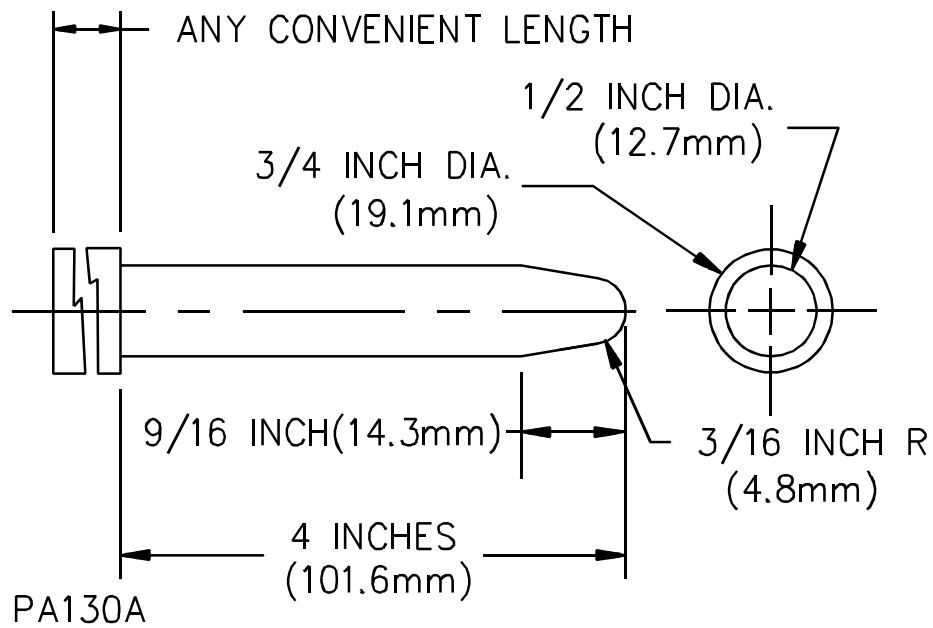


Figure 11.3
Straight probe

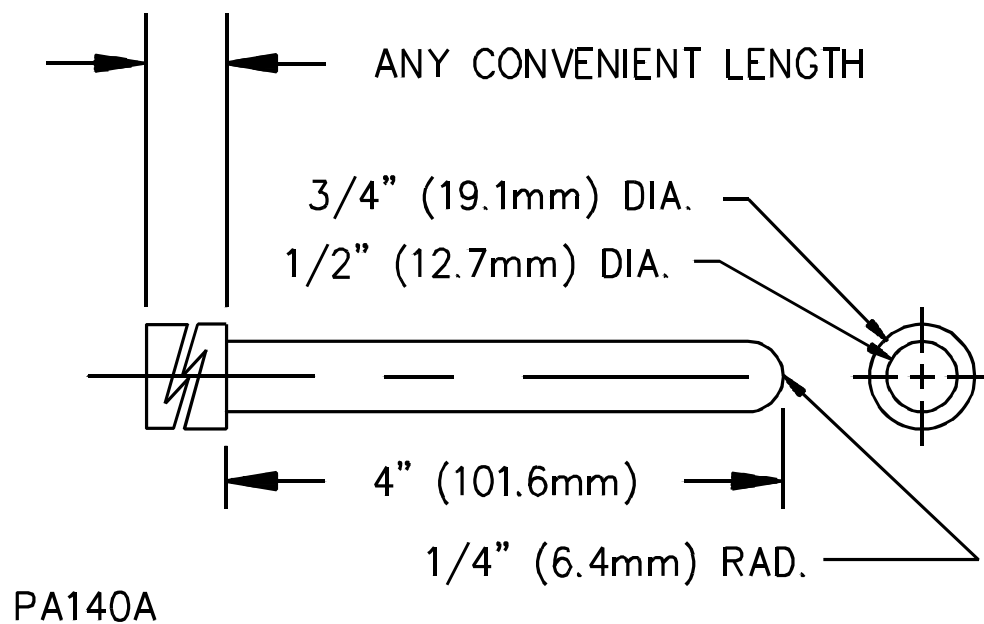


Figure 11.4
International Electrotechnical Commission (IEC)
Articulate accessibility probe with stop plate
All dimensions in millimeters
Courtesy of IEC

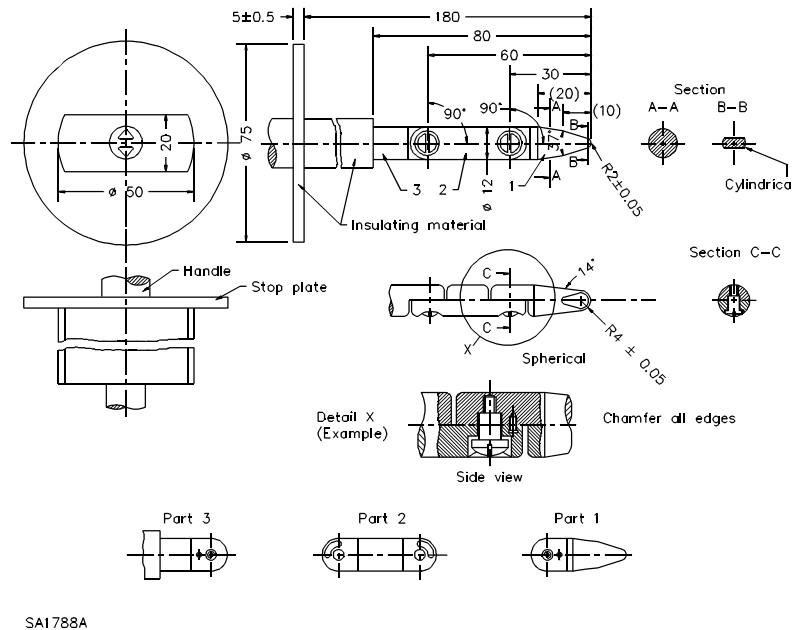


Figure 11.4 revised July 2, 1998

11.5 With reference to the requirements in 11.1 and 11.2, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.

11.6 With reference to the requirements in 11.2, an indirectly accessible motor is a motor that is accessible only by opening or removing a part of the outer enclosure, such as a guard or panel, than can be opened or removed without using a tool, or that is located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted. A directly accessible motor is a motor that can be contacted without opening or removing any part or that is located so as to be accessible to contact.

11.7 During the examination of an appliance to determine whether it complies with the requirements in 11.1 or 11.2, a part of the enclosure that may be opened or removed by the user without a tool (to attach an accessory, to make an operating adjustment, or for other reasons) is to be opened or removed.

11.8 With reference to the requirements in 11.1 and 11.2, insulated brush caps are not required to be additionally enclosed.

12 Supply Connections

12.1 Cord-Connected Appliances

12.1.1 Carbonators

12.1.1.1 A carbonator that is connected to the electrical supply by a flexible cord shall comply with the following:

- a) All waterline connections shall be by means of flexible hose or equivalent;
- b) The flexible cord shall be of Type SJT or of a Type equally servicable, shall not be longer than 10 feet (3.05 m), and shall have a grounding conductor and a grounding type attachment plug; and
- c) In addition to complying with the other applicable requirements in the standard, the wiring compartment shall be constructed and the cord attached so a permanent connection is able to be made to the power supply. The construction shall comply with the following conditions:
 - 1) The cord shall enter the wiring compartment through a 7/8-inch (22.2-mm) diameter hole that, after the cord and any bushing or fitting provided have been removed, provides an opening for attachment of a wiring system that is intended for the appliance; and
 - 2) The power-supply cord is connected to the internal wiring by a device such as a terminal block, pressure cable connector, or a similar device, that accommodates permanent wiring having an ampacity rated for the appliance, and that complies with 12.2.2 – 12.2.4.

12.1.1.1 revised July 2, 1998

12.1.2 Cords and plugs

12.1.2.1 An appliance intended to be connected to the power-supply circuit by means of a flexible cord shall be provided with a flexible cord and an attachment plug for connection to the supply circuit.

12.1.2.2 The attachment plug of an appliance intended to be connected to a nominal 120 volt circuit, and employing devices required to be connected to a specific supply conductor as specified in 20.2, 23.2, and 24.3 shall be a polarized type. The connections to the attachment plug shall be in accordance with Figure 12.1. The polarity identification of the supply cord shall be in accordance with Table 12.1A. See 56.3.3.

12.1.2.2 revised July 2, 1998

12.1.2.3 An appliance that is required to employ a polarized attachment plug as specified in 12.1.2.1, and that is provided with a separate or detachable cord set as specified in Exception No. 1 of 12.1.2.7 and 12.1.2.9 shall also employ an appliance connector of the polarized type.

12.1.2.3 effective June 3, 1993