



UL 961

STANDARD FOR SAFETY

Electric Hobby and Sports Equipment

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UL Standard for Safety for Electric Hobby and Sports Equipment, UL 961

Fifth Edition, Dated December 5, 2014

Summary of Topics

This new edition UL 961, the Standard for Electric Hobby and Sports Equipment, incorporates editorial and organizational revisions.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated September 19, 2014.

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December 5, 2014



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1

UL 961

Standard for Electric Hobby and Sports Equipment

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Fifth Edition

December 5, 2014

This ANSI/UL Standard for Safety consists of the Fifth Edition.

The most recent designation of ANSI/UL 961 as an American National Standard (ANSI) occurred on December 5, 2014. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

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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CONTENTS

INTRODUCTION

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

CONSTRUCTION

6 Enclosure	6
7 Accessibility of Parts	7
8 Mechanical Assembly	13
9 Protection Against Corrosion	14
10 Power-Supply Connections – Cord-Connected Products	14
10.1 Cords and plugs	14
10.2 Strain relief	15
10.3 Bushings	16
11 Power-Supply Connections – Permanently-Connected Products	17
11.1 General	17
11.2 Field-wiring compartments	17
11.3 Field-wiring terminals and leads	17
11.4 Grounded connections	18
11.5 Equipment-grounding	18
12 Grounding	19
13 Current-Carrying Parts	21
14 Internal Wiring	21
14.1 General	21
14.2 Wires	22
15 Insulating Materials	23
15.1 Electrical insulation	23
15.2 Thermal insulation	23
16 Motors	23
16.1 General	23
16.2 Overload protection	23
16.3 Brush-holder assembly	25
17 Overcurrent Protection	25
18 Switches and Controls	25
19 Lampholders	26
20 Capacitors	26
21 Secondary Circuits	26
22 Spacings	27
23 Batteries and Battery Chargers	29
24 Attachments	29
25 Sharp Edges and Corners	30
26 Enclosures and Guards	30
27 Switches, Controls, and Interlocks	31

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PERFORMANCE

28	General	32
29	Leakage Current Test	33
30	Humidity Conditioning	36
31	Starting Current Test	36
32	Input Test	37
33	Temperature Test	37
34	Dielectric Voltage-Withstand Test	42
35	Continuity of Ground Connection Test	43
36	Resistance to Moisture Test	43
37	Rain Test	44
38	Abnormal Operation Test	47
39	Strain Relief Test	47
40	Push-Back Relief Test	48
41	Switches and Controls	48
41.1	Controls for solenoids, relay coils, or the like	48
41.2	Controls for motors	49
42	Materials	49
43	Rotating or Moving Parts	50
44	Parts Subject to Pressure	50
45	Pressure-Relief Devices	51
46	Stability Test	52
47	Impact Test	53
48	Strength of Handles Test	55

MANUFACTURING AND PRODUCTION TESTS

49	Grounding Continuity Test	55
50	Dielectric Voltage-Withstand Test	56
51	Leakage Test	58

RATINGS

52	General	58
----	---------	----

MARKINGS

53	Permanence	58
54	Identification	58
55	Fuses	59
56	Switches and Controls	59
57	Power-Supply Cord	59
58	Cautionary Markings	59

INSTRUCTIONS

59	Manufacturer's Literature	60
----	---------------------------	----

APPENDIX A

Standards for Components	A1
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INTRODUCTION

1 Scope

1.1 These requirements cover electrically-powered hobby and sports equipment rated 250 volts or less for use in ordinary locations in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements cover equipment intended for the home entertainment and amusement of adults.

1.3 These requirements do not cover toys and games intended to be used by children, amusement machines, photographic equipment, or other products that are covered by separate requirements.

1.4 In the following text, a requirement that does not apply to all of the types of products covered by this standard is identified by a specific reference in that requirement to the type or types of product involved. Absence of such specific reference or use of the term product indicates that the requirement applies to all types of products unless the context indicates otherwise.

2 Components

2.1 Except as indicated in 2.2, 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 used in the products covered by this standard.

2.2 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.

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

2.4 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.

3 Units of Measurement

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

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

4 Undated References

4.1 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 Glossary

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

5.2 LINE-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 250 volts and having circuit characteristics in excess of those of a low-voltage circuit.

5.3 LOW-VOLTAGE CIRCUIT – A circuit involving a peak open-circuit potential of not more than 42.4 volts supplied by:

- a) A primary battery;
- b) A Class 2 transformer; or
- c) 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 a low-voltage circuit.

CONSTRUCTION

6 Enclosure

6.1 A product shall have the strength and rigidity necessary to resist the abuses to which it may be subjected, without increasing the risk of fire, electric shock, or injury to persons due to total or partial collapse of the enclosure and resulting reduction of spacing, loosening or displacement of a part, or other malfunction.

6.2 Among the factors taken into consideration when an enclosure is evaluated are its:

- a) Mechanical strength;
- b) Resistance to impact;
- c) Resistance to corrosion;
- d) Resistance to distortion at temperatures to which the enclosure may be subjected under conditions of normal or abnormal use; and

- e) Dielectric properties, insulation resistance, and resistance to arc tracking.

6.3 Cast- and sheet-metal portions of the enclosure shall not be thinner than the applicable value specified in Table 6.1 unless the enclosure is determined to be acceptable when evaluated under the considerations specified in 6.2.

Table 6.1
Thickness of metal enclosure

Metal	Minimum thickness			
	At small, flat unreinforced surfaces and at surfaces that are reinforced by curving, ribbing, and the like		At relatively large unreinforced flat surfaces	
	inch	(mm)	inch	(mm)
Die-cast metal	3/64	(1.2)	5/64	(2.0)
Cast malleable iron	1/16	(1.6)	3/32	(2.4)
Other cast metal	3/32	(2.4)	1/8	(3.2)
Uncoated sheet steel	0.026	(0.66)	0.026	(0.66)
Galvanized sheet steel	0.029	(0.74)	0.029	(0.74)
Nonferrous sheet metal	0.036	(0.91)	0.036	(0.91)

6.4 A nonmetallic enclosure shall comply with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

7 Accessibility of Parts

7.1 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from uninsulated live parts and film-coated wire and contact that may involve a risk of injury to persons from a moving part, an opening in an enclosure of a product or in a motor shall be investigated as described in (a) or (b).

- a) For an opening that has a minor dimension (see 7.4) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 7.1.
- b) For an opening that has a minor dimension of 1 inch or more:
 - 1) A moving part shall be spaced from the opening as specified in Table 7.1, and
 - 2) Neither an uninsulated live part nor film-coated wire shall be within:
 - i) X inches of the perimeter of the opening; or
 - ii) The volume generated by projecting the perimeter X inches normal to its plane. X equals five times the minor dimension of the opening, but not less than 6-1/16 inches (154 mm) – see Figure 7.2.

Exception No. 1: A motor other than one used in either a hand-held product or a hand-supported portion of a product need not comply with these requirements if it complies with the requirements in 7.2.

Exception No. 2: An opening necessary for intended operation of a product need not comply with this requirement.

7.2 With reference to the requirements in 7.1, in the enclosure of a motor:

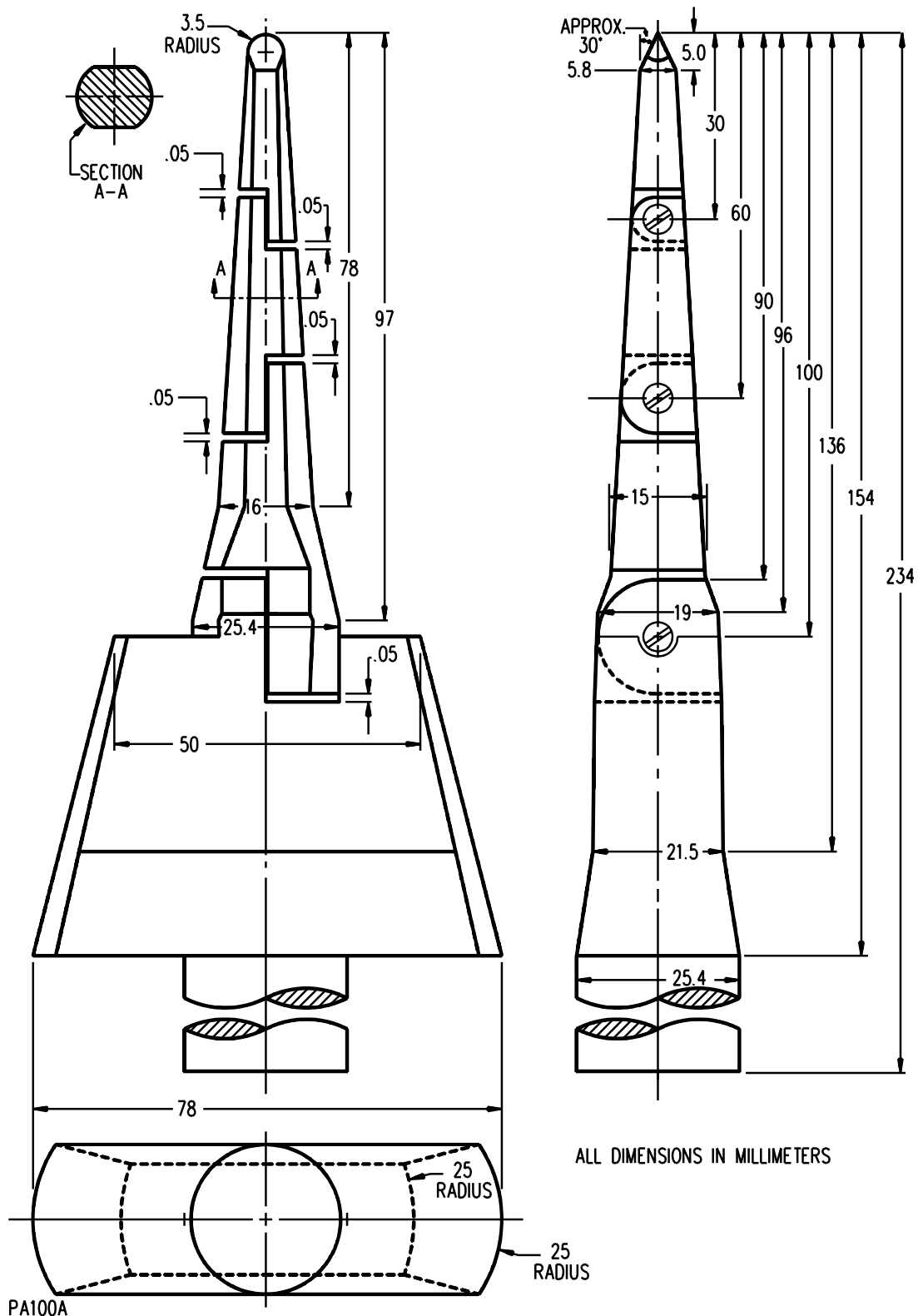
a) An opening that has a minor dimension (see 7.4) less than 3/4 inch (19.1 mm) is acceptable if:

- 1) A moving part cannot be contacted by the probe illustrated in Figure 7.3;
- 2) Film-coated wire cannot be contacted by the probe illustrated in Figure 7.4;
- 3) In a directly accessible motor, an uninsulated live part cannot be contacted by the probe illustrated in Figure 7.5; and
- 4) In an indirectly accessible motor (see 7.5), an uninsulated live part cannot be contacted by the probe illustrated in Figure 7.3.

b) An opening that has a minor dimension of 3/4 inch or more is acceptable if:

- 1) A moving part is spaced from the opening as specified in Table 7.1; and
- 2) An uninsulated live part or film-coated wire is not within:
 - i) X inches of the perimeter of the opening; or
 - ii) The volume generated by projecting the perimeter X inches normal to its plane (see Figure 7.2). X equals five times the minor dimension of the opening, but not less than 3-5/32 inches (80 mm) for contact with an uninsulated live part through an opening in the enclosure of a directly accessible motor, and 4 inches (102 mm) for all other openings.

Figure 7.1
Articulate probe with web stop



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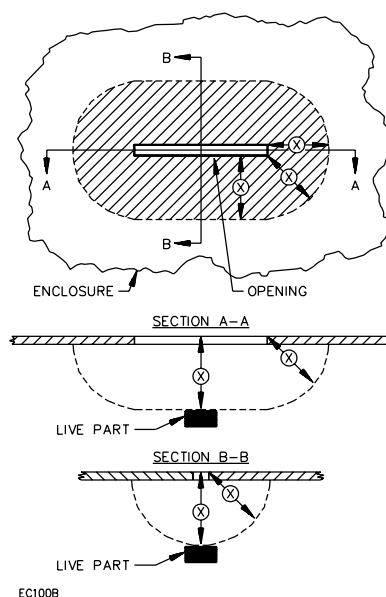
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Table 7.1
Minimum distance from an opening to a moving part that may involve a risk of injury to persons

Minor dimension of opening		Minimum distance from opening to part	
inches	(mm)	inches	(mm)
3/4	(19.1)	4-1/2	(114)
1	(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)
c	(c)	30	(762)

^a See 5.2.
^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 More than 2-1/8 inches, but not more than 6 inches (152 mm).

Figure 7.2
Opening in enclosure



(Proportions exaggerated for clarity)

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Figure 7.3
Probe for moving parts and uninsulated live parts

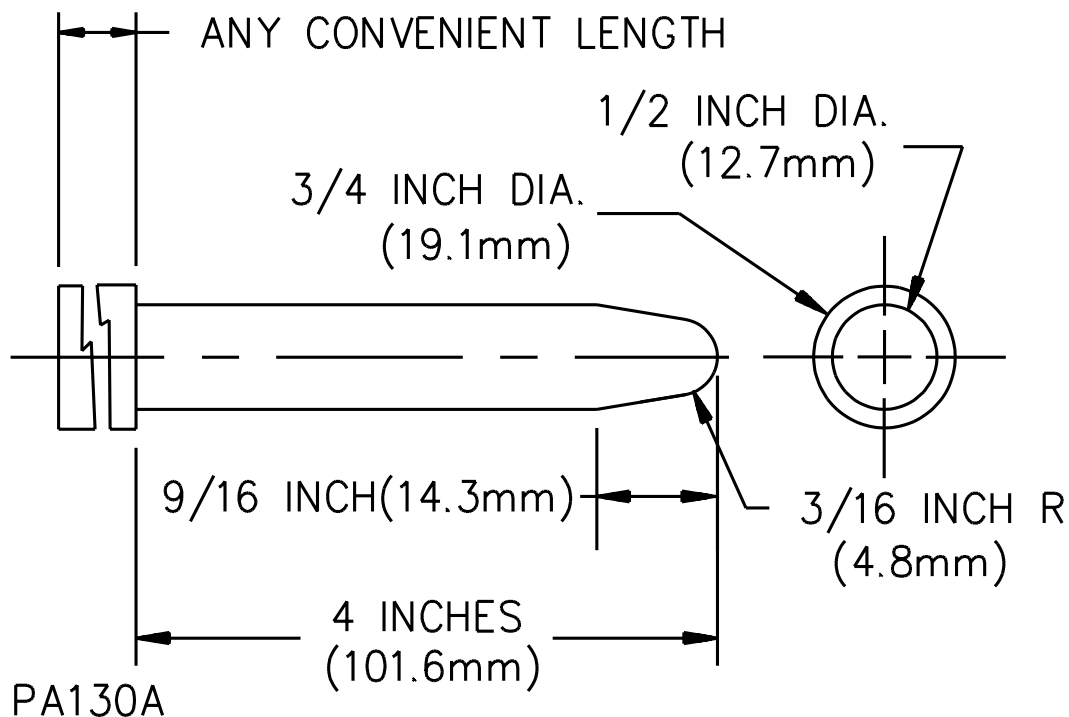
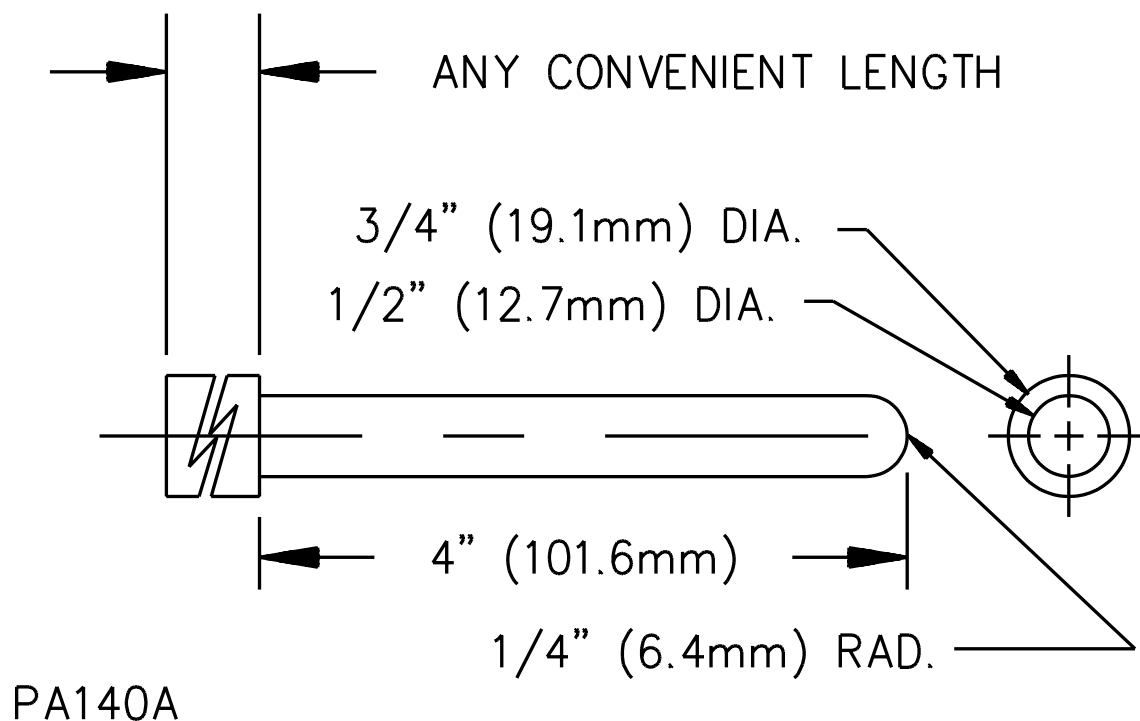


Figure 7.4
Probe for film-coated wire



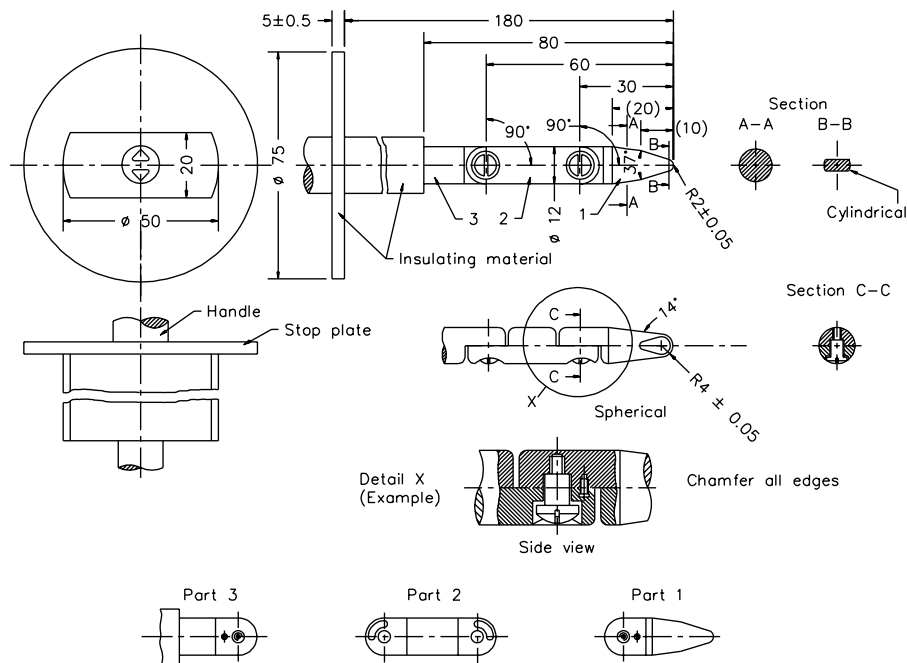
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Figure 7.5
IEC articulate probe



SA1788A

7.3 The probes specified in 7.1 and 7.2 and illustrated in Figures 7.1 and 7.3 – 7.5 are to be applied to any depth that the opening will permit and with a force not greater than 1 pound (4.4 N); and are to be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the product or motor. The probes illustrated in Figures 7.1 and 7.5 are to be applied in any possible configuration; and, if necessary, the configuration is to be changed after insertion through the opening.

7.4 With reference to the requirements in 7.1 and 7.2, 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 perpendicular to the plane of the opening with a force not greater than 5 pounds (22.2 N).

7.5 With reference to the requirements in 7.2, an indirectly accessible motor is a motor that is:

- a) Accessible only by removing a part of the outer enclosure of a product, such as a guard or panel, that can be removed without using a tool; or
- b) Located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted.

7.6 During the examination of a product to determine whether it complies with the requirements in 7.1 and 7.2, a part of the enclosure that may be removed by the user without using a tool – to attach an accessory, make an operating adjustment, or for other reasons – is to be disregarded.

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7.7 With reference to the requirements in 7.1 and 7.2, insulated brush caps are not required to be additionally enclosed.

8 Mechanical Assembly

8.1 A product shall be assembled so that it will not be adversely affected by the vibration of intended operation. A brush cap shall be threaded or shall be provided with other means to reduce the likelihood of loosening.

8.2 A switch other than a through-cord switch, a lampholder, an attachment-plug receptacle, a motor-attachment plug, or similar component shall be mounted securely and shall be prevented from turning. See 8.3 for specifications.

Exception No. 1: A means need not be provided to prevent a switch from turning if all four of the following conditions are met:

- 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 operation of the switch.*
- b) The method of mounting is such that operation of the switch will not loosen the switch.*
- c) The spacings are not reduced below the minimum acceptable values if the switch rotates.*
- d) The 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, may turn if rotation cannot reduce spacings below the acceptable values.

8.3 The means for preventing the turning specified in 8.2 shall consist of more than friction between surfaces. For example, a lock washer may be used as the means for preventing a small, stem-mounted switch, or other device having a single-hold mounting means, from turning.

8.4 An uninsulated live part shall be secured to the base or mounting surface so that it will be prevented from turning or shifting in position if such motion may result in a reduction of spacings below the minimum required values.

8.5 Friction between surfaces is not to be used to prevent shifting or turning of live parts, but a lock washer applied as intended may be used.

9 Protection Against Corrosion

9.1 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: If oxidation due to the exposure of the metal to air and moisture is not likely to be appreciable – thickness of metal and temperature also being factors – surfaces of sheet-steel and cast-iron parts within an enclosure may not be required to be protected against corrosion.

Exception No. 2: Bearings, laminations, or minor parts of iron or steel, such as washers, screws, and the like, need not be protected against corrosion.

10 Power-Supply Connections – Cord-Connected Products

10.1 Cords and plugs

10.1.1 Other than as noted in 10.1.2, a cord-connected product shall be provided with 6 – 10 feet (1.8 – 3.0 m) of flexible cord and an attachment plug for connection to the power-supply circuit.

10.1.2 A cord-connected product may be provided with not more than 18 inches (457 mm) of permanently attached flexible cord or with a connector base motor-attachment plug if:

- a) Use of the product is such that it is necessary to connect it by means of an extension cord during intended operation; the manufacturer makes extension cords available; and a statement indicating the availability of such extension cords is marked on the product or is included in an instruction book or the like that is furnished with the product; or
- b) The manufacturer furnishes a detachable cord set, 6 feet (1.8 m) long or more, with the product.

10.1.3 If a product employs a detachable cord set, the arrangement shall be such that live parts will not be exposed under any conditions encountered in intended use of the product.

10.1.4 The flexible cord shall have a voltage rating not less than the rated voltage of the product, and shall have an ampacity not less than the current rating of the product.

10.1.5 Other than as noted in 10.1.6, the flexible cord provided with a product shall be Type SP-2, SPE-2, or SPT-2, or a type determined to be equivalent.

Exception: Type SPT-1 cord may be used for a household golf practice putter.

10.1.6 A flexible power-supply cord provided with a product intended for outdoor use shall be Type SEW, STW, STOW, SJW, SJEW, SJOW, SJTW, SJTOW, or SW.

10.1.7 The attachment plug shall have an ampacity not less than the rated current at the rated voltage of the product.

10.1.8 The circuit conductors in the flexible cord shall be connected to the attachment plug and to the wiring in the product so that any of the following devices used in the line-voltage circuit are connected to the ungrounded side of the line:

- a) The center contact of an Edison-base lampholder;
- b) A fuseholder; and
- c) Any other overcurrent-protective device or single-pole switch other than an automatic control without a marked-off position.

10.1.9 The attachment plug for a double-insulated appliance as specified in the Exception of 12.1 shall be of a two-blade type. If a double-insulated appliance incorporates a single-pole switch that disconnects the appliance from the branch circuit, and the appliance includes an Edison-base lampholder or a 15- or 20-ampere rated convenience receptacle, the attachment plug shall also be of the polarized type and comply with the Standard for Attachment Plugs and Receptacles, UL 498.

10.2 Strain relief

10.2.1 Strain relief shall be provided so that mechanical stress placed on a flexible cord is not transmitted to a terminal, splice, or interior wiring. See Strain Relief Test, Section 39.

10.2.2 Means shall be provided so that the flexible cord cannot be pushed into the product through the cord-entry hole if such displacement may subject the cord to mechanical damage or to exposure to a temperature higher than that for which the cord is intended, or may reduce spacings, such as to a metal strain-relief clamp, below the minimum required values. See Figure 40.1 for the specific test method. To determine compliance, the supply cord or lead shall be tested in accordance with Section 40, Push-Back Relief Test.

10.2.3 If a metal strain-relief clamp or band is used with Type SP-2 cord, auxiliary insulation shall be provided over the cord for mechanical protection.

10.2.4 Unless investigated and determined to be acceptable for the purpose, a clamp of any material – metal or otherwise – is not to be used with Type SPT-1, SPT-2, SVT, or SVTO cord, except that, if the cord is protected by varnished-cloth tubing or the equivalent under the clamp, the construction may be acceptable. For heavier types of thermoplastic-insulated cord, a clamp may be used and the auxiliary insulation is not required unless the clamp may damage the cord insulation.

10.2.5 If a knot in a flexible cord serves as strain relief, the surfaces that the knot may touch shall be free from burrs, fins, sharp edges, and projections that can damage the cord.

10.3 Bushings

10.3.1 At a point where a flexible cord passes through an opening in a wall, barrier, or enclosing case, there shall be a bushing or the equivalent which shall be secured in place, and shall have a smooth, rounded surface against which the cord may bear. An insulating bushing shall be provided if:

- a) Type SPT-1, SP-2, or SPT-2 cord is employed;
- b) The wall or barrier is of metal; or
- c) The construction is such that the cord may be subjected to strain or motion.

10.3.2 If the cord hole is in wood, porcelain, phenolic composition, or other similar nonconducting material, a smooth, rounded surface is considered to be equivalent to a bushing.

10.3.3 An insulated metal grommet may be used instead of an insulating bushing if the insulating material used is not less than 1/32 inch (0.8 mm) thick and completely fills the space between the grommet and the metal in which it is mounted.

10.3.4 Ceramic materials and some molded compositions may be used for insulating bushing; but separate bushings of wood or of hot-molded, shellac-and-tar compositions shall not be used.

10.3.5 A bushing of vulcanized fiber at least 3/64 inch (1.2 mm) thick may be used if formed and secured in place so that it will not be adversely affected by conditions of moisture encountered in the intended use of the product.

10.3.6 A bushing made of the same material as – and molded integrally with – the supply cord may be used on a Type SP-1 or heavier cord if the built-up section is at least 1/16 inch (1.6 mm) thick at the point where the cord passes through the enclosure.

10.3.7 A separate soft-rubber, neoprene, or polyvinyl chloride bushing may be employed in the frame of a motor or in the enclosure of a capacitor attached to a motor – but not elsewhere in the product – if the bushing is:

- a) Not less than 3/64 inch (1.2 mm) thick; and
- b) Located so that it will not be exposed to oil, grease, oily vapor, or other substances having a deleterious effect on its material.

Exception: A bushing made of any of the materials specified above may be employed at any point in a product if used with a type of cord for which an insulating bushing is not required and the edges of the hole in which the bushing is mounted are smooth and free from burrs, fins, and the like.

11 Power-Supply Connections – Permanently-Connected Products

11.1 General

11.1.1 A product intended for permanent connection to the power-supply circuit shall have provision for connection of one of the wiring systems that is intended for the product.

11.2 Field-wiring compartments

11.2.1 A field-wiring compartment in which power-supply connections are to be made shall be located so that these connections may be readily inspected after the product has been installed as intended.

11.2.2 A field-wiring compartment intended for connection of a supply raceway shall be attached to the product so that it cannot turn.

11.2.3 An outlet box, terminal box, wiring compartment, or the like, in which connections to the supply circuit will be made in the field, shall be free from any sharp edge, including screw threads, a burr, a fin, a moving part, or the like, that could damage the insulation on a conductor.

11.3 Field-wiring terminals and leads

11.3.1 A field-wiring terminal is considered to be a terminal to which a wire may be connected in the field, unless the wire and a means of making the connection, such as a pressure wire connector, soldering lugs, soldered loop, crimped eyelet, and the like, factory-assembled to the wire, are provided as a part of the product.

11.3.2 A permanently-connected product shall be provided with wiring terminals for the connection of conductors having an ampacity acceptable for the product, or the product shall be provided with leads for such connection.

11.3.3 A wiring terminal shall be provided with a soldering lug or pressure terminal connector fastened in place – for example, bolted or held by a screw.

Exception: A wire-binding screw may be employed at a wiring terminal intended to accommodate a 10 AWG (5.3 mm²) or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in position.

11.3.4 A wiring terminal shall be prevented from turning by means other than friction between surfaces.

11.3.5 The free length of a lead inside an outlet box or wiring compartment shall be 6 inches (152 mm) or more if the lead is intended for field connection to an external circuit.

Exception: Leads of field-wiring supply connections enclosed in a motor terminal box or motor wiring compartment may be less than 6 inches long.

11.3.6 A wire-binding screw at a wiring terminal shall not be smaller than No. 10.

Exception: A No. 8 screw may be used at a terminal intended only for the connection of a 14 AWG (2.1 mm²) conductor.