

# UL 1081

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## Swimming Pool Pumps, Filters, and Chlorinators

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UL Standard for Safety for Swimming Pool Pumps, Filters, and Chlorinators, UL 1081

Fifth Edition, Dated March 19, 1997

Revisions: This Standard contains revisions through and including May 10, 2006.

### Summary of Topics

***These revisions are being issued to revise the requirements for grounding and equipotential bonding of double insulated pumps in Section 11, the gasket requirements in Section 20 to reference UL 157 requirements in place of the present gasket aging test in Section 40, and the frame and enclosure requirements in Section 4 to include an exception allowing the lowest live part to be less than 4 inches above the supporting surface when tested in accordance with UL 778. Titles of Standards in Appendix A have also been updated.***

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The new and/or revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated November 16, 2005 and March 22, 2006.

The revisions dated May 10, 2006 include a reprinted title page (page1) for this Standard.

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## INTRODUCTION

### 1 Scope

1.1 These requirements apply to motor-operated water pumps of the nonsubmersible type, pump-filter combinations, and chlorinators for use with swimming pools, hot tubs, and spas, to be used in accordance with the National Electrical Code, NFPA 70.

1.2 Swimming pool pumps, pump-filter combinations, and chlorinators covered by these requirements may be permanently connected or cord- and plug-connected to the electrical supply. Permanently-connected units may be covered for indoor use only or for indoor and outdoor use. Cord- and plug-connected units are evaluated under requirements for outdoor use, but may also be used indoors. Swimming pool pumps intended for use with storable pools are provided with a minimum 25-foot (7.6-m) nondetachable power supply cord, are double insulated, have no accessible grounded metal, and have inaccessible dead metal connected to the grounding conductor of the cord. Pumps intended for permanent use may be permanently wired or provided with a maximum 3-foot (0.91-m) nondetachable power supply cord and, in addition, are provided with an accessible wire connector for bonding to all metal parts of the pool, hot tub, or spa structure and to all electrical equipment conduit and piping within 5 feet (1.5 m) of the inside wall of the pool, hot tub, or spa. Hot tub and spa pumps covered by these requirements are not intended for use within an outer enclosure or beneath the skirt of a hot tub or spa, unless so marked.

1.3 Chlorinators covered by these requirements may consist of assemblies such as:

- a) A chlorinator and a clock-operated valve for use with a water circulating system;
- b) A pump with chlorine injection; or
- c) An electrolytic-type chlorinating equipment.

1.4 These requirements do not cover:

- a) Pumping equipment for fire service or other products that are covered by individual requirements elsewhere;
- b) A pump rated at more than 600 volts;
- c) A pump rated at more than 5 horsepower;
- d) A pump involving a universal motor rated at more than 250 volts: or
- e) A sump pump, fountain pump, and aquarium pump, or other products for which individual requirements exist.

1.5 Deleted October 24, 2001

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## 2 General

### 2.1 Components

2.1.1 Except as indicated in 2.1.2, 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.

2.1.1 revised October 24, 2001

2.1.2 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.

2.1.2 revised October 24, 2001

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

2.1.3 revised October 24, 2001

2.1.4 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.

2.1.4 revised October 24, 2001

### 2.2 Units of measurement

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

2.2.1 revised October 24, 2001

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

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## 2.3 Undated references

2.3.1 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.

## 3 Glossary

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

3.2 BASIC INSULATION (formerly FUNCTIONAL INSULATION) – The insulation applied to live parts to provide basic protection against electric shock. Basic insulation does not necessarily include insulation used exclusively for functional purposes.

3.3 CORD- AND PLUG-CONNECTED UNIT – A unit provided with flexible cord and an attachment plug for connection to the supply source.

3.4 DOUBLE INSULATION – An insulation system comprised of basic insulation and supplementary insulation, with the two insulations physically separated and arranged so that they are not simultaneously subjected to the same deteriorating influences (temperature, contaminants, or the like) to the same degree.

3.5 INDOOR UNIT – A unit investigated for use only where protected from the weather.

3.6 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 or limited-energy circuit.

3.7 OUTDOOR UNIT – A unit that has been investigated and determined to be acceptable for use where exposed to weather.

3.8 PERMANENTLY-CONNECTED UNIT – A unit intended to be fastened or secured in position or permanently connected to a water circulating system.

3.9 PERMANENTLY-INSTALLED POOL – A pool constructed wholly or partially in the ground, any pool capable of holding water in a depth greater than 42 inches (1.07 m), or any pool installed inside of a building (regardless of water depth), whether or not served by electrical circuits of any nature.

3.9 revised October 24, 2001

3.10 PERMANENTLY-WIRED UNIT – A unit provided with wiring terminals or leads for the connection of power supply conductors. A permanently wired unit has provision for connection of one of the wiring systems in accordance with the National Electrical Code, ANSI/NFPA 70.

3.11 STORABLE POOL – A pool constructed on or above the ground, capable of holding water to a maximum depth of 42 inches (1.07 m), and constructed so that it may be readily disassembled for storage and reassembled to its original integrity, or a pool with nonmetallic molded polymeric walls or inflatable fabric walls, regardless of dimensions.

3.11 revised October 24, 2001

3.12 SUPPLEMENTARY (PROTECTING) INSULATION – An independent insulation provided in addition to the basic insulation to reduce the risk of electric shock in case of mechanical rupture or dielectric breakdown of the basic insulation. An enclosure of insulating material may form a part or the whole of the supplementary insulation.

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3.13 UNIT – A pump, a pump-filter combination, or a chlorinator.

## CONSTRUCTION

### 4 Frame and Enclosure

4.1 An appliance shall be provided with an enclosure housing all electrical parts that present a risk of fire, electric shock, or injury to persons under all conditions of use.

4.2 The frame and enclosure of an appliance shall possess the strength and rigidity to resist the abuses to be encountered during service. The degree of resistance inherent in the unit shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other serious defects that alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

4.3 The enclosure of a unit for outdoor use, when of sheet metal, shall have a thickness of not less than 0.032 inch (0.81 mm) when uncoated or of not less than 0.034 inch (0.86 mm) when galvanized.

4.4 An enclosure of sheet metal, other than that covered in 4.3, is evaluated with regard to its size, shape, and thickness, considering the intended use of the complete unit. Sheet steel shall have a thickness of not less than 0.026 inch (0.66 mm) when uncoated, or 0.029 inch (0.74 mm) when galvanized. Nonferrous sheet metal shall have a thickness of not less than 0.036 inch (0.91 mm).

*Exception: Relatively small areas or surfaces that are curved or otherwise reinforced are not prohibited from being thinner than specified.*

4.5 An enclosure of cast metal shall not be less than 1/8 inch (3.2 mm) thick at every point, more than 1/8 inch thick at reinforcing ribs and door edges, and not less than 1/4 inch (6.4 mm) thick at tapped holes for conduit.

*Exception: Other than at holes for conduit, die-cast metal shall not be less than:*

*a) 3/32 inch (2.4 mm) thick for an area larger than 24 square inches (155 cm<sup>2</sup>) or having any dimension larger than 6 inches (152 mm) or*

*b) 1/16 inch (1.6 mm) thick for an area of 24 square inches or less and having no dimension larger than 6 inches. This area limitation is capable of being obtained by the provision of reinforcing ribs subdividing a larger area.*

4.6 An enclosure of polymeric material shall be investigated with regard to operating temperatures, stress-relief distortion, impact resistance, resistance to abnormal conditions, and flame resistance, both in the original formed condition and after aging in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. Such enclosures for outdoor equipment shall also be investigated with regard to resistance to ultraviolet light and water in accordance with the Resistance to Ultraviolet Light and Water Test, Section 38.

4.7 An enclosure shall be constructed to restrict water from reducing the effectiveness of the electrical insulation due to breakdown of water connections or shaft seals, flooding onto a mounting surface or within the enclosure, or breakdown of a boot, diaphragm, shaft seal, or similar part, as determined in 37.2.1 – 37.4.2.

4.8 An enclosure of an outdoor unit containing an electrical component, other than for a motor having a sealed housing, shall have provision for drainage if there is a knockout or unthreaded opening in the enclosure or if there is likelihood of the accumulation of condensation.

4.9 The enclosure of an outdoor portable unit shall be such that the lowest portion of any live part is at least 4 inches (101.6 mm) above the supporting surface. When a separate base is to be used in the field to provide the minimum 4-inch height, the portable unit shall be marked in accordance with 51.1.17 and provided with installation instructions as specified in 53.4.

*Exception: Units complying with the requirements for submersible pumps as specified in the Standard for Motor-Operated Water Pumps, UL 778. Testing shall include, but not be limited to, 30-Day Submersion (under 4 inches of water).*

4.9 revised May 10, 2006

4.10 A unit intended for permanent connection shall be provided with means for mounting or support. Fittings required for intended mounting, such as brackets, hangers, or the like, shall be furnished with the unit.

4.11 The enclosure shall restrict molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including the surface upon which the unit is supported.

*Exception: A permanently-connected unit not intended for mounting on a combustible surface is not prohibited from having an open bottom when it is marked in accordance with 51.1.5.*

4.12 The requirement in 4.11 requires that a switch, transformer, relay, solenoid, or similar part be individually and completely enclosed other than at terminals unless it can be shown that malfunction of the component does not result in a risk of fire, or unless there are no openings in the bottom of the

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enclosure. There shall be no opening in the bottom of the enclosure located directly below field- or factory-made splices or overcurrent protective devices. The requirement in 4.11 also requires the use of a barrier of combustion-resistant material under:

a) A motor, unless:

- 1) The structural parts of the motor or of the overall unit 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 unit when the motor is energized under each of the following four fault conditions, applied separately:
  - i) Main winding opened,
  - ii) Starting winding opened,
  - iii) Starting switch short-circuited, and
  - iv) For a permanent-split-capacitor motor, the capacitor short-circuited (the short circuit is to be applied before the motor is energized and the rotor is locked); or
- 3) The motor is provided with a thermal motor protector (a protective device that is sensitive to both temperature and current) that limits the temperature of the motor windings to not more than 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle, and from becoming more than 150°C (302°F) with the rotor of the motor locked.

b) Wiring, unless it is of the flame-retardant type. Neoprene- or PVC-, TFE-, PTFE-, FEP-insulated wires and wires bearing the surface marking "VW-1" are considered to be of this type.

4.13 The barrier specified in 4.12 shall be horizontal, located as indicated in Figure 4.1, and possess an area not less than that described in the figure. Openings for drainage and ventilation are not prohibited from being used in the barrier, when such openings prevent molten metal, burning insulation, or the like from falling on combustible material.

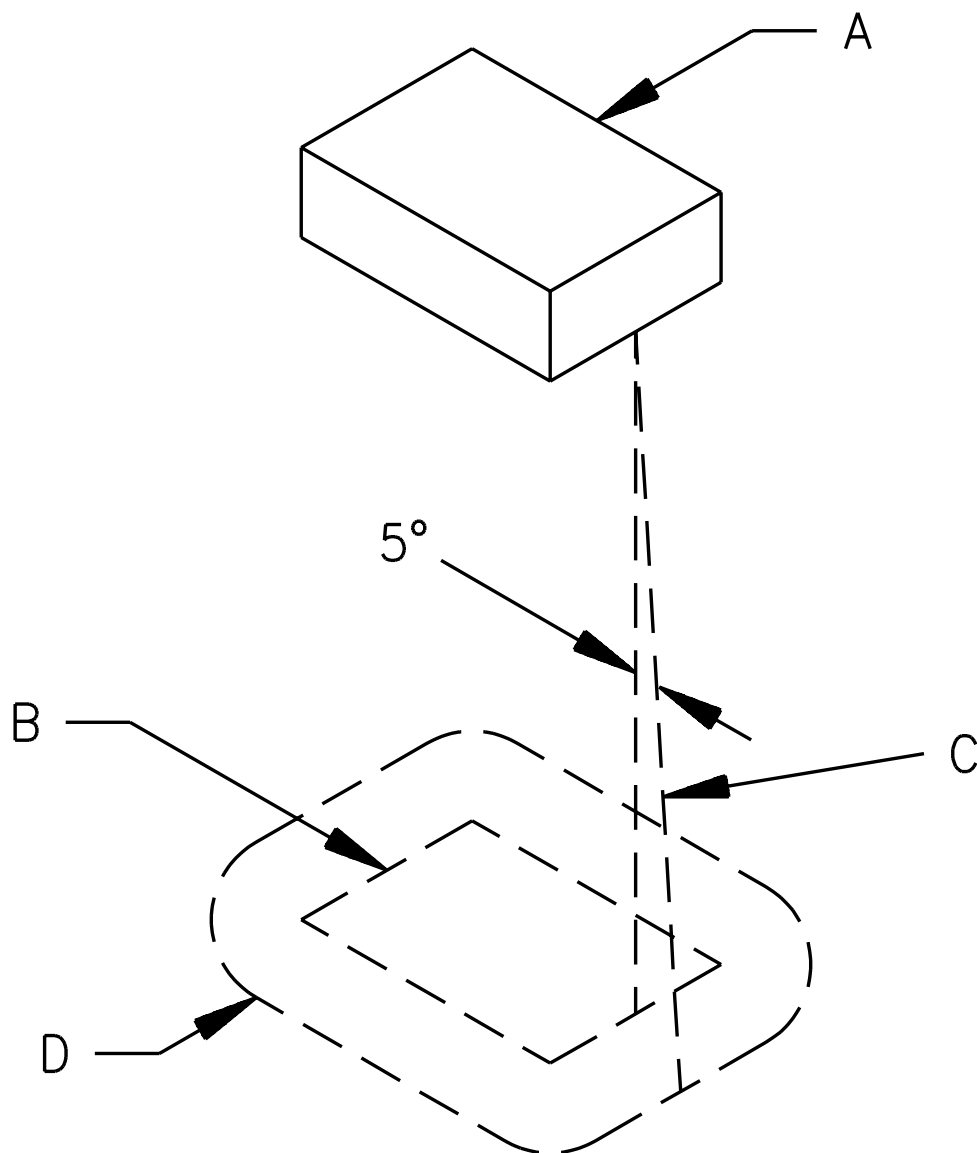
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**Figure 4.1**  
**Location and extent of barrier**



EB120A

- A – Region to be shielded by barrier. This consists of the entire component (unless otherwise shielded) and 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. When moving, the line is always tangent to the component, 5 degrees from the vertical, and 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.

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## 5 Mechanical Assembly

5.1 A unit shall be assembled so that it is not adversely affected by the vibration of intended operation. Brush caps shall be tightly threaded or otherwise constructed to reduce the risk of loosening.

5.2 A switch, a lampholder, an attachment plug receptacle, a motor attachment plug, or similar component shall be mounted securely and shall be restricted from turning.

*Exception No. 1: A switch is not required to be restricted from turning when all four of the following conditions are met:*

- a) The switch is to be 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 intended operation of the switch);*
- b) Means of mounting the switch make it unlikely that operation of the switch loosens it;*
- c) The spacings are not reduced below the minimum required values when the switch rotates; and*
- d) Operation of the switch is to be by mechanical means rather than by contact by persons.*

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*Exception No. 2: A lampholder of a type in which the lamp is incapable of being replaced (such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel) is not required to be restricted from turning when rotation does not reduce spacings below the minimum required values or adversely affect water resistance of outdoor units.*

5.3 The means for restricting the turning specified in 5.2 is to consist of more than friction between surfaces – for example, a lock washer is to be used as means for restricting a small stem-mounted switch or other device having a single hole mounting means from turning.

5.4 An uninsulated live part shall be secured to the base or mounting surface so that it is restricted from turning or shifting in position when such motion results in a reduction of spacings below the minimum required values specified in Spacings, Section 18.

5.5 A part of polymeric material that is used to support a motor shall comply with the Creep Test, Section 46.

5.6 Tin-lead solder shall not be used for the fastening of seams or the assembly of parts.

5.7 Metal into which screws are threaded shall provide for the engagement of at least two full threads. Fastenings such as rivets, screws, bolts, or equivalent means in a sheet-metal enclosure shall have a diameter at least 50 percent greater than the thickness of the finished sheet metal with which they are used.

## 6 Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts

6.1 To reduce the risk of unintentional contact that involves a risk of electric shock from an uninsulated live part or film-coated wire, or injury to persons from a moving part, an opening in an enclosure shall comply with either (a) or (b):

- a) For an opening that has a minor dimension (see 6.5) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 6.1.
- 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 6.1.

*Exception: A motor that complies with the requirements in 6.2 is not required to comply with these requirements.*

6.2 With regard to a part or wire as specified in 6.1, in an integral enclosure of a motor as specified in the Exception to 6.1:

- a) An opening that has a minor dimension (see 6.5) less than 3/4 inch (19.1 mm) complies with the requirements when:
  - 1) A moving part is incapable of being contacted by the probe illustrated in Figure 6.2;
  - 2) Film-coated wire is incapable of being contacted by the probe illustrated in Figure 6.3;
  - 3) In a directly accessible motor (see 6.6), an uninsulated live part is incapable of being contacted by the probe illustrated in Figure 6.4; and

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4) In an indirectly accessible motor (see 6.6), an uninsulated live part is incapable of being contacted by the probe illustrated in Figure 6.2.

b) An opening that has a minor dimension of 3/4 inch or more complies with this requirement when a part or wire is spaced from the opening as specified in Table 6.1.

6.3 The probes specified in 6.1 and 6.2 and illustrated in Figures 6.1 – 6.4 shall be applied to any depth that the opening permits; and shall be rotated or angled before, during, and after insertion through the opening to any position that is required to examine the enclosure. The probe illustrated in Figures 6.1 and 6.4 shall be applied in any possible configuration; and, when required, the configuration shall be changed after insertion through the opening.

6.4 The probes specified in 6.2 and 6.3 shall be used as measuring instruments to determine the accessibility provided by an opening, and not as instruments to determine the strength of a material; they shall be applied with the minimum force required to determine accessibility.

6.5 With reference to the requirements in 6.1 and 6.2, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that is capable of being inserted through the opening.

6.6 With reference to the requirements in 6.2, an indirectly accessible motor is a motor that is:

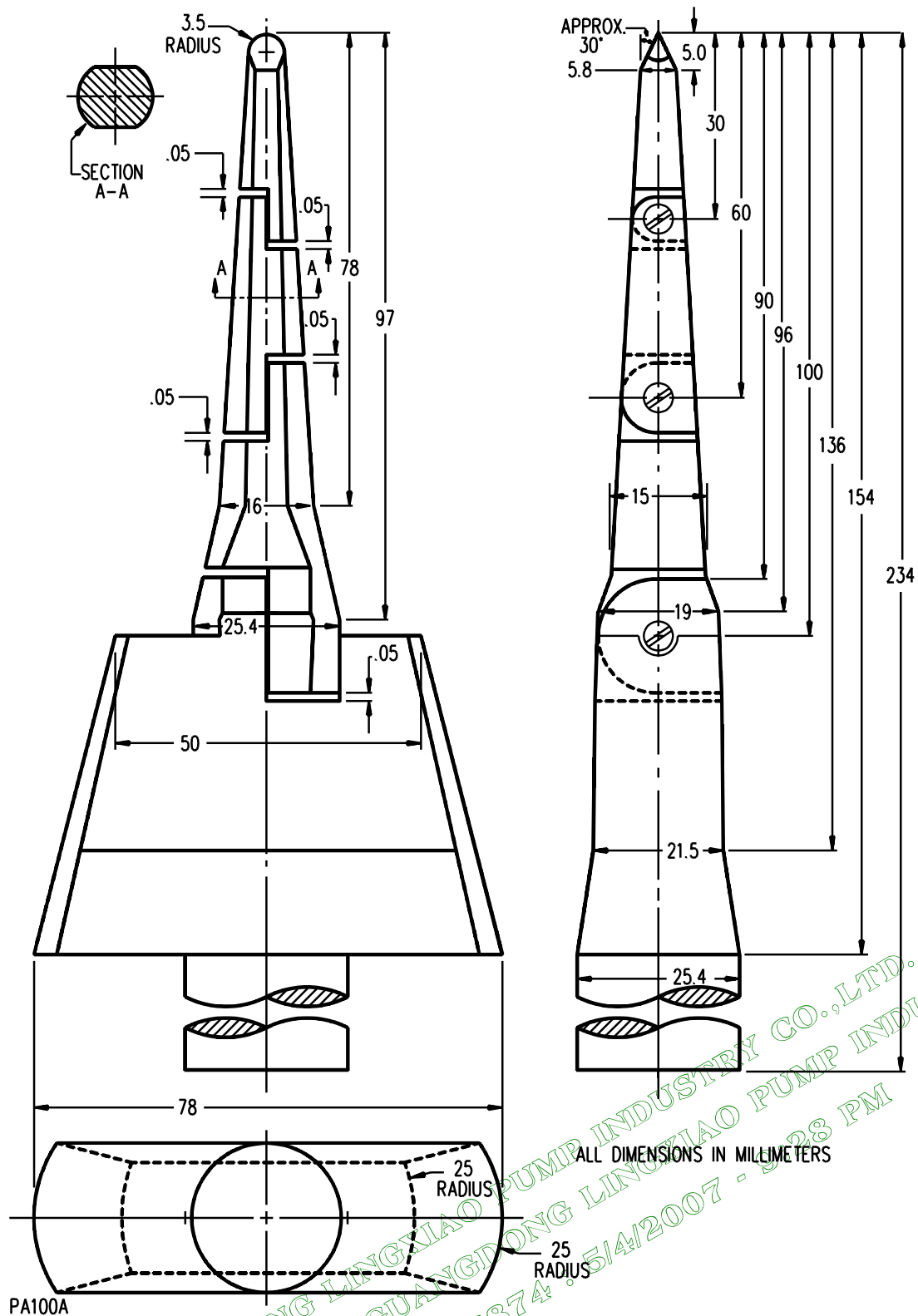
- a) Accessible only by opening or removing a part of the outer enclosure, such as a guard or panel, that is capable of being opened or removed without using a tool or
- b) Located at such a height or is otherwise guarded or enclosed so that it is not capable of being contacted.

A directly accessible motor is a motor that is capable of being contacted without opening or removing any part or that is located so as to be accessible to contact.

**Table 6.1**  
**Minimum distance from an opening to a part that involves a risk of electric shock or injury to persons**

| Minor dimension of opening, <sup>a</sup>                                                                                                                                                                                                                                                                         |                   | Minimum distance from opening to part, |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------|------|
| inches <sup>b</sup>                                                                                                                                                                                                                                                                                              | (mm) <sup>b</sup> | inches                                 | (mm) |
| 3/4 <sup>c</sup>                                                                                                                                                                                                                                                                                                 | 19.1              | 4-1/2                                  | 114  |
| 1 <sup>c</sup>                                                                                                                                                                                                                                                                                                   | 25.4              | 6-1/2                                  | 165  |
| 1-1/4                                                                                                                                                                                                                                                                                                            | 31.8              | 7-1/2                                  | 191  |
| 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                                 | 445  |
| d                                                                                                                                                                                                                                                                                                                | d                 | 30                                     | 762  |
| <sup>a</sup> See 6.5.<br><sup>b</sup> Between 3/4 and 2-1/8 inches, interpolation is to be used to determine a value between values specified in the table.<br><sup>c</sup> Any dimension less than 1 inch applies to a motor only.<br><sup>d</sup> More than 2-1/8 inches, but not more than 6 inches (152 mm). |                   |                                        |      |

Figure 6.1  
Articulate probe with web stop



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Figure 6.2  
Probe for moving parts and uninsulated live parts

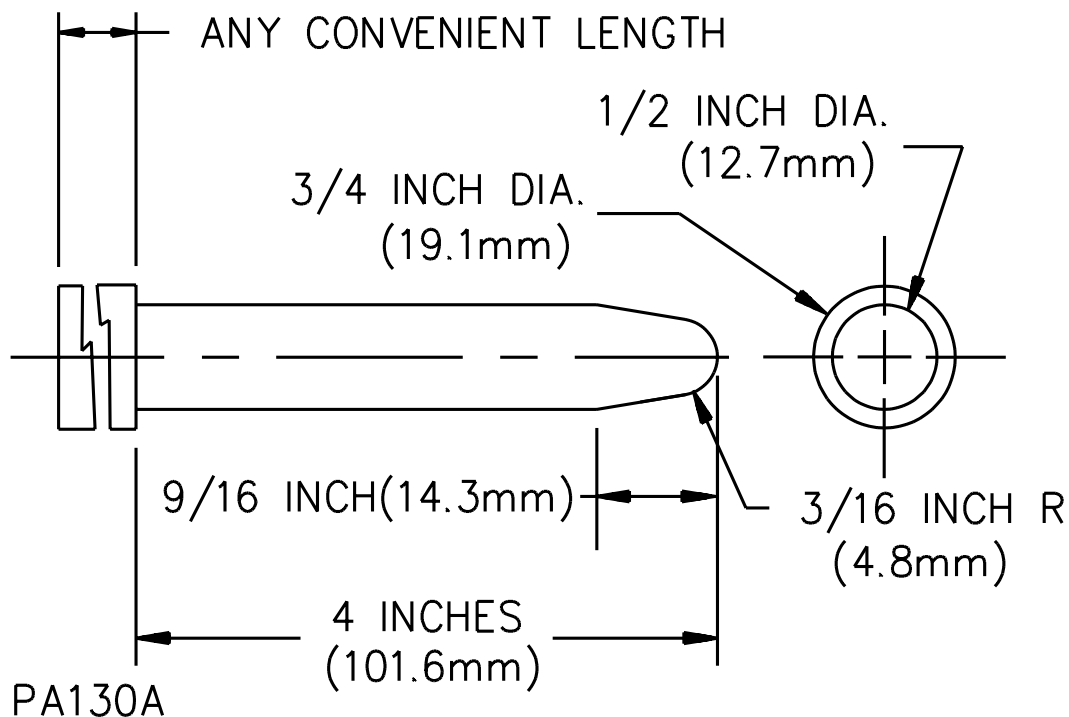
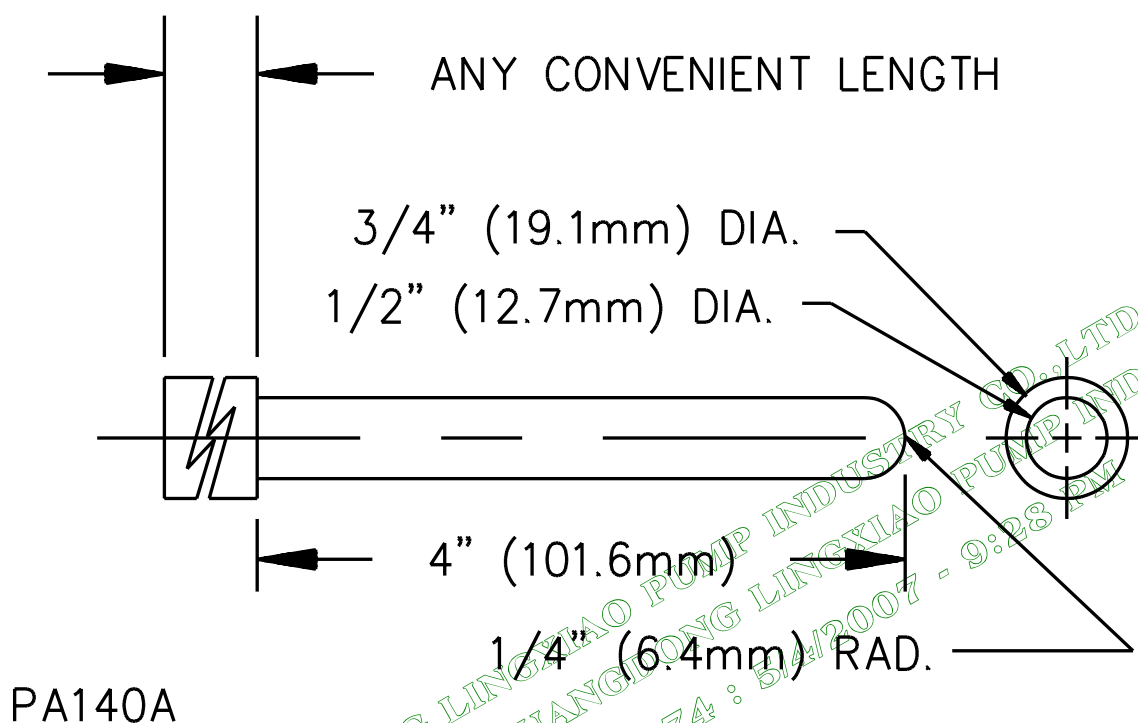


Figure 6.3  
Probe for film-coated wire



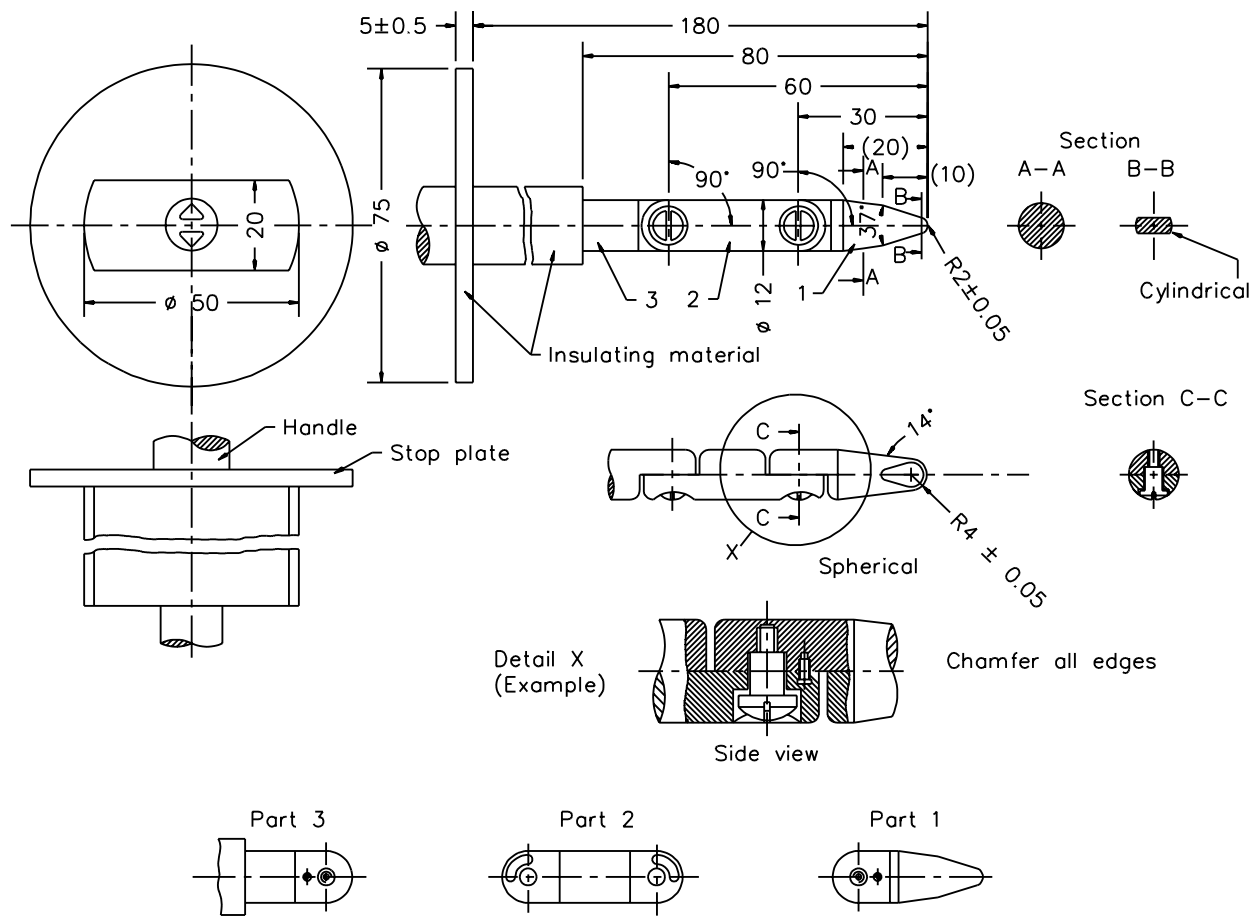
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**Figure 6.4**  
**IEC articulate probe**



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