

# UL 979

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## Water Treatment Appliances



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### **Summary of Topics**

***This is the First Edition of the Standard for Water Treatment Appliances, UL 979.***

The following table lists the future effective dates with the corresponding item.

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|-----------------------|-----------------|
| May 12, 2008          | Entire Standard |

The new requirements are substantially in accordance with UL's Bulletin(s) on this subject dated December 17, 2004. The bulletin(s) is now obsolete and may be discarded.

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

| Page       | Date         |
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| 1-76.....  | May 11, 2005 |
| A1-A2..... | May 11, 2005 |

**May 11, 2005**

**1**

**UL 979**

**Standard for Water Treatment Appliances**

**First Edition**

**May 11, 2005**

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

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.

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## INTRODUCTION

### 1 Scope

Section 1 effective May 12, 2008

1.1 These requirements cover electrically operated water treatment appliances for household and commercial use. These appliances are intended for installation and use in accordance with the National Electrical Code, NFPA 70, and are rated 600 V or less.

1.2 These requirements cover appliances utilizing features that treat water through the use of cation exchange water softeners, ionization, filters, ultraviolet radiation, ozone generation, and reverse osmosis.

1.3 These requirements do not cover water treatment appliances for use with pools or spas, water distillers, aquariums, or other equipment connected to plumbing that is covered by individual requirements.

1.4 These requirements do not cover appliances for use in hazardous locations as defined in the National Electrical Code, NFPA 70.

1.5 These requirements do not cover the aesthetic effects or the effectiveness of water treatment.

### 2 Glossary

Section 2 effective May 12, 2008

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

2.2 APPLIANCE – A collective term to designate all products covered by this Standard.

2.3 APPLIANCE, PERMANENTLY-CONNECTED – An appliance intended to be permanently connected electrically.

2.4 APPLIANCE, PORTABLE – An appliance with the following characteristics:

- a) The appliance is cord- and plug-connected;
- b) The operating literature and installation instructions illustrate connecting the water lines to the output of a sink-type faucet. The connection to the sink-type faucet does not require tools, or the appliance is provided with its own water container;
- c) The operating literature and installation instructions do not portray placing the appliance under the cabinet or a dedicated space, and they only illustrate placing the appliance on a counter top near the sink; and
- d) The appliance has feet or keyhole slots and does not have non-keyhole slots or other more permanent mounting means.

2.5 APPLIANCE, STATIONARY – An appliance connected to plumbing and not expected to be moved except during servicing or storage. A stationary appliance may have wheels or casters.

2.6 BARRIER – A partition for the insulation or isolation of electric circuits, for the isolation of electric arcs, or for isolation of moving parts or hot surfaces. In this respect, a barrier may serve as a portion of an enclosure or as a functional part.

2.7 CIRCUIT, HIGH-VOLTAGE – A circuit involving a potential of more than 600 V.

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

2.9 CIRCUIT, LOW-VOLTAGE – A circuit involving a peak open-circuit potential of not more than 42.4 V 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.

2.10 ENCLOSURE – A part that by itself or in conjunction with barriers:

- a) Renders inaccessible all or any parts that may otherwise present a risk of electric shock;
- b) Reduces the risk of contact with parts that may cause injury to persons; or
- c) Prevents propagation of flame due to electrical disturbances occurring within. A cabinet that serves to enclose electrical components or wiring is considered to be an enclosure.

2.11 FIELD WIRING TERMINAL – A terminal to which a supply or other wire can be connected by an installer in the field.

2.12 MAXIMUM WORKING PRESSURE – The maximum operating pressure recommended by the manufacturer.

2.13 MOTOR, ACCESSIBLE – A motor that may be contacted without opening or removing any part and that is located so as to be accessible to contact.

2.14 MOTOR, INACCESSIBLE – A motor that is accessible only by opening or removing a part of the outer enclosure, such as a panel or service door, which can be removed without the use of tools, or a motor that is located in such a position or is otherwise guarded or enclosed so that it is unlikely to be contacted.

2.15 OPPOSITE POLARITY – A difference of potential between two points, where shorting of these two points would result in a condition involving overload, rupturing of printed wiring-board tracks, components or fuses, and similar components.

2.16 PRESSURE-RELIEF DEVICE – A pressure-actuated valve or rupture member designed to relieve excessive pressures automatically.

2.17 PRESSURE VESSEL – A component of the system intended to hold water under pressure higher than atmospheric pressure.

2.18 USER SERVICING – Any form of servicing that can be performed by personnel other than those who are trained to maintain the particular appliance. Some examples of user servicing are:

- a) Attaching accessories by means of attachment plugs and receptacles or by means of other separable connectors;
- b) Replacing lamps and fuses and resetting circuit breakers located in an operator-access area unless the lamps, fuses, or circuit breakers are marked to indicate replacement or resetting only by qualified service personnel;

- c) Making routine operating adjustments necessary to adapt the appliances for its different intended functions; and
- d) Any operation described or implied in the operator's manual, whether or not tools are required.

### 3 Components

Section 3 effective May 12, 2008

3.1 Except as indicated in 3.2, a component of a product covered by this Standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

3.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

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

3.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

### 4 Units of Measurement

Section 4 effective May 12, 2008

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

### 5 Undated References

Section 5 effective May 12, 2008

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 General

Section 6 effective May 12, 2008

6.1 An appliance shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

6.2 An appliance shall be acceptable for both indoor and outdoor use unless marked for restricted use in accordance with 60.8.

6.3 A waste connection or drain outlet of appliances connected to a potable water system shall be designed and constructed to provide for connection to the sanitary waste system through an air gap of 2 pipe diameters or 1 in (25.4 mm), whichever is larger.

6.4 A low voltage circuit shall be judged under the requirements for primary circuits in this standard unless the transformer or power supply that supplies the circuit complies with 25.1 or 25.3.

### 7 Frame and Enclosure

Section 7 effective May 12, 2008

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 reduction of spacings, loosening or displacement of parts, or other serious defects.

7.2 An edge, projection, or corner of an enclosure, opening, frame, guard, knob, handle, or similar part, of an appliance shall be smooth and rounded and not sufficiently sharp to cause a cut-type injury when contacted during normal use or maintenance.

7.3 A door or cover of an enclosure shall be provided with a means for securing the door or cover in place in the closed position.

7.4 A device, such as a lampholder, fuseholder, or circuit breaker, of the replaceable type shall be designed and installed so that persons servicing the lamps, fuses, circuit breakers, or other devices will not unintentionally contact any uninsulated live part other than a screwshell or the clips of a fuseholder.

7.5 The enclosure of an appliance shall be complete. The enclosure shall not depend on adjacent walls or equipment to complete the enclosure.

7.6 Mounting holes shall be located or guarded so that nails or similar hangers shall not come in contact with any bare, covered, or uninsulated live part.

7.7 Among the factors to be considered when determining the acceptability of an enclosure are:

- a) Physical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Flammability;

- e) Resistance to corrosion;
- f) Resistance to distortion at temperatures to which the enclosure is subjected under conditions of intended use;
- g) For a sheet-metal enclosure, in addition to the factors in (a) – (f), the size and shape of the metal, the thickness of the metal, and the conditions of intended use;
- h) For a nonmetallic enclosure exposed to an ultraviolet radiation weathering source, resistance to degradation from exposure to ultraviolet radiation; and
- i) For a nonmetallic enclosure, all of the factors are to be considered with respect to thermal aging.

7.8 A polymeric enclosures shall comply with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. When determining compliance with UL 746C, the polymeric (including epoxy potting compounds) enclosure shall comply with the following:

- a) Material Properties – The material shall comply with the “Material property considerations” in Table 8.1 of UL 746C.
- b) Impact Test – A minimum impact of 5 ft-lbf (6.8 J) shall apply to all enclosure materials. In addition to the test requirements specified in UL 746C, any cracking of a polymeric material that would be exposed to water is considered unacceptable. All other parts constructed of materials that do not comply with the enclosure requirements shall be removed during this test.
- c) Abnormal Operations – See Abnormal Operation Tests, Section 38.
- d) Mold-Stress Relief Distortion – In addition to the test requirements specified in UL 746C, any cracking of a polymeric material that would be exposed to water is considered unacceptable. All other parts constructed of materials that do not comply with the enclosure requirements shall be removed during this test.
- e) Strain Relief – This test is only required if the strain relief means is secured to the enclosure or is an integral part of the polymeric enclosure.
- f) UV Resistance – This test is only required if the equipment is intended for outdoor use. All other parts constructed of materials that do not comply with the enclosure requirements shall be removed during this test.
- g) Flammability – Minimum flammability rating of polymeric enclosures shall be 5VA, 5VB, V-0, V-1, V-2 for portable appliances and 5VA for all other appliances.
- h) Water Exposure and Immersion – Polymeric materials shall comply with UL 746C.
- i) Dimensional Stability – Polymeric materials shall comply with UL 746C.
- j) Conduit Connections – Products permanently connected electrically shall comply with the requirements in UL 746C.

7.9 Cast- and sheet-metal portions of the enclosure shall not be thinner than indicated in Table 7.1.

**Table 7.1**  
**Minimum thicknesses of metal enclosure material**

| Metal                                                                                                                                                                                                                                                  | At small, flat, unreinforced surfaces and at surfaces that are reinforced by curving, ribbing and similar methods or are otherwise of a shape and size or size to provide physical strength |                     | At surfaces to which a wiring system is to be connected in the field |        | At relatively large unreinforced flat surfaces |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------|--------|------------------------------------------------|--------|
|                                                                                                                                                                                                                                                        | In                                                                                                                                                                                          | (mm)                | In                                                                   | (mm)   | In                                             | (mm)   |
| Die-cast                                                                                                                                                                                                                                               | 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 <sup>a</sup>                                                                                                                                                                          | (0.66) <sup>a</sup> | 0.032                                                                | (0.81) | 0.026                                          | (0.66) |
| Galvanized sheet steel                                                                                                                                                                                                                                 | 0.029 <sup>a</sup>                                                                                                                                                                          | (0.74) <sup>a</sup> | 0.034                                                                | (0.86) | 0.029                                          | (0.74) |
| Nonferrous sheet metal                                                                                                                                                                                                                                 | 0.036 <sup>a</sup>                                                                                                                                                                          | (0.91) <sup>a</sup> | 0.045                                                                | (1.14) | 0.036                                          | (0.91) |
| <sup>a</sup> Thinner sheet metal may be employed if found to be acceptable when the enclosure 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. |                                                                                                                                                                                             |                     |                                                                      |        |                                                |        |

7.10 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.

7.11 The requirement in 7.10 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;

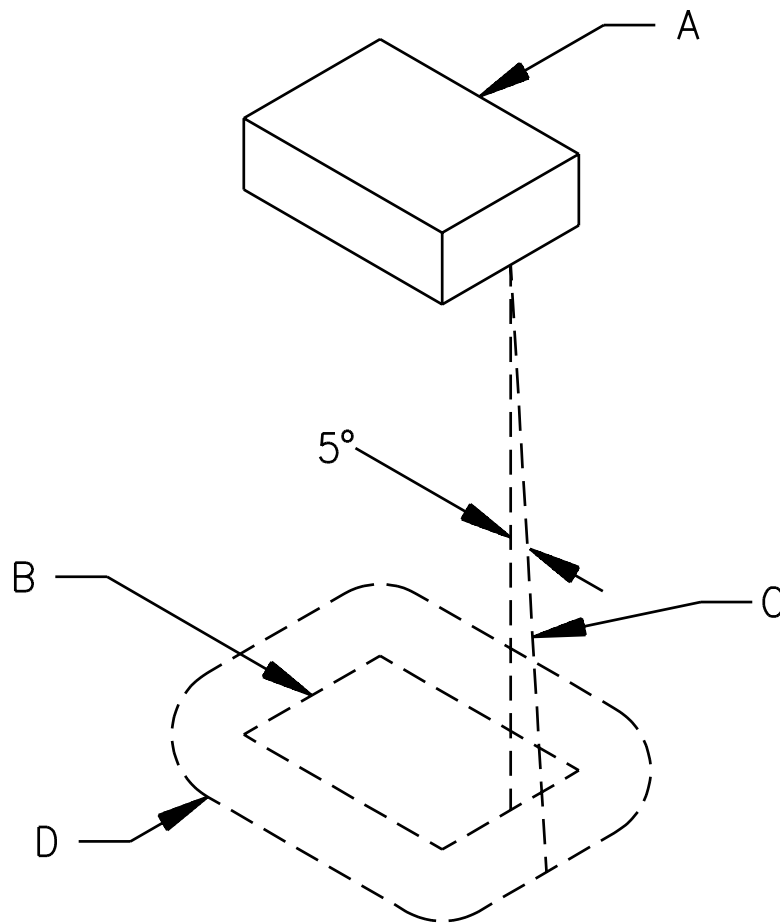
3) The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that will reduce the risk of the temperature of the motor windings from exceeding 125°C (257°F) under the maximum load under which the motor will run without causing the protector to cycle and from exceeding 150°C (302°F) 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 150°C during the first 72 h of operation with the rotor of the motor locked.

b) Under wiring, unless the wiring complies with the VW-1 (Vertical-Specimen) Flame Test in the Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581.

7.12 The barrier mentioned in 7.11 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 similar purposes may be employed in the barrier, if such openings would not permit molten metal, burning insulation, or similar material 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) So oriented 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.

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

Section 8 effective May 12, 2008

8.1 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:

- a) For an opening that has a minor dimension as described in 8.5 of less than 1 in (25.4 mm), an uninsulated live part, a moving part, or film-coated wire shall not be contacted by the probe illustrated in Figure 8.1; or
- b) For an opening that has a minor dimension as described in 8.5 of 1 in or more, an uninsulated live part, a moving part, or film-coated wire shall be spaced from the opening as specified in Table 8.1.

*Exception: An opening in a motor need not comply with these requirements if it complies with the requirements in 8.2.*



**Table 8.1**  
**Minimum distance from an opening to a part involving a risk of electric shock or injury to persons**

| Minor dimension <sup>a</sup> of opening |                   | Minimum distance from opening to part |                   |
|-----------------------------------------|-------------------|---------------------------------------|-------------------|
| In                                      | (mm) <sup>b</sup> | In                                    | (mm) <sup>b</sup> |
| 3/4 <sup>c</sup>                        | (19.1)            | 4-1/2                                 | (114.0)           |
| 1 <sup>c</sup>                          | (25.4)            | 6-1/2                                 | (165.0)           |
| 1-1/4                                   | (31.8)            | 7-1/2                                 | (191.0)           |
| 1-1/2                                   | (38.1)            | 12-1/2                                | (318.0)           |
| 1-7/8                                   | (47.6)            | 15-1/2                                | (394.0)           |
| 2-1/8                                   | (54.0)            | 17-1/2                                | (445.0)           |
| d                                       |                   | 30                                    | (762.0)           |

<sup>a</sup> See 8.5 for a description of the minor dimension of an opening.  
<sup>b</sup> Between 3/4 in (19.1 mm) and 2-1/8 in, (54.0 mm) interpolation is to be used to determine a value between values specified in the table.  
<sup>c</sup> Any dimension less than 1 in (25.4 mm) applies to a motor only.  
<sup>d</sup> More than 2-1/8 in, (54.0 mm) but no more than 6 in (152 mm).

8.2 With respect to a moving part or film-coated wire within the enclosure of a motor as specified in the Exception to 8.1:

- a) An opening that has a minor dimension, as described in 8.5, of less than 3/4 in (19.1 mm) is acceptable if:
- 1) In an indirectly accessible motor, an uninsulated live part or a moving part cannot be contacted by the probe illustrated in Figure 8.2;
  - 2) Film-coated wire cannot be contacted by the probe illustrated in Figure 8.3; and
  - 3) In a directly accessible motor, an uninsulated live part or a moving part cannot be contacted by the probe illustrated in Figure 8.4.
- b) An opening that has a minor dimension of 3/4 in or more is acceptable if an uninsulated live part, a moving part, or film-coated wire is spaced from the opening as specified in Table 8.1.

Figure 8.2  
Probe for moving and uninsulated live parts

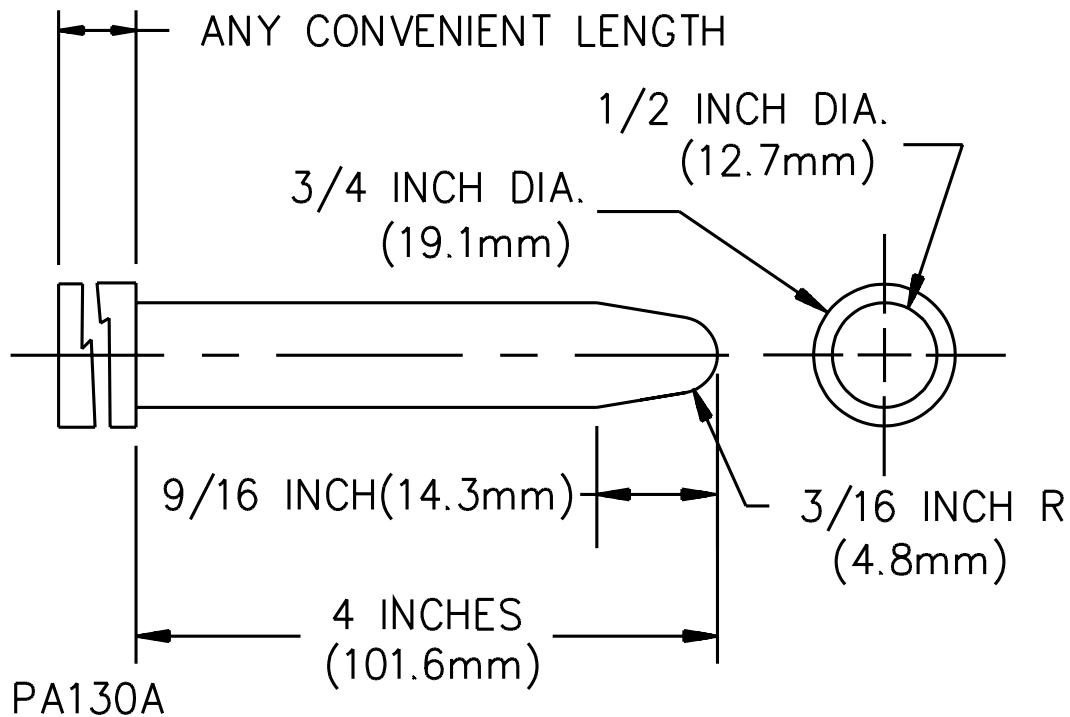


Figure 8.3  
Probe for film-coated wire

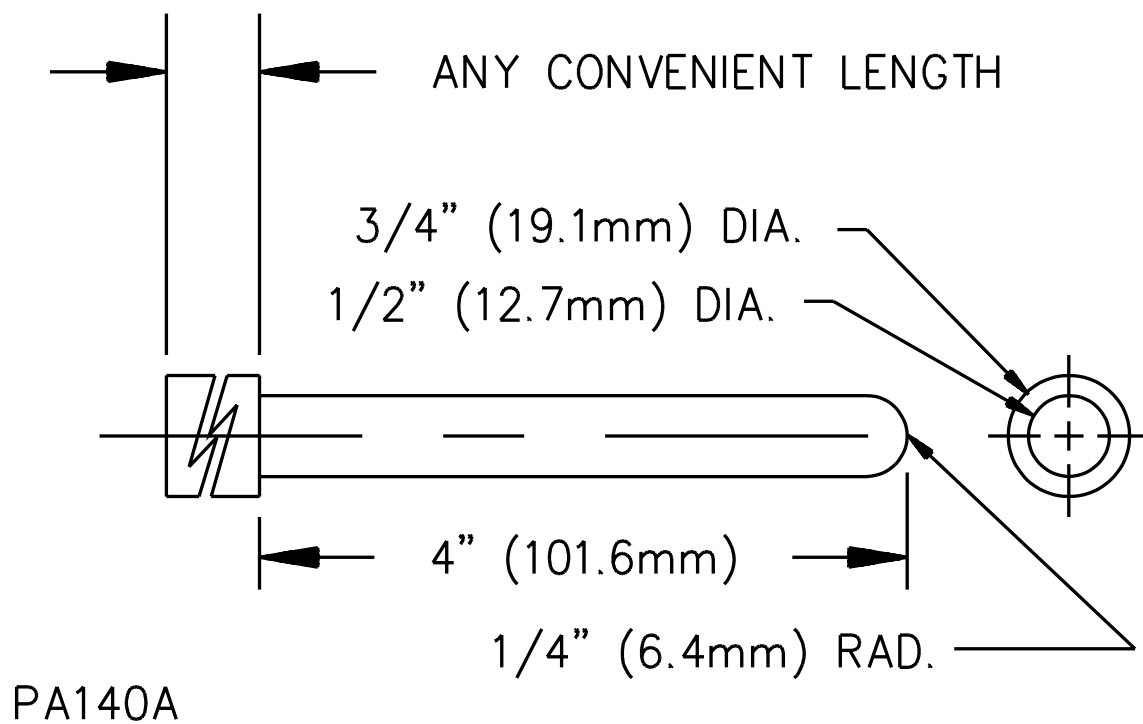
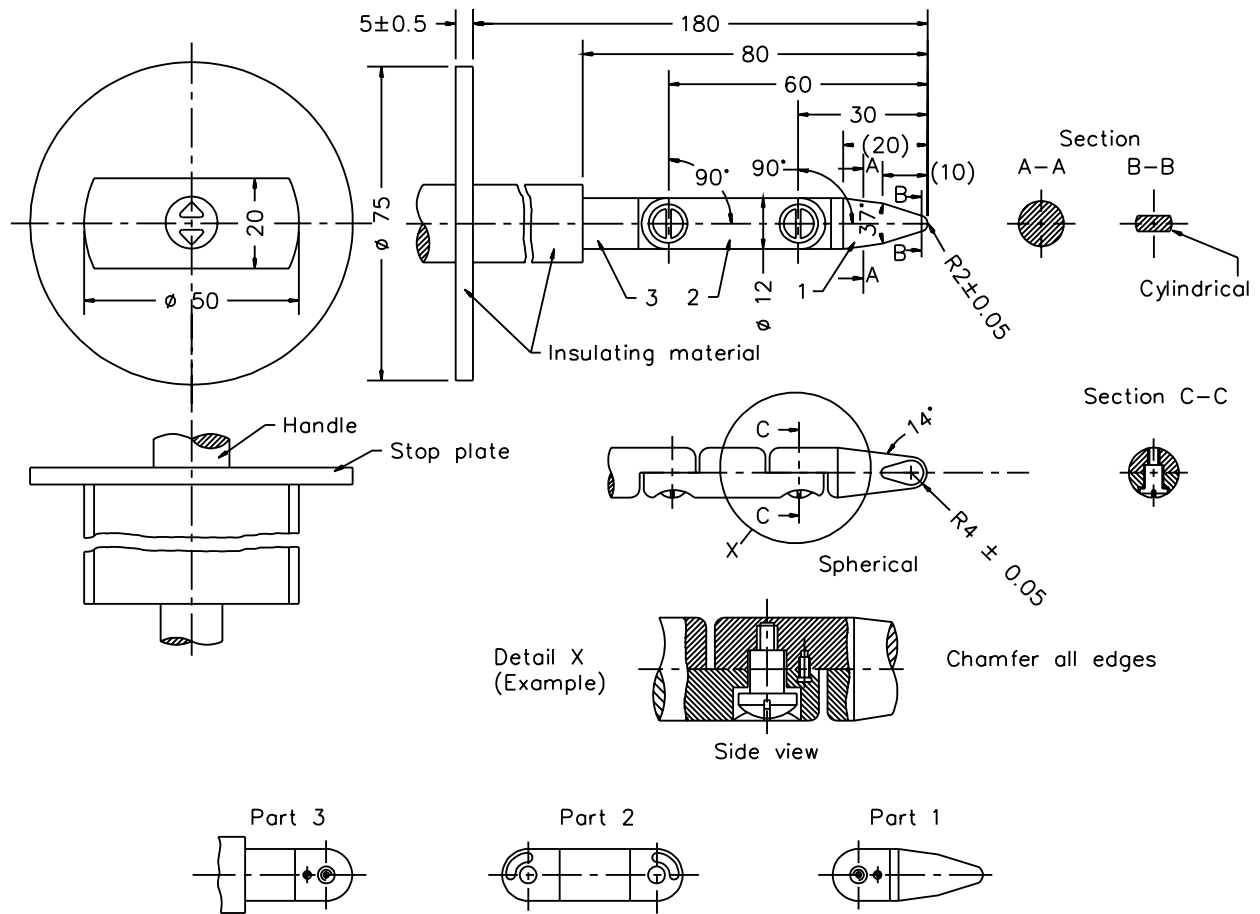


**Figure 8.4**  
**Articulated probe**



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8.3 The probes specified in 8.1 and 8.2 and illustrated in Figures 8.1 – 8.4 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 probes illustrated in Figures 8.1 and 8.4 shall be applied in any possible configuration; and, if necessary, the configuration shall be changed after insertion through the opening.

8.4 The probes illustrated in Figures 8.1 – 8.4 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 necessary to determine accessibility.

8.5 With reference to 8.1 and 8.2, 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.

8.6 During the examination of an appliance to determine compliance with 8.1 or 8.2, a part of the enclosure that can be opened or removed by the user without using a tool (to attach an accessory, to make an operating adjustment, or for other reasons) is to be opened or removed.

8.7 A moving part shall be enclosed or guarded to reduce the risk of injury to persons.

8.8 With reference to 8.7, the degree of protection required of the enclosure depends upon the general design and intended use of the appliance. The factors to be taken into consideration in determining the acceptability of an exposed moving part are:

- a) The degree of exposure;
- b) The sharpness of the moving part;
- c) The risk of unintentional contact with the moving part;
- d) The speed of movement of the part; and
- e) The risk of fingers, arms, or clothing being drawn into the moving part.

8.9 A component that requires inspection, replacement, cleaning, or other servicing shall be accessible. Excluding the lamp compartment, such a component shall be readily accessible without the use of tools not available to other than service personnel, if the component is intended to be manually operated, manually adjusted, or periodically serviced.

8.10 A cord-connected appliance that is provided with keyhole slots, notches, hanger holes, or similar openings, for mounting the appliance on a wall, shall be constructed so that the mounting means is not accessible without removing the appliance from the supporting means.

8.11 When determining compliance with 8.10, any part of the enclosure or barrier that can be removed without the use of tools to gain access to the mounting means are to be removed.

## 9 Protection Against Corrosion

Section 9 effective May 12, 2008

9.1 An iron or steel part shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, if the failure of the part results in a risk of fire, electric shock, or injury to persons.

*Exception: This requirement does not apply to bearings, laminations, or to minor parts of iron or steel (such as washers, screws, and similar parts).*

9.2 A sheet-steel cabinet or an electrical enclosure intended for outdoor use shall be protected against corrosion by the means specified in Table 9.1 or by other metallic or nonmetallic coatings that have been shown to provide equivalent resistance.

*Exception: This requirement does not apply to enclosures that comply with outdoor use requirements in the Standard for Enclosures for Electrical Equipment, UL 50.*

**Table 9.1**  
**References for requirements for protection against corrosion**

| Type of cabinet or enclosure                                                    | Minimum thickness of steel     |                                    |
|---------------------------------------------------------------------------------|--------------------------------|------------------------------------|
|                                                                                 | 0.056 in (1.42 mm) and thicker | Less than 0.056 in (1.42 mm) thick |
| Outer cabinet that protects a motor, wiring, or encloses current-carrying parts | 9.3                            | 9.4                                |
| Inside enclosure that protects current-carrying parts other than a motor        | 9.3                            | 9.4                                |
| Outer cabinet that is the sole enclosure of current-carrying parts              | 9.4                            | 9.4                                |

9.3 With reference to Table 9.1, as applicable, one of the following coatings shall be used:

a) Hot-dipped, mill-galvanized sheet steel conforming with the coating designation G60 or A60 in the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A 653/A 653M, with no less than 40 percent of the zinc on any one side, based on the minimum single-spot test requirement in this designation. The weight of the coating shall be established in accordance with the Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles With Zinc or Zinc-Alloy Coatings, ASTM A90, or by any method that has been determined to be similar. An A60 (alloyed) coating shall also comply with 9.6.

b) A zinc coating, other than that provided on hot-dipped, mill-galvanized sheet steel, uniformly applied to an average thickness of no less than 0.00041 in (0.0104 mm) on each surface, with a minimum thickness of 0.00034 in (0.0086 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 47. An annealed coating shall also comply with 9.6.

c) Two coats of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on each surface. The acceptability of the paint is to be determined by consideration of the composition or, when required, by the corrosion tests specified in 9.5.

d) A single coat of an organic finish of the epoxy or alkyd-resin type over phosphate- or oxide-treated steel in a form that has been shown to be equivalent to mill-galvanized steel as noted in (a).

9.4 With reference to Table 9.1, as applicable, one of the following coatings shall be used:

- a) Hot-dipped, mill-galvanized sheet steel conforming with the coating designation G90 in the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A 653/A 653M, with no less than 40 percent of the zinc on any side, based on the minimum single-spot-test requirement in this designation. The weight of the zinc coating shall be established in accordance with the Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles With Zinc or Zinc-Alloy Coatings, ASTM A90, or by any method that has been determined to be similar.
- b) A zinc coating, other than that provided on hot-dipped, mill-galvanized sheet steel, uniformly applied to an average thickness of no less than 0.00061 in (0.01549 mm) on each surface with a minimum thickness of 0.00054 in (0.01372 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 47. An annealed coating shall also comply with 9.6.
- c) A cadmium coating no less than 0.001 in (0.0254 mm) thick on both surfaces. The thickness of the coating shall be established in accordance with the Metallic Coating Thickness Test, Section 47.
- d) A zinc coating that complies with 9.3 (a) or (b), with one coat of outdoor paint as specified in 9.3 (c) on each surface.
- e) A cadmium coating no less than 0.00075 in (0.01905 mm) thick on both surfaces, with one coat of outdoor paint on both surfaces, or no less than 0.0005 in (0.0127 mm) thick on both surfaces, with two coats of outdoor paint on each surface. The thickness of the cadmium coating shall be established in accordance with the Metallic Coating Thickness Test, Section 47, and the paint shall be as specified in 9.3 (c).

9.5 With reference to Tables 9.1 and 9.2, other finishes, including paints, metallic finishes, and combinations of the two may be acceptable when comparative tests with galvanized sheet steel (without annealing, wiping, or other surface treatment) that are in compliance with 9.3(a) or 9.4(a) indicate that they provide equivalent resistance. Among the factors considered when evaluating the acceptability of such coating systems are exposure to salt spray, moist carbon dioxide-sulfur dioxide-air mixtures, moist hydrogen sulfide-air mixtures, ultraviolet light, and water.