UL 399

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Drinking Water Coolers

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

UL Standard for Safety
for
Drinking-Water Coolers, UL 399

Sixth Edition, Dated June 25, 1993

Revisions: This Standard contains revisions through and including December 1, 1998.

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

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

The revisions dated December 1, 1998 were issued to correct flammable material designations, replace obsolete standards references, add a flexible cord type for outdoor use and correct editorial errors. The references to the Standard for Thermal Protectors for Motors, UL 547 and Impedance – Protected Motors, UL 519, were changed to Overheating Protection for Motors, UL 2111. The flexible cord type "W" for outdoor use was added based on a 1996 NEC Code revision.

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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that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.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.

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ANSI/UL 399-1992

1

UL 399

Standard for

Drinking-Water Coolers

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Sixth Edition

June 25, 1993

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

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Approved as ANSI/UL 399-1992, March 31, 1992

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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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 which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, 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.

Paragraph D revised December 1, 1998

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INTRODUCTION

1 Scope

1.1 These requirements cover self-contained drinking-water coolers which employ hermetic refrigerant motor-compressors and which are designed for connection to alternating-current circuits rated not greater than 600 volts in accordance with the National Electrical Code, NFPA 70. The requirements also apply to water coolers which supply both hot and cold water.

1.2 These requirements do not include additional requirements applicable to equipment designed for use in hazardous locations as defined in the National Electrical Code, NFPA 70.

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

1.3 revised December 1, 1998

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 generally used in the products covered by this standard.

2.1.2 A component need not comply with a specific requirement that:

a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard or

b) Is superseded by a requirement in this standard.

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

2.1.4 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.

2.2 Units of measurement

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

2.3 Terminology

2.3.1 The term "product" as used in these requirements refers to all drinking-water coolers or any part thereof covered by these requirements unless specifically noted otherwise.

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2.4 Undated references

2.4.1 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.

3 Glossary

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

3.2 AGAINST-THE-WALL WATER COOLERS – Freestanding units intended to be placed in close proximity to a wall.

3.3 BUILT-IN WATER COOLERS – These are intended to be permanently mounted and enclosed to some degree by structural parts of a building. A wall-insert water cooler is an example of a "built-in" type.

3.4 CAFETERIA WATER COOLERS – Pressure-type coolers intended primarily for use in cafeterias and restaurants for dispensing water rapidly into glasses and pitchers.

3.5 CIRCUITS, ELECTRICAL:

a) High-Voltage – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) Low-Voltage – A circuit involving a potential of not more than 30 volts rms alternating current, 42.4 volts by peak or direct current, and supplied by:

1) A primary battery,

2) A standard Class 2 National Electrical Code, ANSI/NFPA 70-1993, transformer, or

3) A combination of a transformer and fixed impedance which, as a unit, complies with all performance requirements for a Class 2 transformer.

3.6 COLUMN MOUNT WATER COOLERS – Remote water coolers intended for installation on a column or post usually at an elevated position above the floor.

3.7 FREESTANDING WATER COOLERS – Intended for installations in which the structural parts of a building neither enclose nor functionally obstruct the water cooler.

3.8 HOT- AND COLD-TYPE WATER COOLERS – These include means for heating and dispensing potable water.

3.9 REMOTE WATER COOLERS – Pressure-type coolers designed for use with remotely installed bubblers or other dispensing means.

3.10 SELF-CONTAINED WATER COOLERS – Completely factory-made and factory-tested assemblies to which no refrigerant-containing parts are connected in the field.

3.11 TEMPERATURE LIMITING CONTROL – A control which serves only to prevent abnormal temperature and is not intended to function during normal operation.

3.12 TEMPERATURE REGULATING CONTROL – A control which regulates temperature and is intended to function frequently during normal operation.

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3.13 ULTIMATE STRENGTH – The highest stress level that a refrigerant-containing component can tolerate without rupture.

3.14 WALL-HUNG WATER COOLERS – Water coolers intended to be suspended from a wall.

4 Installation And Operating Instructions

4.1 A water cooler shall be provided with installation and operating instructions that shall contain such directions and information as deemed by the manufacturer to be necessary for the safe installation, maintenance, and use of the water cooler. These instructions shall include roughing-in dimensions for electrical connections of permanently connected units and for plumbing connections of pressure-type units.

4.2 A copy of the manufacturer's installation and operating instructions, or equivalent information intended to accompany each water cooler, is to be furnished with the sample submitted for investigation. These instructions are to be used as a guide in the examination and test of the water cooler. For this purpose, a printed edition is not required initially if rough draft instructions or information as to what the instructions will include are submitted for review as part of the investigation.

CONSTRUCTION

5 General

5.1 Ferrous metal parts used to support or retain electrical components in position shall be protected against corrosion by metallic or nonmetallic coatings, such as plating or painting.

Exception: This requirement does not apply to parts such as washers, screws, bolts, and the like, where corrosion of such unprotected parts would not affect compliance with the requirements of this standard.

6 Assembly

6.1 General

6.1.1 A bottle-type water cooler shall be assembled so that removal and replacement of bottles will not result in damage to electrical components and wiring, or to refrigerant-containing components.

6.2 Mechanical protection

6.2.1 Louvers and other openings in the enclosure shall be constructed and located to reduce the risk of unintentional contact with moving parts and with hot surfaces that may cause injury to persons. See 6.2.4 and 6.2.5. Knockouts for entrance of electrical conduit and plumbing may be provided. In determining compliance with the requirements specified in 6.2.2 – 6.2.5, parts such as covers, panels, or grilles used as part of the enclosure are to be removed unless tools are required for their removal.

6.2.2 Moving parts, such as fan blades, shall be guarded or enclosed. Parts required for guarding shall be secured by means dependent upon tools for removal unless functioning of the water cooler requires the guard to be in place.

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6.2.3 With reference to 6.2.2, moving parts are considered to be enclosed when the distance from an opening to the moving part is as specified in Table 6.1. For an opening having a minor dimension intermediate between two of the values included in the table, the distance from the opening to the moving part is determined by interpolation between the corresponding values in the right-hand column of the table. The minor dimension of the opening is determined by the largest hemispherically tipped cylindrical probe that can be inserted through the opening with a force of 5 pounds (22.3 N).

Exception No. 1: The following areas are considered to be solid surfaces for the purpose of applying this requirement:

a) The bottom of a freestanding unit.

b) The rear of a wall-hung unit.

c) The rear of an against-the-wall unit if, according to the instructions provided with the unit, no gap is allowed between the unit and the wall, and the unit has been tested accordingly.

Exception No. 2: A moving part is not to be considered if:

a) The part is unlikely to be contacted through the opening because of the location of fixed components, including baffles, water lines, drain tubes, and the like, or

b) The part is made inoperative, when exposed, through the use of interlocking devices.

If more than one method of routing plumbing lines is specified in the installation instructions, all methods are to be evaluated when determining if such lines, as installed, serve as baffles to prevent contact with moving parts.

Table 6.1
Dimensions of openings

Minor dimensions of opening[a],		Minimum distance from opening to moving part[b],	
inches	**(mm)**	**inches**	**(mm)**
1/4	(6.4)	1/2	(12.7)
3/8	(9.5)	1-1/2	(38.1)
1/2	(12.7)	2-1/2	(63.5)
3/4	(19.1)	4-1/2	(114.0)
1	(25.4)	6-1/2	(165.0)

[a] Openings less than 1/4 inch (6.4 mm) are not to be considered. Openings greater than 1 inch (25.4 mm) shall be designed or located to reduce the risk of unintentional contact with moving parts that may involve injury to persons.

[b] Also applies to thermally hot parts. See Table 33.1.

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6.2.4 When tested in accordance with the provisions of the Temperature and Pressure Test, Section 33, surfaces that exceed the temperature limit of Table 33.1(d)(3) and (d)(4) shall be guarded in accordance with 6.2.2 and 6.2.3. In determining compliance with this requirement, the handle of the hot water spigot on a hot- and cold-type water cooler is considered to be a surface contacted by persons in the operation of the unit, Table 33.1(d)(3). The hot water spigot itself is exempt from this requirement. Surfaces that are recessed or located away from the front of the water cooler are not considered subject to casual contact, see Table 33.1(d)(4). Examples of such surfaces include a condenser located at the rear of a freestanding unit and a compressor located over an opening in the bottom of a wall-hung unit.

6.2.5 The sheath of a heater element, as installed in a water cooler, shall be protected against mechanical damage. A copper or steel sheath at least 0.016 inch (0.41 mm) thick is considered to provide such protection. In addition, if the temperature of a heater exceeds the limits permitted by Table 33.1 (d)(3) or (d)(4), whichever is appropriate, it shall be guarded in accordance with 6.2.2 and 6.2.3 to protect persons from coming in contact with it.

6.3 Electrical protection

6.3.1 Louvers and other openings in the enclosure shall be constructed and located to reduce the risk of unintentional contact with uninsulated high-voltage live parts. Knockouts for entrance of electrical conduit and plumbing may be provided. To determine compliance with this requirement, parts such as covers, panels, or grilles used as part of the enclosure are to be removed unless tools are required for their removal or an interlock is provided. See 7.2.1.

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Figures 6.1
Probes

Figure 6.1 revised December 1, 1998

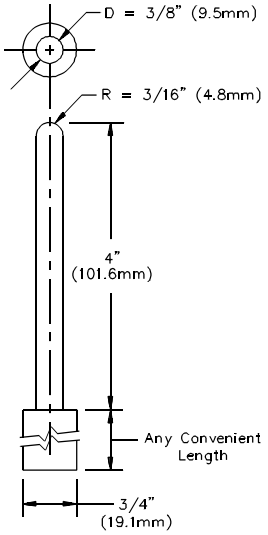

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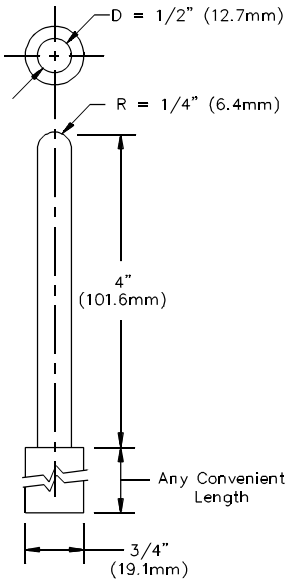
Figure 6.2
Probe

Figure 6.2 revised December 1, 1998



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6.3.2 Where an opening in the enclosure will not permit the entrance of a 3/4 inch (19.1 mm) diameter rod, the probe illustrated in Figure 6.1 shall not touch any uninsulated high-voltage live parts and the probe illustrated in Figure 6.2 shall not touch any film-coated wire when inserted through the opening. The probe shall not pass through grilles, screens, louvers, or the like when a force of 5 pounds (22.3 N) is applied.

6.3.3 Where an opening in the enclosure permits the entrance of a 3/4 inch (19.1 mm) diameter rod, the conditions described in Figure 6.3 shall be used in determining compliance with the requirements. The minor dimension of the opening shall not exceed 1 inch (25.4 mm) in any case.

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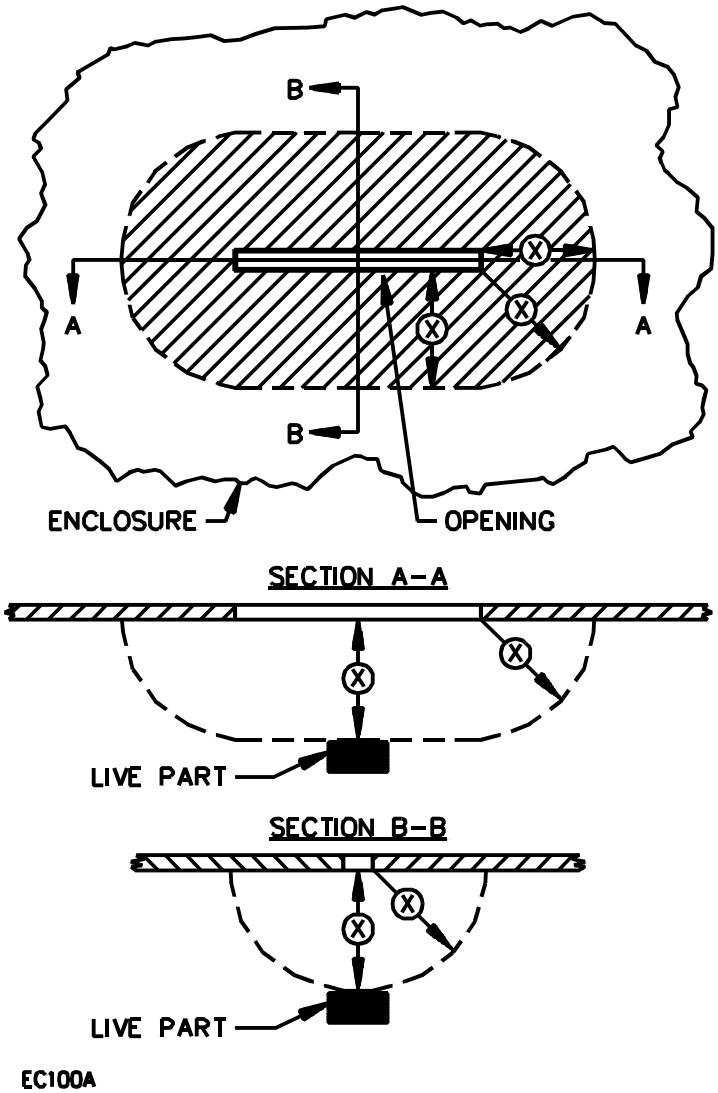
Figure 6.3
Opening in enclosure

Figure 6.3 revised December 1, 1998



The opening is acceptable if, within the enclosure, there is no uninsulated live part or film-coated wire (1) less than X inches from the perimeter of the opening, as well as (2) within the volume generated by projecting the perimeter X inches normal to its plane. X equals five times the diameter of the largest diameter rod which can be inserted through the opening, but not less than 4 inches (102 mm).

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6.3.4 In addition to the requirements of 6.3.2 and 6.3.3, uninsulated high-voltage live parts inside the enclosure which are likely to be contacted by persons performing operations such as replacing fuses, resetting manual-reset devices, oiling motors, or other such normal service operations shall be located, guarded, or enclosed to reduce the risk of unintentional contact unless tools are required to expose the live part. See 57.11.

6.3.5 A fuseholder shall be constructed, installed, or protected so that adjacent uninsulated high-voltage live parts, other than the screw shell of a plug fuseholder, cartridge fuse clips, or wiring terminals to the fuseholder, will not be exposed to contact by persons removing or replacing fuses. A barrier of vulcanized fiber or similar material employed as a guard for high-voltage live parts shall be not less than 1/32 inch (0.8 mm) in thickness. A separation less than 4 inches (102 mm) is considered to be adjacent.

6.3.6 Electrical components shall be located or enclosed so that uninsulated high-voltage live parts will not be wetted by water due to condensation, splashing, or leakage.

6.3.7 On pressure type water coolers, a drain basin shall be constructed so that overflow due to a blocked drain will not wet uninsulated high-voltage live parts or film-coated wire.

6.3.8 A water reservoir on a bottle type water cooler and waste water receptacles on any type water cooler shall be constructed and located so that overflow will not wet uninsulated high-voltage live parts or film-coated wire.

6.3.9 The Overflow Test, Section 37, is to be conducted if it is not evident that the water cooler complies with the provisions of 6.3.7 and 6.3.8.

6.3.9.1 A bottle type water cooler shall be constructed so that a liquid spill on the top surface of the unit, during removal or installation of water containers will not wet uninsulated live parts or film-coated wire in line-voltage circuits. A Spill Test, Section 37A, is to be conducted if it is not evident that the water cooler complies with this requirement.

Added 6.3.9.1 effective March 24, 1998

6.3.10 A switch, attachment-plug receptacle, motor-attachment plug, or similar component shall be secured in position and, except as noted in 6.3.11, shall be prevented from turning. See 6.3.12.

6.3.11 The requirement that a switch be prevented from turning will be waived if the following conditions are met:

a) The switch is 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 the operation of the switch,

b) Means of mounting the switch make 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) Operation of the switch is by mechanical means rather than direct contact by persons.

6.3.12 With reference to 6.3.10, the means for preventing rotation is to consist of more than friction between surfaces. A toothed lock washer that provides both spring take-up and an interference lock is acceptable as means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

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6.3.13 An uninsulated high-voltage live part and its support shall be secured to a 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 acceptable values. See Spacings, High-Voltage Circuits, Section 20. Friction between surfaces is not acceptable as a means to prevent shifting or turning of a live part, but a lock washer as described in 6.3.12 is acceptable.

6.3.14 Flammable or electrically conductive thermal or acoustical insulation shall not contact uninsulated high-voltage live parts. See 45.2.1.

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7 Enclosures

7.1 General

7.1.1 Enclosures shall be formed and assembled so that they will have the strength and rigidity necessary to resist the abuses to which they may be subjected without increasing the risk of fire or injury to persons due to total or partial collapse with the resulting reduction of spacings, loosening or displacement of parts, or other serious defects. Enclosures for individual electrical components, outer enclosures, and combinations of the two are considered in determining compliance with this requirement.

7.1.2 Among the factors that are taken into consideration when evaluating an enclosure are:

a) Mechanical strength,

b) Resistance to impact, and

c) Resistance to corrosion.

In addition to these factors, a nonmetallic enclosure or part of an enclosure is evaluated for:

a) Moisture-absorption properties,

b) Flammability, and

c) Resistance to distortion at temperatures to which the material may be subjected under conditions of use.

For a nonmetallic enclosure or part of an enclosure, all of these factors are considered with respect to aging.

7.1.2.1 A nonmetallic outer enclosure or part of an outer enclosure shall have a flame spread index (FSI) of not more than 200 when tested in accordance with the Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723.

Exception No. 1: If the total unbroken surface area is 25 square feet (2.32 m^2) or less, a material having a FSI of not more than 200 when tested in accordance with the radiant panel method in the Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E162-1990 can be used.

Exception No. 2: If the total unbroken surface area is 10 square feet (0.93 m^2) or less, a material having a flammability rating of HB, V-0, V-1, V-2, or 5V in accordance with the Standard for Tests for Flammability of Plastics Materials for Parts in Devices and Appliances, UL 94, can be used.

7.1.2.1 revised December 1, 1998

7.1.2.2 For the purpose of the requirement in 7.1.2.1, the surface area is considered to be broken if there is an air gap at least 12 inches (305 mm) wide or a metallic material at least 12 inches wide between sections of nonmetallic material.

7.1.2.2 added September 24, 1996

7.1.2.3 Additional flammability tests may be needed on nonmetallic outer enclosure materials if internal wiring is not enclosed by means such as conduit, electric metallic tubing, metal raceways or control boxes. See Internal Wiring and Wiring Methods, Section 9.

7.1.2.3 added September 24, 1996

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7.1.3 The enclosure(s) of a water cooler shall prevent mechanical damage to wiring, electrical components, and refrigerant tubing.

7.1.4 The enclosure shall reduce the risk of molten metal, burning insulation or flaming particles, falling through bottom openings onto flammable material, including surfaces over which the water cooler is mounted.

7.1.4.1 Electrical components, such as controls, solenoids, starting relays, and switches, shall be individually enclosed, except for terminals, unless it can be determined that failure of a component will not result in a risk of fire. See Burnout Test – Components, Section 42.

7.1.4.1 added September 24, 1996

7.1.5 In accordance with 7.1.4, openings in the bottom of a water cooler are to be located or provided with barriers or baffles to reduce the risk of molten metal, burning insulation or flaming particles from falling out of the enclosure. Also see 9.3.2 and 15.14 – 15.16.

Exception No. 1: Small openings are exempt from this requirement if:

a) No such opening has an area greater than 0.049 square inch (31.6 mm^2),

b) Such openings are not located within 2 inches (50.8 mm) of each other, and

c) The total area of such openings does not exceed 1 percent of the bottom surface area.

Exception No. 2: Openings in finned tube refrigeration coils that form part or all of the bottom closure of the water cooler are exempt from this requirement if the density and configuration of the fins are such that the coil will not permit passage of a 3/32-inch (2.4-mm) diameter rod.

7.1.6 A built-in water cooler shall be constructed and assembled to reduce the risk of the emission of molten metal, burning insulation or flaming particles into the wall space or the area beneath the water cooler.

7.1.7 The requirement of 7.1.6 necessitates the use of totally enclosed fan motors and complete enclosures for controls, starting relays, capacitors, and other electrical components, including the wiring, unless these parts are installed in an overall enclosure provided with the built-in unit. Such an enclosure shall have:

a) No ventilating openings which will permit the entrance of a 3/8 inch (9.5 mm) diameter rod,

b) All ventilating openings located or provided with a barrier, baffle, or louver to reduce the risk of the expulsion of molten metal, burning insulation or flaming particles, and

c) A nonflammable solid bottom without openings. Knockouts for entrance of electrical conduit and plumbing may be provided.

7.1.8 A built-in water cooler shall have necessary ventilating grilles furnished with the water cooler.

7.1.9 A sheet metal enclosure is evaluated with respect to its size, shape, metal thickness and use in the particular application. Sheet steel shall have a thickness of not less than 0.026 inch (0.66 mm) if uncoated or 0.029 inch (0.74 mm) if galvanized. Nonferrous sheet metal shall have a thickness of not less than 0.036 inch (0.91 mm).

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7.1.10 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.

7.1.11 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or if an equivalent construction is employed, there shall be not less than three nor more than five threads in the metal, and the construction of the device shall be such that a conduit bushing can be properly attached. If threads for the connection of conduit are not tapped all the way through a hole in an enclosure wall, conduit hub, or the like, there shall be not less than 3-1/2 threads in the metal, and there shall be a smooth, rounded inlet hole for the conductors which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing and which shall have an internal diameter approximately the same as that of the corresponding trade size of rigid conduit.

7.1.12 A knockout in a sheet metal enclosure shall be secured in place, but shall be capable of being removed without deformation of the enclosure that would result in damage to electrical components, reduction in electrical spacings, or both.

7.1.13 A knockout shall remain in place when a force of 10 pounds (44.5 N) is applied at right angles to the knockout by a 1/4 inch (6.4 mm) diameter mandrel with a flat end. The mandrel shall be applied at the point most likely to cause movement of the knockout.

7.1.14 A knockout shall be provided with a flat surrounding surface for seating of a conduit bushing and shall be located so that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated high-voltage live parts and the bushing of less than those required by this standard.

7.1.15 In measuring a spacing between an uninsulated high-voltage live part and a bushing installed in a knockout, it is to be assumed that a bushing having the dimensions indicated in Table 7.1 is in place, in conjunction with a single locknut installed on the outside of the enclosure.

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Table 7.1
Knockout or hole sizes and dimensions of bushings

Trade size of conduit,		Knockout or hole diameter,		Bushing dimensions			
				Overall diameter,		Height,	
inches	(mm O.D.)	inches	(mm)	inches	(mm)	inches	(mm)
1/2	(21.3)	7/8	(22.2)	1	(25.4)	3/8	(9.5)
3/4	(26.7)	1-3/32	(27.8)	1-15/64	(31.4)	27/64	(10.7)
1	(33.4)	1-23/64	(34.5)	1-19/32	(40.5)	33/64	(13.1)

7.1.16 Steel enclosures shall be protected against corrosion by metallic or nonmetallic coatings such as plating or painting. See 7.3.1 – 7.3.6.

7.2 Doors and covers

7.2.1 Service covers or panels in the outer enclosure shall require the use of tools for removal or shall be provided with an interlocking mechanism if they give access to unenclosed uninsulated high-voltage live parts or moving parts.

7.2.2 An interlocking mechanism which:

a) Must be engaged in the closed position of the cover before parts are energized and

b) Will secure the cover in the closed position when engaged,

is considered to comply with 7.2.1.

7.2.3 A hinged or pivoted panel or cover shall be positioned or arranged so that when it is in an open position to facilitate servicing, it is not subject to falling or swinging due to gravity or vibration so as to cause injury to persons from the panel or cover, from moving parts or from uninsulated high-voltage live parts.

7.2.4 The assembly shall be arranged so that an overcurrent protective device, such as a fuse, can be replaced and manual-reset devices can be reset without removing parts other than a service cover(s) or panel(s), and the cover or door enclosing the device.

7.2.5 A required protective device shall not be accessible from outside the enclosure without opening a door or cover.

Exception: The operating handle of a circuit breaker, the reset button of a manually resettable motor protector, the reset button of a manually resettable pressure switch, and similar parts may project outside the enclosure.

7.2.6 An opening in an outer enclosure around a handle, reset button, or other control member is acceptable if the clearance between the control member and the edge of the opening is not more than 1/8 inch (3.2 mm) for any setting or position of the control member.

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7.2.7 Covers for enclosures of fuses in high-voltage circuits shall be hinged. Covers for manual-reset overload protective device enclosures shall be hinged if it is necessary to open the cover to reset the device.

Exception: A hinged cover is not required where the only fuses enclosed are:

a) Supplementary type control circuit fuses, provided the fuses and control circuit loads, other than a fixed control circuit load such as a pilot lamp, are within the same enclosure, or

b) Supplementary type fuses of 2 amperes or less for small auxiliary resistance heaters, such as crankcase heaters, with a maximum rating of 100 watts (W),

c) An extractor-type fuse with its own enclosure, or

d) Fuses in low-voltage circuits.

7.2.8 Hinged covers, where required, shall not depend solely upon screws or other similar means to hold them closed, but shall be provided with a latch or the equivalent.

7.2.9 A spring latch, magnetic latch, dimple, or any other mechanical arrangement that will hold the door in place and will require some effort on the user's part to open it is considered to be a means for holding the door in place as required in 7.2.8. When provided as the sole means for securing the cover or panel, a cover interlocking mechanism as described in 7.2.2 is considered to comply with 7.2.8.

7.2.10 A door or cover giving direct access to fuses in other than low-voltage circuits shall shut closely against a 1/4 inch (6.4 mm) rabbet or shall have either turned flanges for the full length of four edges or angle strips fastened to it. Flanges or angle strips shall fit closely with the outside of the wall of the box proper and shall overlap the edges of the box not less than 1/2 inch (12.7 mm). A special construction, such as a fuse enclosure, located within an outer enclosure, or a flange and rabbet combination which affords the equivalent protection is acceptable.

7.2.11 Strips used to provide rabbets, or angle strips fastened to the edges of a door, shall be secured at not less than two points, not more than 1-1/2 inches (38.1 mm) from each end of each strip and at points between these end fastenings, not more than 6 inches (152.4 mm) apart.

Table 7.2
Protection against corrosion

Type of cabinet and enclosure	0.053 inch (1.35 mm) and heavier as specified by paragraph	Lighter than 0.053 inch (1.35 mm) as specified by paragraph
Outer cabinets which protect motors, wiring, or enclosed current carrying parts	7.3.3	7.3.4
Inner enclosures which protect current carrying parts other than motors	7.3.3	7.3.4
Outer cabinets which are the sole enclosure of current carrying parts	7.3.4	7.3.4

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7.3 Enclosures exposed to weather

7.3.1 Sheet steel cabinets and electrical enclosures exposed to the effects of weathering shall be protected against corrosion as specified in Table 7.2 or by other metallic or nonmetallic coatings which provide equivalent protection.

7.3.2 7.3.1 is not applicable to a metal part, such as a decorative grill, which is not required for conformance with this standard.

7.3.3 To comply with 7.3.1, one of the following coatings shall be used:

a) Hot-dipped, mill-galvanized sheet steel conforming with the Coating Designation G60 or A60 in Table 1 of the Standard for Steel Sheet, Zinc-Coated by the Hot-Dip Process, ASTM A525-91, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in the ASTM Specification. The weight of zinc coating may be determined by any suitable method, but in case of question, the weight of coating shall be established in accordance with the Test Method of the Standard for the Weight of Coating on Zinc-Coated Iron or Steel Articles, ASTM A90-81. An A60 (alloyed) coating shall also comply with 7.3.5.

b) A zinc coating, other than that provided on hot-dipped, mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00041 inch (0.0104 mm) on each surface with a minimum thickness of 0.00034 inch (0.0086 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 52. An annealed coating shall also comply with 7.3.5.

c) Two coats of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on both surfaces. The suitability of the paint may be determined by consideration of its composition or by corrosion tests.

7.3.4 To comply with 7.3.1, one of the following coatings shall be used:

a) Hot-dipped, mill-galvanized sheet steel conforming with the Coating Designation G90 in Table 1 of ASTM A525-90 with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirements in the ASTM Specification. The weight of zinc coating may be determined by any suitable method, but in case of question, the weight of coating shall be established in accordance with the Test Method of ASTM A90-81.

b) A zinc coating, other than that provided on hot-dipped, mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00061 inch (0.0155 mm) on each surface with a minimum thickness of 0.00054 inch (0.0137 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 52. An annealed coating shall also comply with 7.3.5.

c) A cadmium coating of not less than 0.001 inch (0.025 mm) in thickness on both surfaces. The thickness of coating shall be established by the Metallic Coating Thickness Test, Section 52.

d) A zinc coating conforming with 7.3.3 (a) or (b) with one coat of outdoor paint as specified in 7.3.3 (c).

e) A cadmium coating of not less than 0.00075 inch (0.0191 mm) in thickness on both surfaces with one coat of outdoor paint on both surfaces or of not less than 0.0005 inch (0.013 mm) in thickness on both surfaces with two coats of outdoor paint on both surfaces. The thickness of the cadmium coating shall be established by the Metallic Coating Thickness Test, Section 52, and the paint shall be as specified in 7.3.3 (c).

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7.3.5 An annealed zinc coating which is bent or similarly formed after annealing shall additionally be painted in the bent or formed area if the bending or forming process damages the zinc coating. If flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification, the zinc coating is considered damaged. Simple sheared or cut edges and punched holes are not considered to be formed, but extruded and rolled edges and holes are to conform with this requirement.

7.3.6 With reference to 7.3.1, other finishes, including paints, special metallic finishes, and combinations of the two, may be accepted when comparative tests with galvanized sheet steel without annealing, wiping, or other surface treatment conforming with 7.3.3(a) or 7.3.4(a), as applicable, indicate they provide equivalent protection. Among the factors which are taken into consideration when judging the suitability of such coating systems are exposure to salt spray, moist carbon dioxide-sulphur dioxide-air mixtures, moist hydrogen sulphide-air mixtures, ultraviolet light, and water.

7.3.7 Nonferrous enclosures may be employed without special corrosion protection. See 7.1.2.

7.3.8 Where gaskets are required to seal electrical enclosures against the entrance of rain and condensate, they shall be held in place by mechanical fasteners or adhesives, except as indicated in 7.3.9, and shall comply with the requirements of 51.1 – 51.5. Sealing compounds required to seal electrical enclosures shall comply with the requirements of 51.6. Adhesives required to secure gaskets shall comply with the requirements of 51.7. Gaskets shall be neoprene, rubber, or thermoplastic. Other materials may be used if they have equivalent properties.

7.3.9 Gaskets which are prevented from displacement either by their location or placement of other components in the enclosure when the cover is removed and which would be reengaged in the intended manner when the cover is replaced are not required to beheld by mechanical fasteners or adhesives. Consideration shall be given in the intended mounting of the gasket in the application.

8 Field Supply Connections

8.1 General

8.1.1 A plug fuseholder in a water cooler intended to be connected to a 125- or a 125/250-volt, 3-wire circuit shall be wired in the unidentified (ungrounded) conductor with the screw shell connected toward the load.

8.1.2 A single-pole switching device shall not be connected to the identified (grounded) conductor.

Exception: An automatic control which does not have a marked OFF position is not required to comply with this requirement.

8.2 Permanently connected water coolers

8.2.1 Water coolers of the following types shall have provision for permanent connection to the power supply:

a) Any remote or built-in type.

b) Any unit which has a total marked rating exceeding a 16-ampere load.

c) Any unit rated in excess of 250 volts.

d) All polyphase units.

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8.2.2 With reference to 8.2.1(b), the largest sum of concurrent loads shown on the nameplate is used to determine the total marked rating.

8.2.3 As used in 8.2.4 – 8.2.20, field-wiring connections are considered to be the terminals or leads to which power supply, control, or equipment grounding connections will be made in the field when the water cooler is installed.

8.2.4 A water cooler shall have provision for connection of one of the wiring systems that in accordance with the National Electrical Code, ANSI/NFPA 70-1993, would be acceptable for it.

8.2.5 A knockout for connection of a field-wiring system to a field-wiring compartment shall accommodate conduit of the trade size determined by applying Table 8.1.

Table 8.1
Trade size of conduit (mm O.D.)

Wire size,		Number of wires, inches (mm OD)									
AWG	(mm^2)	2		3		4		5		6	
14	(2.1)	1/2	(21.3)	1/2	(21.3)	1/2	(21.3)	1/2	(21.3)	1/2	(21.3)
12	(3.3)	1/2	(21.3)	1/2	(21.3)	1/2	(21.3)	3/4	(26.7)	3/4	(26.7)
10	(5.3)	1/2	(21.3)	1/2	(21.3)	1/2	(21.3)	3/4	(26.7)	3/4	(26.7)
8	(8.4)	3/4	(26.7)	3/4	(26.7)	3/4	(26.7)	1	(33.4)	1	(33.4)

NOTE – This table is based on the assumption that all conductors will be of the same size and there will be no more than six conductors in the conduit. If more than six conductors will be involved of if all of them are not of the same size, the internal cross-sectional area of the smallest conduit that may be used is determined by multiplying by 2.5 the total cross-sectional area of the wires, based on the cross-sectional area of Type THW wire.

8.2.6 The location of a terminal box or compartment in which power supply connections are to be made shall be such that these connections may be inspected after the water cooler is installed. The connections are to be accessible without removing parts other than a service cover or panel and the cover of the outlet box or compartment in which the connections are made.

8.2.7 A terminal compartment intended for the connection of a supply raceway shall be secured in position and shall be prevented from turning.

8.2.8 The water cooler shall be provided with field-wiring terminals or leads for the connection of conductors having an ampacity of not less than that indicated in 58.11. It is assumed that branch circuit conductors rated 140EF (60EC) will be used.

8.2.9 A field-wiring terminal shall be prevented from turning or shifting in position by means other than friction between surfaces. This may be accomplished by such means as two screws or rivets; by square shoulders or mortises; by a dowel pin, lug, or offset; or by a connecting strap or clip fitted into an adjacent part.

8.2.10 For No. 8 AWG (8.4 mm^2) conductors, pressure wire connectors shall be used. For No. 10 AWG (5.3 mm^2) and smaller conductors, the parts to which wiring connections are made may consist of clamps or wire binding screws with cupped washers, terminal plates, or the equivalent to hold the wire in position.

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8.2.11 A wire binding screw at a field-wiring terminal shall not be smaller than No. 8 (4.2 mm diameter), except that a No. 6 (3.5 mm diameter) screw may be used for the connection of one No. 14, 16, or 18 AWG (2.1, 1.3, or 0.82 mm^2) conductor.

8.2.12 It should be noted that according to the National Electrical Code, ANSI/NFPA 70-1993, No. 14 AWG (2.1 mm^2) is the smallest conductor which the installer may use for branch circuit wiring and thus is the smallest conductor that may be anticipated at a terminal for the connection of a power supply wire.

8.2.13 A terminal plate for a wire binding screw shall be of metal not less than 0.030 inch (0.76 mm) in thickness for a No. 14 AWG (2.1 mm^2) or smaller wire and not less than 0.050 inch (1.27 mm) in thickness for a wire larger than No. 14 AWG, and in either case there shall be not less than two full threads in the metal.

8.2.14 A terminal plate formed from stock having the minimum required thickness may have the metal extruded at the tapped hole for the binding screw to provide two full threads, except that two full threads are not required if a lesser number of threads results in a connection in which the threads will not strip with normal tightening torque in accordance with the values indicated in the Standard for Wire Connectors and Soldering Lugs for Use With Copper Conductors, UL 486A.

8.2.15 Upturned lugs or a cupped washer shall be capable of retaining a conductor of the size mentioned in 8.2.8 and 58.11, but no smaller than No. 14 AWG (2.1 mm^2), under the head of the screw or the washer.

8.2.16 A wire binding screw shall thread into metal.

8.2.17 A field-wiring terminal intended for the connection of a grounded conductor shall be of a metal or plated with a metal distinguishable from the other terminals, or proper identification of that terminal shall be shown in some other manner, such as on an attached wiring diagram. A lead intended for the connection of a grounded conductor shall be finished to show a white or natural gray color, shall be readily distinguishable from other leads, and no other lead shall be so identified.

8.2.18 The 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: The lead may be less than 6 inches (152 mm) in length if it is evident that the use of a longer lead might result in damage to the lead insulation.

8.2.19 Leads intended for connection to an external circuit shall be provided with strain relief if stress on the lead may be transmitted to terminals, splices, or internal wiring. See 8.3.8.

8.2.20 Leads provided for spliced connections to an external high-voltage circuit shall not be connected to wire binding screws or pressure wire connectors located in the same compartment as the splice unless the screws or connectors are rendered unusable for field-wiring connections or the leads are insulated at the unconnected ends.

8.3 Cord connected water coolers

8.3.1 Equipment intended for cord connection to the supply shall be provided with:

a) A non-detachable power supply cord for connection to the supply by means of a plug, or

b) An appliance inlet for connection of a detachable power supply cord and either a detachable power supply cord or instructions for selection of a suitable detachable power supply cord.

8.3.1. revised September 24, 1996

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8.3.2 The marked rating of a cord connected water cooler, see 59.1, is not to exceed 80 percent of the rating of the attachment plug.

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8.3.3 Cord-connected water coolers shall employ grounding-type attachment-plugs. Refer to Table 8.2 for configurations that comply with ANSI.

Exception: Equipment rated 250 Volts or less and intended for connection to circuits rated:

a) Other than 60 hertz;

b) Other than the voltages specified in the first column of Table 30.1; or

c) Both,

may employ a grounding-type attachment plug acceptable for the circuit involved.

8.3.3 revised September 24, 1996

8.3.4 A cord connected water cooler may employ Type S, SO, ST, STO, SJ, SJO, SJT, SJTO, SP-3, or SPT-3 power supply cord rated for use at a voltage not less than the rated voltage of the water cooler. The ampacity of the cord as given in the National Electrical Code, ANSI/NFPA 70-1993, shall be not less than that required by the ampere input measured in the Temperature and Pressure Test, Section 33.

Table 8.2
Grounding-type attachment plugs

Attachment-plug rating, amperes	volts	ANSI designation[a]
15	125	C73.11-1972
20	125	C73.12-1972
15	250	C73.20-1972
20	250	C73.51-1972

[a] As part of the standard for plugs and receptacles, C73-1973 series.

8.3.5 A power supply cord for an outdoor-use water cooler shall be Type SO, SJO, or equivalent cords which are resistive to the effects of sunlight and low temperatures. Such cords are identified by suffix letters "W" or "W-A" following their type designation.

8.3.5 revised December 1, 1998

8.3.6 The length of the power supply cord shall be not more than 10 feet nor less than the lengths indicated below.

a) Not less than 6 feet (1.83 m) for bottle-type water coolers.

b) Not less than 4 feet (1.22 m) for freestanding, pressure-type water coolers.

c) Not less than 1-1/2 feet (457 mm) for wall-hung, pressure-type water coolers.

The length is measured between the attachment plug and any point at which the cord exits the water cooler cabinet or the last strain relief, whichever is shorter.

Revised 8.3.6 effective March 24, 1998

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8.3.7 The power supply cord shall be provided with strain relief means so that a stress on the cord will not be transmitted to terminals, splices, or internal wiring. If a metallic strain relief means is provided, it shall not contact uninsulated high-voltage live parts or reduce spacings within the enclosure if the cord is moved inward. The cord shall not be subject to damage by moving parts if it can be moved inward.

8.3.8 To determine the adequacy of the strain relief means required by 8.2.19 or 8.3.7, a 35 pounds-mass (15.9 kg) weight is to be suspended on the lead or cord, as applicable, and supported by the water cooler so that the strain relief means will be stressed from any angle which the design of the water cooler permits. The load is to be applied for 1 minute. The strain relief is not acceptable if there is such movement of the lead or cord as to indicate that stress would have resulted on the connections.

8.3.9 The edges of the entry hole for the power supply cord, including the cord entry hole in a bushing, shall be smooth and rounded without burrs, fins, or sharp edges which might damage the cord insulation. The power supply cord shall be routed to prevent damage to the cord insulation.

8.4 Grounding

8.4.1 A water cooler shall be provided with means for grounding:

a) In a permanently connected water cooler, an equipment grounding terminal or lead.

b) In a cord-connected water cooler, an equipment grounding conductor shall be in the cord.

8.4.2 On a permanently connected water cooler, a terminal solely for connection of an equipment grounding conductor shall be capable of securing a conductor of the size required for the particular application in accordance with the National Electrical Code, ANSI/NFPA 70-1993.

8.4.3 A soldering lug, a push-in, a screwless connector, or a quick connect or similar friction fit connector shall not be used for a grounding terminal intended for the connection of field supply connections or for the grounding wire in a supply cord.

8.4.4 On a permanently connected water cooler, a wire binding screw intended for the connection of an equipment grounding conductor shall have a green colored head that is hexagonal, slotted, or both. Except as indicated in 8.4.5, a pressure wire connector intended for connection of such a conductor shall be plainly identified such as by being marked G, GR, GROUND, or GROUNDING, or by a marking on a wiring diagram provided on the water cooler. The wire binding screw or pressure wire connector shall be secured to the frame or enclosure of the water cooler and shall be located so that it is unlikely to be removed during normal service operations such as replacing fuses, resetting manual-reset devices, or oiling motors.

8.4.5 If a pressure wire connector intended for grounding is located where it could be mistaken for the neutral conductor of a grounded supply, it shall be identified by a marking EQUIPMENT GROUND and/or with a green color identification.

8.4.6 On a permanently connected water cooler, the surface of an insulated lead intended solely for the connection of an equipment grounding conductor shall be finished in a continuous green color or a continuous green color with one or more yellow stripes, and no other lead shall be so identified.

8.4.7 On a cord connected water cooler, the grounding conductor of the flexible cord shall be finished with a continuous green color or with a continuous green color with one or more yellow stripes, and no other conductor shall be so identified. The grounding conductor shall be secured to the frame or enclosure of the water cooler by a positive means, see 11.5, that is not liable to be removed during any servicing operation not involving the power supply cord. The grounding conductor shall be connected to the grounding blade of the attachment plug.

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9 Internal Wiring And Wiring Methods

9.1 General

9.1.1 A water cooler shall employ conductors of not less than No. 18 AWG (0.82 mm^2) size except for short integral leads of small electrical components, such as relay coils and clock motors.

9.1.2 Wiring which is color coded green or green with one or more yellow stripes shall be used only for grounding conductors. Wiring used for other purposes shall not be identified with the above color codes.

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