



UL 621

Underwriters Laboratories Inc. Standard for Safety

Ice Cream Makers



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UL Standard for Safety for Ice Cream Makers, UL 621

Sixth Edition, Dated May 27, 2005

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Standard for Ice Cream Makers

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INTRODUCTION

1 Scope

1.1 These requirements cover unitary ice cream makers designed for connection to alternating current circuits rated not more than 600 volts. For the purposes of this standard, ice cream makers include equipment for preparing products such as hard ice cream, soft serve ice cream, milk shakes, and sherbets and may include means for dispensing the product directly into containers.

1.2 Ice cream makers covered by these requirements employ sealed (hermetic type) motor compressors and air-cooled or water-cooled condensers.

1.3 These ice cream makers are intended to be installed in accordance with the National Electrical Code, NFPA 70, and the Safety Standard for Refrigeration Systems, ASHRAE 15.

2 General

2.1 Terminology

2.1.1 The term "ice cream maker" refers to any equipment covered by this standard unless specifically noted otherwise.

2.2 Components

2.2.1 Except as indicated in 2.2.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

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- b) Is superseded by a requirement in this standard.

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

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

2.3 Units of measurement

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

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 these requirements, the following definitions apply.

3.2 ACCESSORY – An optional electrical device or other component, intended for installation in or connection to an ice cream maker for the purpose of modifying or supplementing the functions of the ice cream maker. It may be factory installed or intended for installation by the user or service personnel.

3.3 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 alternating current, 42.4 volts peak or direct current, and supplied by:

- 1) A primary battery,
- 2) A standard Class 2 National Electrical Code, NFPA 70, transformer, or
- 3) A combination of a transformer and fixed impedance that, as a unit, complies with all performance requirements for a Class 2 National Electrical Code, NFPA 70, transformer.

3.4 SELF-CONTAINED ICE CREAM MAKER – Unitary equipment consisting of a complete factory-assembled and factory-tested refrigerating system in which all of the refrigerant-containing parts are permanently connected at the factory.

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

3.6 UNITARY ICE CREAM MAKER – Equipment consisting of a complete factory-assembled and factory-tested refrigerating system comprising one or more assemblies that:

- a) May be shipped separately, but
- b) Are intended to be used together.

CONSTRUCTION

4 General

4.1 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.

4.2 Lead base paints, cadmium, antimony, bismuth, and similar toxic materials shall not be employed on parts that come in contact with the ingredients or end-product of an ice cream maker.

5 Assembly

5.1 General

5.1.1 If an ice cream maker is provided in more than one assembly, the separate assemblies shall be constructed to be used together, and the requirements of this standard are based on the use of matched assemblies. Interconnection of the assemblies shall result in a complete factory-charged refrigerating system.

5.1.2 An ice cream maker incorporating a condensing unit of the pull-out type shall be constructed so that the condensing unit can be pulled out and reinserted without kinking or otherwise damaging the refrigerant tubing; and without pinching, abrading, or stressing electrical wires and cords.

5.1.3 An ice cream maker shall be assembled so that removal and replacement of tanks and containers, replenishment of the product, and the like, will not result in damage to electrical components and wiring, or to refrigerant-containing components.

5.1.4 An ice cream maker having provision for the storage of product cylinders or the like shall be provided with means for securely retaining the cylinders in position.

5.2 Pressurized product system

5.2.1 All parts of a product system pressurized by a pump or by compressed gas provided with an ice cream maker shall comply with the requirement of 52.1.9 or 52.1.10.

5.2.2 A gas pressure regulator or reducing valve shall:

- a) Comply with the requirements of 2.2, or
- b) Be tested for the application.

5.2.3 A pressure-relief valve shall be installed in the gas pressurized product system of the ice cream maker. There shall be no shutoff valve between the relief valve and any parts of the system under pressure. See 52.1.9.

Exception: A pressure relief valve is not required provided:

- a) *The system consists only of tubing, or hose, or both, with or without dispensing valves,*
- b) *The ice cream maker is marked in accordance with 59.24, and*

c) The system complies with the strength requirement of 52.1.9.

5.3 Mechanical protection

5.3.1 A slideout product storage component, such as a drawer or shelf shall be restrained to prevent its being unintentionally pulled free of supporting means. See Component Restraint Test, Section 54.

5.3.2 Electrical components shall be located or enclosed so that live parts will not be wetted by liquids due to accumulation, overflow, splashing, leakage, or cleaning.

5.3.3 A drippage or drain pan shall be constructed and located so that overflow due to a blocked drain will not wet live parts or film-coated wire.

5.3.4 An overflow spout, drain hole, cutout, or the like, in the drippage or drain pan may be acceptable for preventing dripping of liquid on electrical parts. The Overflow Test, Section 41, is to be conducted if it is not evident that the ice cream maker complies with the requirements of 5.3.3.

5.3.5 A switch, lampholder, an attachment-plug receptacle, or similar component, shall be secured in position and shall be prevented from rotating. See 5.3.6.

Exception No. 1: The requirement that a switch be prevented from rotating will be waived upon compliance with all of the following conditions:

a) The switch shall 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 rotate 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) Electrical spacings shall not be reduced below the minimum required values if the switch rotates.

d) Operation of the switch is by mechanical means rather than direct contact by persons.

Exception No. 2: A lampholder of a type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning if rotation cannot reduce electrical spacings below the minimum acceptable values. See Spacings, Sections 25 and 26.

5.3.6 The means for preventing rotation mentioned in 5.3.5 is to consist of more than friction between surfaces. A toothed lock washer that provides both spring takeup and an interference lock is acceptable as means for preventing a small stem-mounted switch or other device intended for single-hole mounting from rotating.

5.3.7 An uninsulated current-carrying part, or a part that supports a live part, shall be secured to the base or mounting surface so that it will be prevented from turning or shifting in position if such motion may result in a reduction of electrical spacings below the minimum acceptable values. See Spacings, Sections 25 and 26. 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 5.3.6 is acceptable.

5.3.8 Flammable or electrically conductive thermal or acoustical insulation shall not contact uninsulated live parts. See Insulation Resistance Test, Section 49.

6 Accessibility Of Uninsulated Live Parts, Film-Coated Wire, Moving And Hot Parts

6.1 Uninsulated live parts, film-coated wire, moving parts, and hot parts shall be guarded or enclosed. Except as indicated in 6.2 or 6.4, such parts are considered to be enclosed when:

- a) An opening has a minor dimension (see 6.7) less than 1 inch (25.4 mm), and such a part or wire is not contacted by the probe illustrated in Figure 6.1, and
- b) An opening has a minor dimension of 1 inch (25.4 mm) or more, such a part or wire is spaced from the opening as specified in Table 6.1.

Exception: A product fill or discharge opening located in the front of a dispensing type ice cream maker is considered to comply when:

- a) The diameter of the opening is less than 2-1/2 inches (63.5 mm) or the maximum diagonal dimension of the opening is less than 3 inches (76.2 mm),*
- b) The distance from a moving part that can cause injury to persons to the nearest edge of the plane of the opening is at least 4 inches (101.6 mm),*
- c) The opening is closed except when filling or discharging the product, and*
- d) A warning marking, as described in 59.18, is located on the ice cream maker.*

6.2 Moving parts that are necessarily exposed to perform the work function are not required to be enclosed but, where necessary, shall be provided with guarding. The degree of protection shall be based upon the construction and intended use of the machine.

6.3 In accordance with 6.2 the extent of guarding shall be based on the following factors:

- a) The degree of exposure necessary to perform the intended function;
- b) The sharpness of the moving part;
- c) The likelihood of unintentional contact with the moving part;
- d) The speed of the moving part; and
- e) The risk:
 - 1) That a part of the body could be endangered; or
 - 2) That clothing could be entangled, resulting in injury to persons.

The above factors are to be considered with respect to both intended operation and reasonable foreseeable misuse of the machine.

Figure 6.1
Articulate probe with web stop

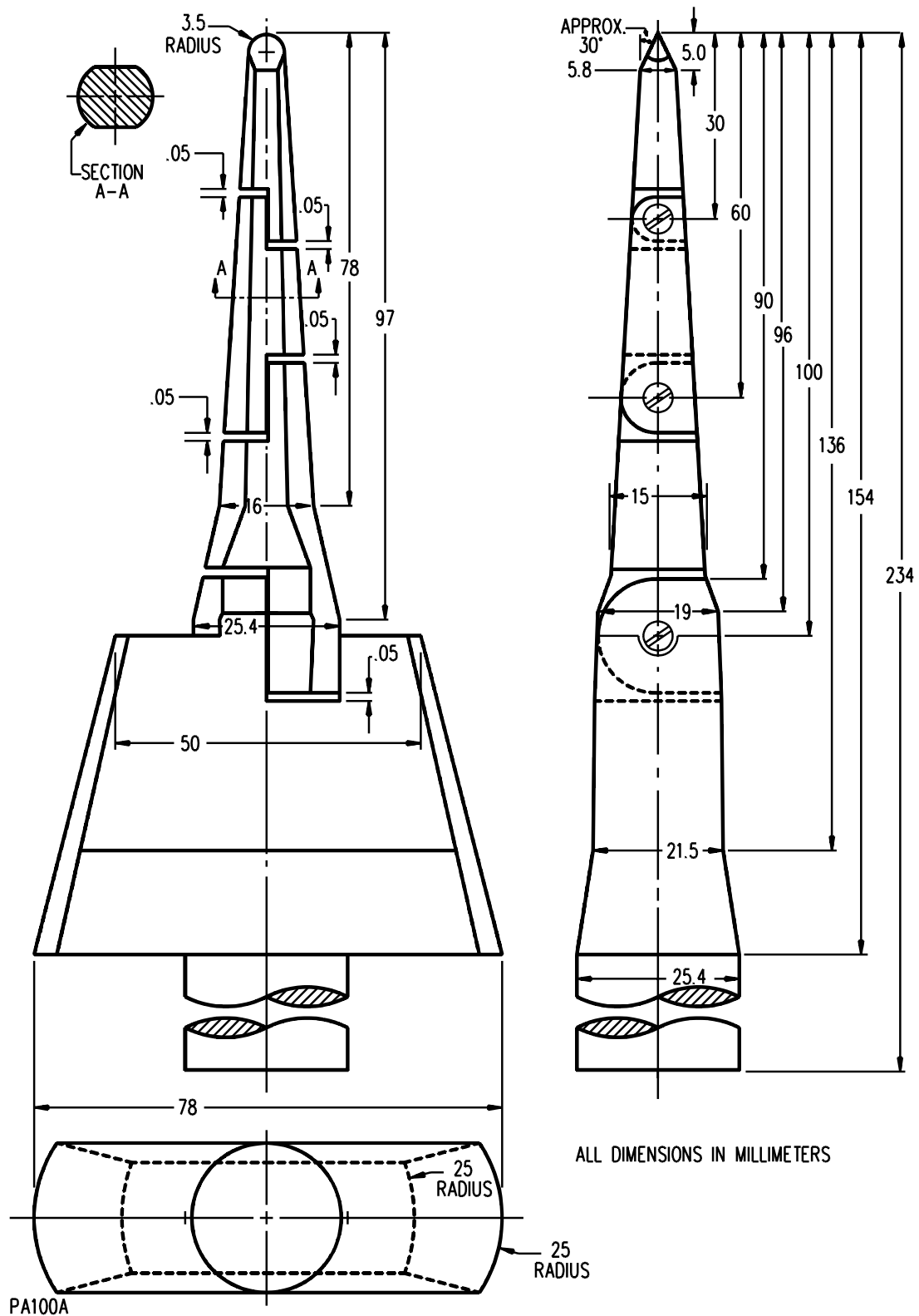


Table 6.1
Minimum acceptable distance from an opening to a part that may involve a risk of electric shock or injury to persons

Minor dimension ^a of opening,		Minimum distance from opening to part,	
inches	(mm) ^b	inches	(mm) ^b
3/4 ^c	(19.1)	4-1/2	(114.0)
1 ^c	(25.4)	6-1/2	(165.0)
1-1/4	(31.8)	8-1/2	(190.0)
1-1/2	(38.1)	10-1/2	(267.0)
2 ^e	(50.8)	14-1/2	(388.0)
2-1/4 ^d	(57.2)	16-1/2	(419.0)
2-1/2 ^d	(63.5)	18-1/2	(470.0)
2-3/4 ^d	(69.9)	20-1/2	(521.0)
3 ^d	(76.2)	22-1/2	(572.0)
Over 2 ^e	(over 50.8)	30	(762.0)

^a See 6.6.
^b For an opening between two of the values shown, the distance from the opening to the part shall be not less than that found by interpolation between the corresponding values shown in the applicable column.
^c Any dimensions less than 1 inch (25.4 mm) applies to a motor only.
^d These values apply to openings at the base of the ice cream makers where the upper edge of the opening is less than 8 inches (203 mm) above the floor. The ice cream maker shall be in its intended operating position.
^e More than 2 inches (50.8 mm), but not more than 3 inches (76.2 mm).

6.4 With regards to an integral enclosure of a motor:

- a) An opening that has a minor dimension (see 6.7) less than 3/4 inch (19.1 mm) is acceptable if:
- 1) A moving part cannot be contacted by the probe illustrated in Figure 6.2;
 - 2) Film-coated wire cannot be contacted by the probe illustrated in Figure 6.3;
 - 3) In a directly accessible motor (see 6.8), an uninsulated live part cannot be contacted by the probe illustrated in Figure 6.4; and
 - 4) In an indirectly accessible motor (see 6.8), an uninsulated live part cannot be contacted by the probe illustrated in Figure 6.2.
- b) An opening that has a minor dimension of 3/4 inch (19.1 mm) or more is acceptable if a part or wire is spaced from the opening as specified in Table 6.1.

Figure 6.2
Probe for moving parts and uninsulated live parts

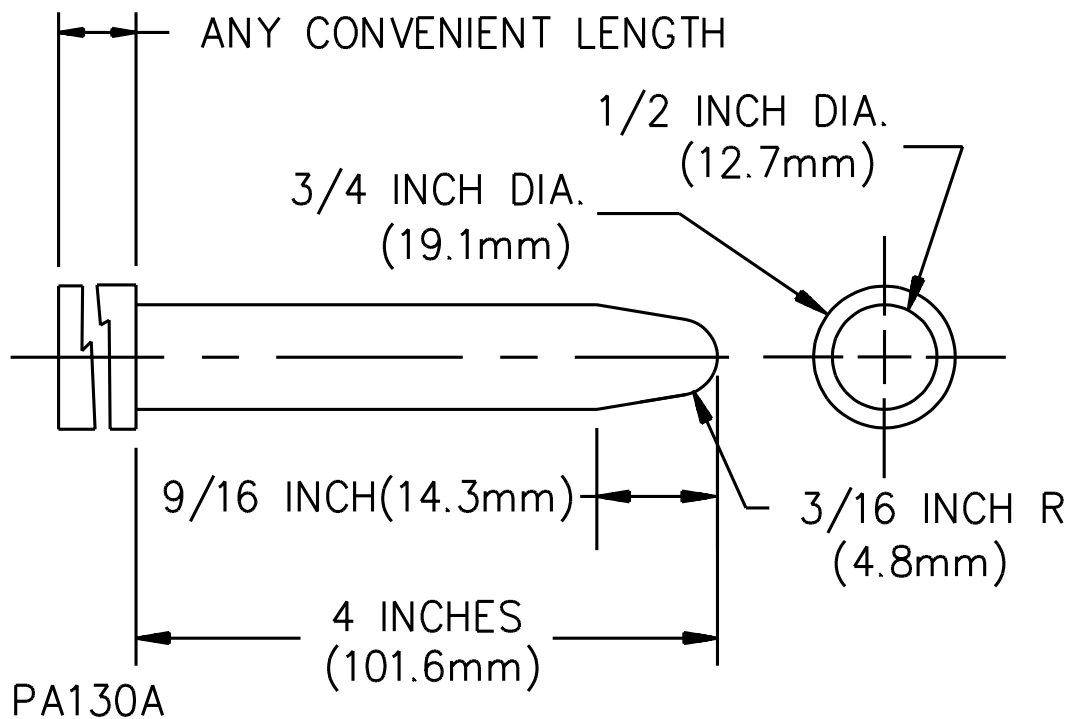


Figure 6.3
Probe for film-coated wire

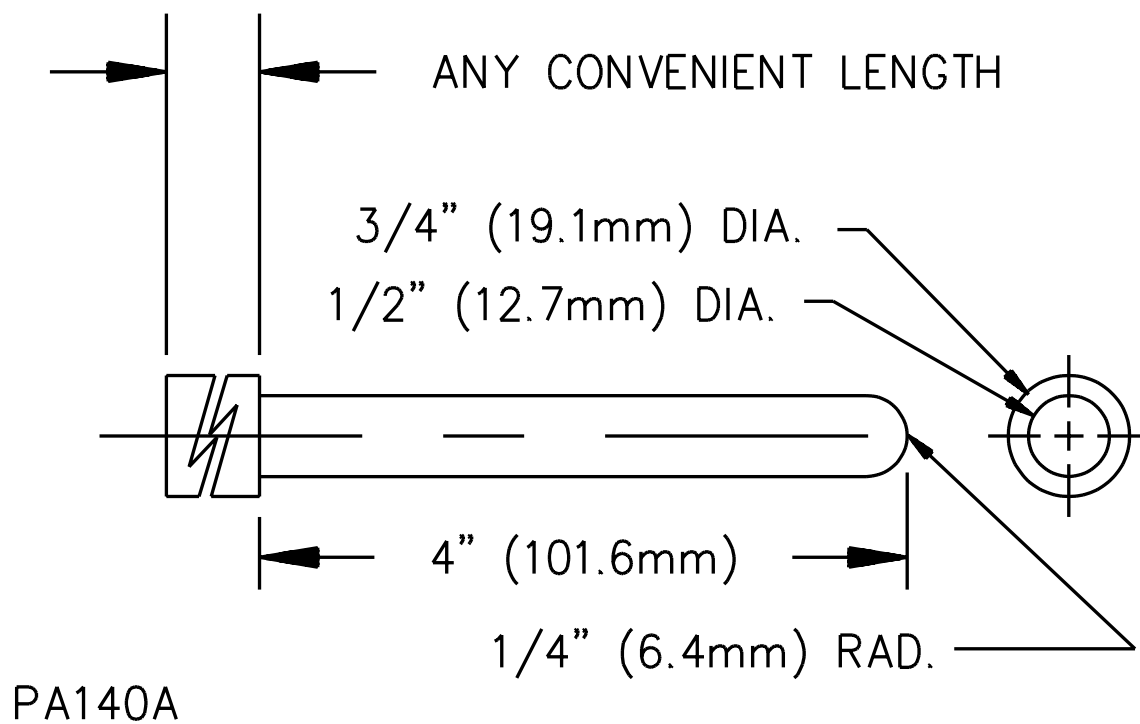
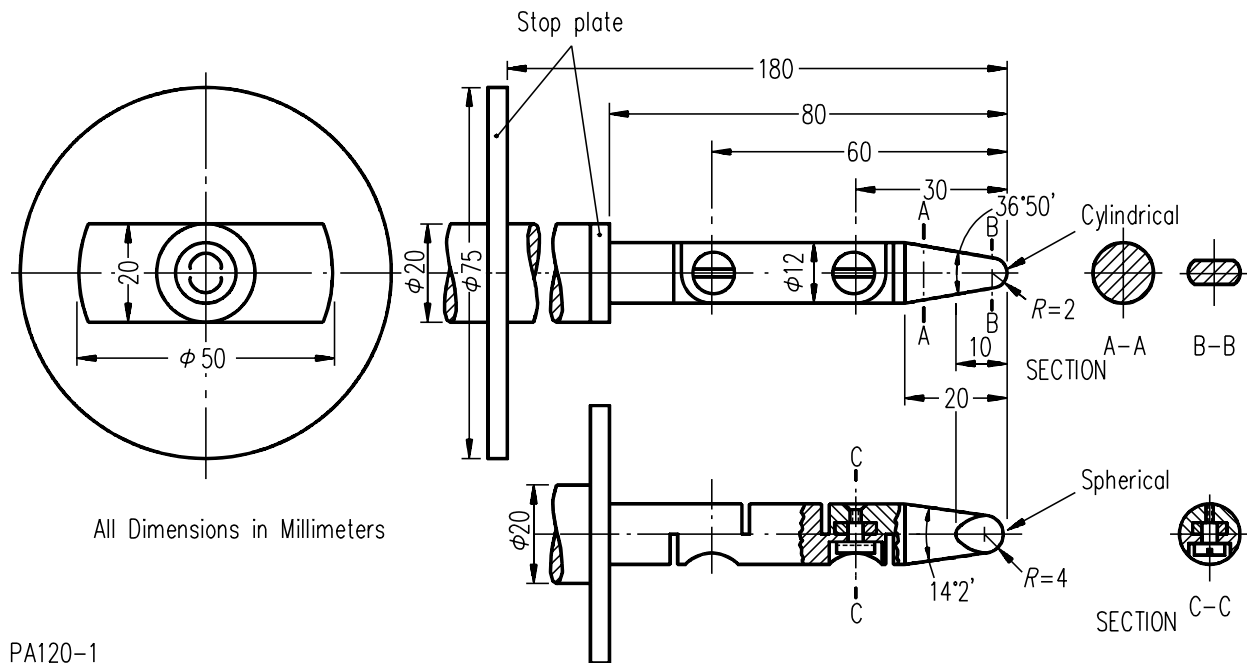


Figure 6.4
IEC articulate probe



PA120-1

6.5 The probes mentioned in 6.1 and 6.4 and illustrated in Figures 6.1 – 6.4 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 6.1 and 6.4 shall be applied in any possible configuration; and, if necessary, the configuration shall be changed after insertion through the opening.

6.6 The probe mentioned in 6.5 shall be used as measuring instruments to judge the accessibility provided by an opening, and not as instruments to judge the strength of a material; they shall be applied with the minimum force necessary to determine accessibility.

6.7 With reference to the requirement in 6.1 and 6.4, 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 with a 2-1/2 pound-force (11.1 N).

Exception: No force is applied to the probe to determine the minor dimension of openings in a motor.

6.8 With reference to the requirements in 6.4, an indirectly accessible motor is a motor:

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

A directly accessible motor is a motor:

- a) That can be contacted without opening or removing any part, or
- b) That is located so as to be accessible to contact.

6.9 During the examination of the ice cream maker to determine whether it complies with the requirements in 6.1 or 6.4, a part of the enclosure that may 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.

Exception: A freezing cylinder cover plate, that is, the plate in direct contact with the product chamber need not be opened or removed provided that:

- a) Moving parts within the freezing cylinder do not present the risk of injury due to pinching or shearing action with the cover plate removed, such as may occur with counter-rotating mixer blades,*
- b) Product dispensing openings through the cover plate comply with 6.1 with the cover plate in place, and*
- c) A warning marking, as described in 60.16 is located on or adjacent to the freezing cylinder cover plate where it will be visible before removal of the cover plate.*

6.10 With reference to the requirements in 6.1 and 6.4, insulated brush caps are not required to be additionally enclosed.

6.11 When tested according to the Temperature-Pressure Test, Section 38, surfaces that exceed the temperature rise of Table 38.1 D(2) and D(3) shall be guarded as specified in 6.1.

6.12 A moving or hot part is not to be considered when determining compliance with 6.1 and 6.4 if:

- a) The part is unlikely to be contacted through the opening because of the location of fixed components, including baffles, or
- b) The part is made inoperative when exposed, through the use of interlocking devices.

6.13 A live part is not to be considered when determining compliance with 6.1 and 6.4 if the part is made inoperative when exposed, through the use of interlocking devices.

6.14 Uninsulated high-voltage live parts located inside the enclosure that are likely to be contacted by persons performing operations such as refilling, relamping, replacing fuses, resetting manual-reset devices, oiling motors, or other such intended service operations, shall be located, guarded or enclosed, to reduce the risk of unintentional contact unless tools are required to expose the live part.

7 Accessories

7.1 An ice cream maker having provisions for the use of electrical accessories to be attached in the field shall comply with all requirements of this standard with or without the accessory installed.

7.2 Installation of accessories by the user shall be restricted to an arrangement that can be accomplished by means of receptacles and plug-in connectors.

7.3 Installation of accessories by service personnel shall be by means of receptacles, plug-in connectors, insulated wire connectors, or by connection to existing wiring terminals.

7.4 Installation of accessories shall not require the cutting of wiring or the soldering of connections by the installer. Installation shall not require cutting, drilling, or welding either in (1) electrical enclosures or (2) other areas where such operations may result in damage to electrical or refrigeration components and wiring within the enclosure.

7.5 Strain-relief means shall be provided for the wiring in the accessory if there is a possibility of transmitting stress to the terminal conditions during installation. See 9.4.10.

7.6 All terminals and wiring intended to be field connected shall be identified on the:

- a) Accessory,
- b) Ice cream maker if connections are made between the accessory and the ice cream maker, and
- c) Wiring diagram.

7.7 The mounting location of the accessory shall be indicated on the ice cream maker.

Exception: If the mounting location is fixed due to the function of the accessory and arrangement of the ice cream maker, and instructions are provided covering the installation and location for the accessory, the mounting location of the accessory need not be indicated on the ice cream maker.

7.8 As part of the investigation, accessories are to be trial-installed to determine that their installation is feasible, and that the instructions are detailed and correct.

8 Enclosures

8.1 General

8.1.1 An enclosure shall be formed and assembled so that it will have the strength and rigidity necessary to resist the conditions of intended use without total or partial collapse and the resulting reduction of spacings, loosening or displacement of parts, or other defects. Enclosures for individual electrical components, outer enclosures, and combinations of the two are to be considered in determining compliance with this requirement.

8.1.2 Among the factors that are taken into consideration when judging the acceptability of an enclosure are:

- a) Mechanical strength,
- b) Resistance to impact,
- c) Moisture-absorptive properties,
- d) Flame resistance,
- e) Resistance to distortion at temperatures to which the material may be subjected under conditions of use, and
- f) Resistance to corrosion.

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

8.1.3 The enclosure(s) of an ice cream maker shall reduce the risk of mechanical damage to wiring, electrical components, and refrigerant tubing.

8.1.4 The enclosure shall reduce the risk of emission of molten metal, burning insulation, flaming particles, or the like, through openings onto flammable material, including the surface over which the ice cream maker is mounted.

8.1.5 Components, such as controls, solenoids, starting relays, and switches, shall be individually enclosed except as terminals, unless it can be determined that malfunction of an electrical component will not result in:

- a) Emission of flame or molten metal from the ice cream maker, or
- b) Glowing or flaming of flammable material. See Burnout Tests – Components, Section 44.

Exception: Electrical parts within the outer cabinet need not be individually enclosed if the assembly complies with (a) – (c).

a) Their design and location with respect to openings in the outer cabinet will not result in the emission of flame or molten metal through openings in the cabinet, or if it can be shown that failure of the component would not result in:

- 1) Emission of flame or molten metal, or*

2) Glowing or flaming of flammable material.

b) There are no openings in the bottom of the compartment in which the part is located that would permit dropping of molten metal, or the like onto flammable material, and

c) The part is not in proximity to flammable material other than electrical insulation.

8.1.6 A sheet metal enclosure is to be evaluated with respect to its size, shape, metal thickness, and use in a particular application. Sheet steel shall be not less than 0.026 inch (0.66 mm) thick if uncoated or 0.029 inch (0.74 mm) thick if galvanized, and nonferrous sheet metal shall be not less than 0.036 inch (0.91 mm) thick, except for relatively small areas or for surfaces that are curved or corrugated or otherwise reinforced such as by angles, channels, flanges, or ribs.

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

8.1.8 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 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 that shall:

a) Afford protection to the conductor equivalent to that provided by a standard conduit bushing and

b) Have an internal diameter approximately the same as that of the corresponding trade size of rigid conduit.

8.1.9 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. See 8.1.10.

8.1.10 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.

8.1.11 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 live parts and the bushing of less than those required.

8.1.12 In measuring a spacing between an uninsulated live part and a bushing installed in a knockout, it is to be assumed that a bushing having the dimensions indicated in Table 8.1 is in place, in conjunction with a single locknut installed on the outside of the enclosure.

Table 8.1
Knockout or hole sizes and dimensions of bushings

Trade size of conduit, inches mm O.D.		Knockout or hole diameter, inches (mm)		Bushing dimensions			
				Overall diameter, inches (mm)		Height, 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)
1-1/4	42.3	1-23/32	(43.7)	1-15/16	(49.2)	9/16	(14.3)
1-1/2	48.3	1-31/32	(50.0)	2-13/64	(56.0)	19/32	(15.1)
2	60.3	2-15/32	(62.7)	2-45/64	(68.7)	5/8	(15.9)

8.1.13 Steel enclosures shall be protected against corrosion by metallic or nonmetallic coatings, such as plating or painting.

8.2 Doors and covers

8.2.1 A service cover or panel in the outer enclosure shall require the use of tools for removal or shall be provided with an interlocking mechanism if it gives access to unenclosed uninsulated live parts or moving parts that may cause injury to persons.

8.2.2 An interlocking mechanism that:

- 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 the requirements of 8.2.1.

8.2.3 A hinged or pivoted panel or cover shall be positioned or arranged so that when it is in an open position, it is not subject to falling or swinging due to gravity or vibration that can cause injury to persons from:

- a) The panel or cover,
- b) Moving parts, or
- c) Uninsulated live parts that can cause a risk of electric shock.

8.2.4 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:

- a) Without removing parts other than a service cover(s) or panel(s), and
- b) By opening the cover or door enclosing the device.

8.2.5 A required protective device shall not be accessible from outside the enclosure except by 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.

8.2.6 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.

8.2.7 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 that 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; or*
- c) An extractor-type fuse with its own enclosure; or*
- d) Fuses in low-voltage circuits.*

8.2.8 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.

8.2.9 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 acceptable for holding the door in place as required in 8.2.8. When provided as the sole means for securing the cover or panel, a cover interlocking mechanism as described in 8.2.2 is considered to comply with the requirements of 8.2.8.

8.2.10 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 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 that affords the equivalent protection is acceptable.

8.2.11 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 mm) apart.

9 Field Supply Connections

9.1 General

9.1.1 If an ice cream maker is intended to be connected to the conductor identified as the grounded conductor of a power-supply circuit, a lampholder with a screw-shell base shall be wired so that the screw shell will be connected to that conductor.

9.1.2 A single-pole switching device shall not be connected to the grounded conductor.

9.1.3 An automatic control that does not have a marked "OFF" position is not required to comply with 9.1.2.

9.2 Permanently connected ice cream makers

9.2.1 Ice cream makers of the following types shall have provision for permanent connection to the power supply:

- a) Units rated in excess of 250 volts.
- b) Units having a rated-load current as determined by the largest sum of concurrent loads shown on the nameplate exceeding 16 amperes.

Exception: An ice cream maker complying with 9.4.4 may employ a power supply cord.

- c) Units other than of the self-contained type.

9.2.2 As used in 9.2.3 – 9.3.12, field-wiring terminals are considered to be the terminals to which power supply, control, or equipment grounding connections will be made in the field when the ice cream maker is installed.

9.2.3 An ice cream maker shall have provision for connection of one of the wiring systems, in accordance with the National Electrical Code, NFPA 70, that would be acceptable for it.

9.2.4 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 9.1.

9.2.5 Space shall be provided in the field-wiring compartment or outlet box for installation of conductors of the number and size required by 9.2.8. The space provided shall permit the required number and size of at least 6-inch (150-mm) lengths of Type TW or THW wire to be brought into the wiring compartment. If necessary, a trial installation is to be made.

Exception: Conductors other than Type TW or THW may be used if specified in the installation instructions.

9.2.6 The location of a terminal box or compartment in which power supply connections are to be made shall permit these connections to be inspected after the ice cream maker 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.

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

9.2.8 The ice cream maker shall be provided with field-wiring terminals or leads for the connection of conductors having an ampacity of not less than that indicated in 60.12. It is to be assumed that branch circuit conductors rated 60°C will be used.

Table 9.1
Trade size of conduit in inches (mm OD)

Wire size,		Number of wires									
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)
6	(13.3)	3/4	(26.7)	1	(33.4)	1	(33.4)	1-1/4	(42.3)	1-1/4	(42.3)
4	(21.2)	1	(33.4)	1	(33.4)	1-1/4	(42.3)	1-1/4	(42.3)	1-1/2	(48.3)
3	(26.7)	1	(33.4)	1-1/4	(42.3)	1-1/4	(42.3)	1-1/2	(48.3)	1-1/2	(48.3)
2	(33.6)	1	(33.4)	1-1/4	(42.3)	1-1/4	(42.3)	1-1/2	(48.3)	2	(60.3)
1	(42.4)	1-1/4	(42.3)	1-1/4	(42.3)	1-1/2	(48.3)	2	(60.3)	2	(60.3)

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 or if all of them are not of the same size, the internal cross-sectional area of the smallest conduit that may be used is multiplying by 2.5 the total cross-sectional area of the wires, based on the cross-sectional area of type THW wire.

9.3 Terminals and leads

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

9.3.2 For 8 AWG (5.3 mm²) and larger conductors, pressure wire connectors shall be used. For 10 AWG (3.3 mm²) and smaller conductors, the parts to which wiring connections are to be made may consist of clamps or wire binding screws with cupped washers, terminal plates, or the equivalent to hold the wire in position.

9.3.3 A wire binding screw at a field-wiring terminal shall be not 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 14 AWG (2.1 mm²) or smaller conductor.

9.3.4 It should be noted that according to the National Electrical Code, NFPA 70, 14 AWG (2.1 mm²) is the smallest conductor that 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.

9.3.5 A terminal plate for a wire binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick for a 14 AWG (2.1 mm²) or smaller wire and not less than 0.050 inch (1.27 mm) thick for a wire larger than 14 AWG. In either case, there shall be not less than two full threads in the metal.

9.3.6 A terminal plate formed from stock having the minimum required thickness may have the metal extruded at the hole tapped for the binding screw to provide two full threads.

Exception: Two full threads are not required if a lesser number of threads results in a connection in which the threads will not strip when tightened in accordance with the torques indicated in the Standard for Wire Connectors, UL 486A-486B, as applicable.

9.3.7 Upturned lugs or a cupped washer shall retain a conductor of the size mentioned in 9.2.8 and 60.12, but no smaller than 14 AWG (2.1 mm²), under the head of the screw or the washer.

9.3.8 A wire binding screw shall thread into metal.

9.3.9 A field-wiring terminal intended for the connection of a grounded conductor shall be made of, or plated with, a metal substantially white in color and shall be readily distinguishable from the other terminals, or 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 gray color, shall be readily distinguishable from other leads, and no other lead shall be so identified.

9.3.10 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 in length if it is evident that the use of a longer lead may result in damage to the lead insulation.

9.3.11 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 9.4.9.

9.3.12 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.

9.4 Cord-connected ice cream makers

9.4.1 An ice cream maker intended for cord connection to the power supply shall be equipped with a flexible cord having a grounding conductor of acceptable ampacity and with a grounding-type attachment plug. See 9.4.3.

9.4.2 The marked rating of a cord-connected ice cream maker, see 61.1, shall not exceed 80 percent of the rating of the attachment plug.

9.4.3 On a cord-connected ice cream maker, provision for a drain connection or connection to a water supply shall require the use of flexible tubing only. The supply cord shall employ an attachment plug that complies with the American National Standards designated in Table 9.2.

Exception: Ice cream makers 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 34.1, or*
- c) Both, may employ a grounding-type attachment plug acceptable for the circuit involved.*

9.4.4 An ice cream maker rated over 16 amperes may be provided with a supply cord if it is intended to be moved for cleaning and if the ice cream maker complies with 9.4.4 (a) – (c).

- a) The ice cream maker is of the self-contained type (see 3.4),
- b) The ice cream maker is permanently equipped with castors,
- c) The electrical rating of the ice cream maker does not exceed 40 amperes, 250 volts.

9.4.5 The ampacity of a power supply cord on a ice cream maker intended for connection to a branch circuit which exceeds the limitations specified in 16.6 shall be not less than 80 percent of the maximum continuous current of the motor-compressor determined in accordance with Compressor Protective Device, Section 51, plus the sum of all other loads, including accessories, which may operate concurrently.

Exception: The ampacity of the power supply cord need not be greater than the ampere rating of the attachment plug.

Table 9.2
Attachment plugs

Nameplate rating			Attachment plug	
Volts	Phase	Amperes ^a	Rating	ANSI designation ^b
110 – 120	1	12.0	15 amperes, 125 volts	5-15P
110 – 120	1	16.0	20 amperes, 125 volts	5-20P
110 – 120	1	24.0	30 amperes, 125 volts	5-30P
110 – 120	1	40.0	50 amperes, 125 volts	5-50P
200 – 240	1	12.0	15 amperes, 250 volts	6-15P
200 – 240	1	16.0	20 amperes, 250 volts	6-20P
200 – 240	1	24.0	30 amperes, 250 volts ^c	6-30P
200 – 240	1	40.0	50 amperes, 250 volts ^c	6-50P
110 – 120/200 – 240	1	12.0	15 amperes, 125/250 volts	14-15P
110 – 120/200 – 240	1	16.0	20 amperes, 125/250 volts	14-20P
110 – 120/200 – 240	1	24.0	30 amperes, 125/250 volts ^c	14-30P
110 – 120/200 – 240	1	40.0	50 amperes, 125/250 volts ^c	14-50P
200 – 240	3	12.0	15 amperes, 250 volts	15-15P
200 – 240	3	16.0	20 amperes, 250 volts	15-20P
200 – 240	3	24.0	30 amperes, 250 volts ^c	15-30P
200 – 240	3	40.0	50 amperes, 250 volts ^c	15-50P

^a Ampere rating is maximum permitted to be marked on ice cream maker nameplate for attachment plug indicated. See 9.4.2.

^b Standard for wiring devices – dimensional requirements, NEMA WD6.

^c 30 and 50 ampere attachment plugs permitted on ice cream makers intended only to be moved for cleaning as specified in 9.4.4.

9.4.6 A cord-connected ice cream maker shall employ a Type S, SO, SOO, ST, STO, STOO, SJ, SJE, SJO, SJOO, SJT, SJTO, or SJTOO power-supply cord having a voltage rating not less than that of the ice cream maker. The ampacity of the cord, as given in the National Electrical Code, NFPA 70, shall not be less than that required by the ampere input measured in the Temperature and Pressure Test, Section 38. The ampere input value shall include the loads for convenience outlets and the current drawn by accessories intended for use with the ice cream maker.

9.4.7 The length of a power-supply cord shall be no less than 4 feet (1.2 m) nor more than 10 feet (3.05 m). The length is to be measured between the attachment plug and:

- a) Any point at which the cord exits the ice cream maker cabinet or
- b) The last strain relief, whichever is shorter.

9.4.8 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 the strain relief is metallic, it shall not contact uninsulated 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.

9.4.9 To determine the acceptability of the strain relief means, a 35-pound (15.9-kg) weight is to be suspended on the cord and supported by the ice cream maker so that the strain relief means will be stressed from any angle that the design of the ice cream maker permits. The load is to be applied for 1 minute. There shall be no movement of the cord as to indicate that stress would have been transmitted to the cord connections.

9.4.10 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 that might damage the cord insulation. The power-supply cord shall be routed to reduce the risk of damage to the cord insulation.

9.4.11 An ice cream maker shall have provision for grounding as follows:

- a) For a permanently connected ice cream maker, there shall be an equipment grounding terminal or lead.
- b) For a cord-connected ice cream maker, there shall be an equipment grounding conductor in the power-supply cord terminating in an identified grounding terminal. See 9.4.15.

9.4.12 A terminal intended solely for the connection of an equipment-grounding conductor shall be capable of securing a conductor of the size required by the National Electrical Code, NFPA 70.

9.4.13 A soldering lug, a push-in connector, a screwless connector, or a quick connector or similar friction-fit connector shall not be used for the grounding terminal.

9.4.14 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. 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 ice cream maker. The wire binding screw or pressure wire connector shall be secured to the frame or enclosure of the ice cream maker and shall be located so that it is unlikely to be removed during service operations, such as replacing fuses, resetting manual-reset devices, or oiling motors.

9.4.15 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", by a green color identification, or by both.

9.4.16 On a permanently connected ice cream maker, 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.

9.4.17 On a cord-connected ice cream maker, 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 ice cream maker by a positive means, see 12.6, that is not likely 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.