

UL 982

ISBN 0-7629-1013-5

Motor-Operated Household Food Preparing Machines

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

UL Standard for Safety for Safety for Motor-Operated Household Food Preparing Machines, UL 982

Fifth Edition, Dated October 6, 2004

Revisions: This Standard contains revisions through and including October 22, 2004.

Summary of Topics

This revision of ANSI/UL 982 includes the clarification of an existing effective date of April 6, 2006 for paragraph 70.17.1 item (d).

Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The following table lists the future effective dates with the corresponding reference:

Future Effective Dates	References
December 1, 2004	Paragraphs 1.3, 5.15, 7.6, 11.1.12, 16.2.6, 17.8, 20.1.1, 21.1, 22.4, 24.4, 28.11, 30.9.4, 30.9.5, 31.3, 32.1, 32.6, 36.1.1, 36.5.3, 36.7.1, 36.11.1, 36.12.1, 36.14.1, 36.18.2, 36.19.1, 36.19.2, 36.23.1, 37.4, 39.3, 40.1, 40.2, 48.2, 58.5.1.3, 66.1.2, 66.1.3, 66.25.1, 68.3, 68.5, and 70.32.1 Tables 19.1, 31.1, 36.1, 36.2 Figures 32.1, 58.1 Sections 41, 42, 43,
April 6, 2006	Paragraphs 30.4.3, 70.2, 70.17.1(d) Exception to 60.4.1, Sections 44, 50, and 51

The requirements are substantially in accordance with UL's Bulletin(s) on this subject dated October 19, 2004. The bulletin(s) is now obsolete and may be discarded.

The revisions dated October 22, 2004 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfonet.ul.com/ulforeword.html>

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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 and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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

Page	Date
1	October 22, 2004
2-129	October 6, 2004
130	October 22, 2004
131-138	October 6, 2004
A1-A2	October 6, 2004
SR1-SR10	October 6, 2004

No Text on This Page

OCTOBER 6, 2004
(Title Page Reprinted: October 22, 2004)



ANSI/UL 982-2004

1

UL 982

Standard for Motor-Operated Household Food Preparing Machines

Prior to the first edition, the requirements for the products covered by this standard were included in the Standard for Motor-Operated Appliances, UL 73.

First Edition – January, 1975
Second Edition – May, 1979
Third Edition – February, 1989
Fourth Edition – February, 1995

Fifth Edition

October 6, 2004

The most recent designation of ANSI/UL 982 as an American National Standard (ANSI) occurred on September 16, 2004.

This ANSI/UL Standard for Safety, which consists of the Fifth edition with revisions through October 22, 2004 is under continuous maintenance, whereby each revision is ANSI approved upon publication. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Written comments are to be sent to UL-RTP Standard Department, 12 Laboratory Dr., P.O. Box 13995, Research Triangle Park, NC, 27709-3995.

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

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

ISBN 0-7629-1013-5

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INTRODUCTION

1 Scope

1.1 These requirements cover household motor-operated food preparing machines and kitchen accessories such as knife sharpeners and can openers, that are intended to be operated for short-periods of time resulting in cumulative use-time per year of less than 100 hours and that are for use in accordance with the National Electrical Code.

1.2 In the following text, a requirement that applies to one type of equipment coming within its scope, such as a blender, or mixer will be so identified by a specific reference in that requirement to the type of equipment involved. In the absence of such specific reference or if the term appliance is employed, it is to be understood that the requirement applies to all of the types of equipment covered by the standard.

1.3 These requirements cover cord-connected and permanently wired motor-operated appliances rated at a nominal 120 or 240 V including appliances supplied by low-voltage power supplies, and battery-operated appliances provided with battery chargers.

1.3 effective December 1, 2004

1.4 These requirements cover appliances for household use. The requirements in the Standard for Motor-Operated Commercial Food Preparing Machines, UL 763 are employed for the evaluation of appliances also intended for commercial application.

1.5 This standard does not cover sanitation, contamination, or noise aspects of these products. Reference to these items can be found in the Standard for Food, Drug and Beverage Equipment, ANSI/ASME F2.1.

1.6 An appliance employing a heating element is judged on the basis of its compliance with the requirements of this Standard, insofar as they apply and further appropriate requirements applicable to household cooking appliances.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

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

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

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

3 Units of Measurement

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

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

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

5.2 ATTENDED INTERMITTENT-DUTY HOUSEHOLD APPLIANCE – An appliance intended for infrequent and short-time use in residences and used only while attended. Food mixers and can openers are examples of this type of equipment.

5.3 CART – A stand – see 5.19 – provided with casters, wheels, rollers, or the like to make it mobile.

5.4 CASTER – A roller or swiveled wheel attached to a cart or stand that makes the cart or stand mobile.

5.5 CLOSED-TOP BLENDER CONTAINER – Food blending container with one opening that is used for securing the blade assembly.

5.6 COFFEE GRINDER – A motor operated appliance that crushes coffee beans into a powder by passing them through a system of closely fitting wheels or cones having serrated surfaces. This appliance will have an intake hopper and a discharge container.

5.7 COFFEE MILL – A motor operated appliance that chops coffee beans into a powder by means of a system of blades rotating at high speed.

5.8 COUNTER-SUPPORTED APPLIANCE – An appliance that is physically supported by a counter, table or bench during the performance of its intended electrically-operated functions, such as for a blender – blending, is to be considered a counter supported appliance. Reference is to be made to the specific product's Use and Care Literature in establishing the intended electrically-operated functions of the appliance.

5.9 DAMP LOCATION – Partially protected place or area where the appliance is either used or stored under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, barns, and cold-storage warehouses.

5.10 DRY LOCATION – A place or area where the appliance is either used or stored not normally subject to dampness or wetness. A location temporarily subject to dampness or wetness, as in the case of a building under construction, is included in this category.

5.11 ENCLOSURE – That part of the appliance that:

a) Renders inaccessible all or any parts of the equipment that may otherwise present a risk of electric shock; and/or

b) Reduces the likelihood of propagation of flame initiated by electrical disturbances occurring within.

5.12 FIXED APPLIANCE – An appliance that is fastened or otherwise secured at a specific location.

5.13 HAND-SUPPORTED APPLIANCE – An appliance that is physically supported by any part of the body of the user during the performance of its intended electrically-operated functions, such as for an electric knife – carving meat, is to be considered a hand-supported appliance. Reference is to be made to the specific product's Use and Care Literature in establishing the intended electrically-operated functions of the appliance.

5.14 INTERLOCK – A device or arrangement by means of which the functioning of one part is controlled by the functioning of another, for safety purposes.

5.15 LINE-VOLTAGE CIRCUIT – A circuit classified as line voltage for the purpose of this Standard is one involving a maximum potential of 250 V and having circuit characteristics in excess of those of a low-voltage circuit.

5.15 effective December 1, 2004

5.16 LOW-VOLTAGE CIRCUIT – A circuit classified as low voltage is one involving a peak open-circuit potential of not more than 42.4 V supplied by a primary battery, by a standard Class 2 transformer, or by a combination of a transformer and a fixed impedance which, as a unit, complies with all performance requirements for Class 2 transformers.

5.17 OPEN-TOP BLENDER CONTAINER – Food blending container with opening on the top provided with a separable cover.

5.18 PORTABLE APPLIANCE – An appliance that is actually moved or can easily be moved from one place to another in normal use. Some portable appliances, however, are not likely to be moved from one place to another in normal use.

5.19 STAND – A structure intended to support an appliance.

5.20 STATIONARY APPLIANCE – An appliance that is not easily moved from one place to another in normal use.

5.21 SUPPLEMENTARY OVERCURRENT PROTECTOR – A device designed to open the circuit automatically on a predetermined value of time versus current or voltage within the appliance. It is intended for use as overcurrent, or over- or under-voltage protection within the appliance where branch-circuit overcurrent protection is already provided.

5.22 WET LOCATION – A place or area where the appliance is either used or stored exposed to weather and unprotected.

CONSTRUCTION

6 General

6.1 An appliance shall employ materials that are intended for the particular use and shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

7 Frame and Enclosure

7.1 The frame and enclosure of an appliance shall be strong and rigid enough to resist the abuses likely to be encountered during normal service. The construction of the appliance shall preclude total or partial collapse with the attendant reduction of required minimum acceptable spacings, loosening or displacement of parts, and other serious defects which alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

7.2 An appliance shall be provided with enclosures of material acceptable for the particular application that shall house all electrical parts that may present a risk of fire or injury to persons under normal use and under reasonably foreseeable misuse.

7.3 Among the factors taken into consideration when an enclosure is being judged for acceptability are its:

- a) Physical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Combustibility;
- e) Resistance to corrosion; and
- f) Resistance to distortion at temperatures to which the enclosure may be subjected during conditions of normal or abnormal use.

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

7.4 The appliance enclosure shall house all moving parts except for those which need be exposed to perform their intended function, such as the beater blades to a mixer. See PROTECTION AGAINST PERSONAL INJURY.

7.5 Electrical parts of an appliance shall be so located or enclosed that protection against unintentional contact with uninsulated live parts will be provided.

7.6 The construction of an enclosure of a knife-sharpener (or a combination appliance having a knife-sharpening function, including an appliance provided with a mechanical sharpening block that is open to the motor or electrical compartment) shall preclude the drawing-in of filings developed during the sharpening function if such an event introduces a risk of fire or electric shock. See 39.3 – 39.5.

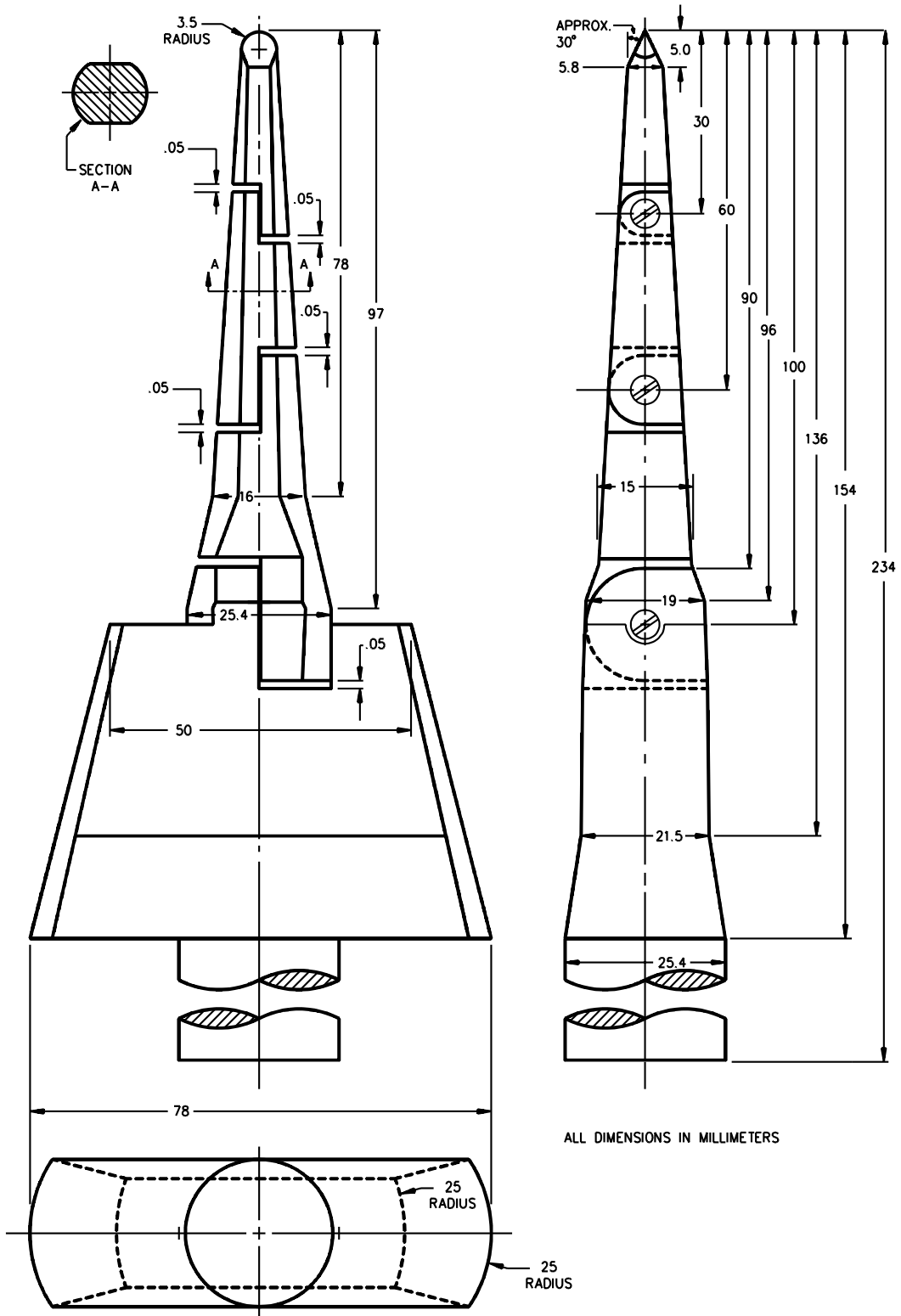
7.6 effective December 1, 2004

7.7 The construction of an appliance intended for outdoor use shall be such as to prevent water from coming into contact with uninsulated live parts when the appliance is subjected to a test to simulate conditions that might occur during actual use. See Resistance to Moisture Test, Section 45.

Exception: This requirement is not applicable if the appliance is marked in accordance with 66.18 for outdoor use type.

7.8 An opening smaller than 1 inch (25.4 mm) in an enclosure is acceptable if a probe, as illustrated in Figure 7.1 when inserted point first into an opening, cannot be made to touch any uninsulated live part or film-coated wire. The probe shall be applied in all possible articulated positions.

Figure 7.1
Probe



ALL DIMENSIONS IN MILLIMETERS

PA100A

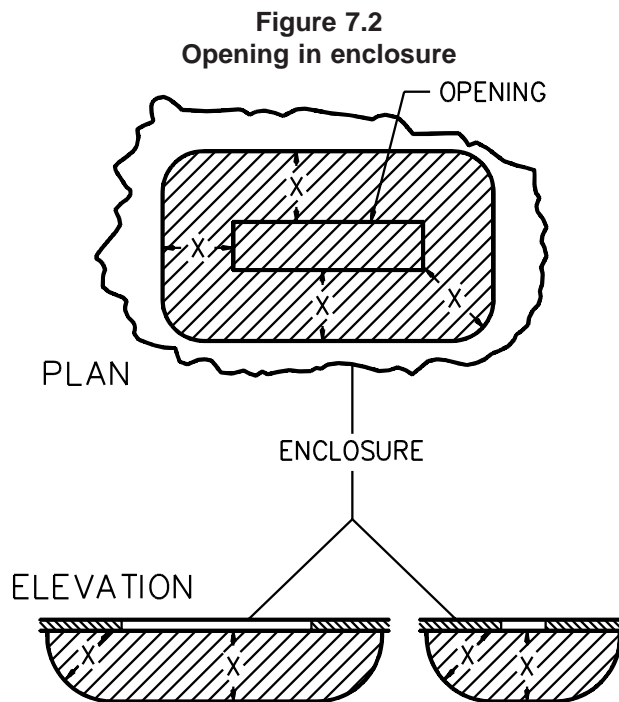
7.9 An opening provided for hanging or mounting an appliance shall be so located or guarded that a nail, hook, or the like does not displace a part that creates a risk of fire or electric shock and does not contact one of the following:

- a) An uninsulated live metal part;
- b) Magnet wire;
- c) Internal wiring;
- d) Moving parts; or
- e) Any other part likely to create a risk of fire or electrical shock.

7.10 An opening 1 inch (25.4 mm) or larger in an enclosure as illustrated in Figure 7.2 is acceptable if, within the enclosure, there is no uninsulated live part or magnet wire:

- a) Less than X distance from the perimeter of the opening; as well as
- b) Within the volume generated by projecting the perimeter X distance normal to its plane.

X equals 5 times the diameter of the largest diameter rod which can be inserted through the opening.



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7.11 During the examination of an appliance in connection with the requirements in 7.2– 7.5 any part of the enclosure is to be disregarded – that is, it will not be assumed that the part in question affords protection against electric shock or injury to persons – if it either:

- a) Must be opened or removed, with or without the use of tools, to perform manufacturer's recommended user servicing, maintenance, operating adjustments, attachment of accessories, or other instructions; or
- b) Can be opened or removed without the use of tools.

Exception: A part that requires a tool for opening or removal to perform manufacturer's recommended user servicing, maintenance, operating adjustments, attachment of accessories, or other instructions is to remain in place if the appliance is marked in accordance with 65.7.

7.12 The enclosure of an automatically controlled appliance shall prevent molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including the surface upon which the appliance is supported. See 16.2.2.

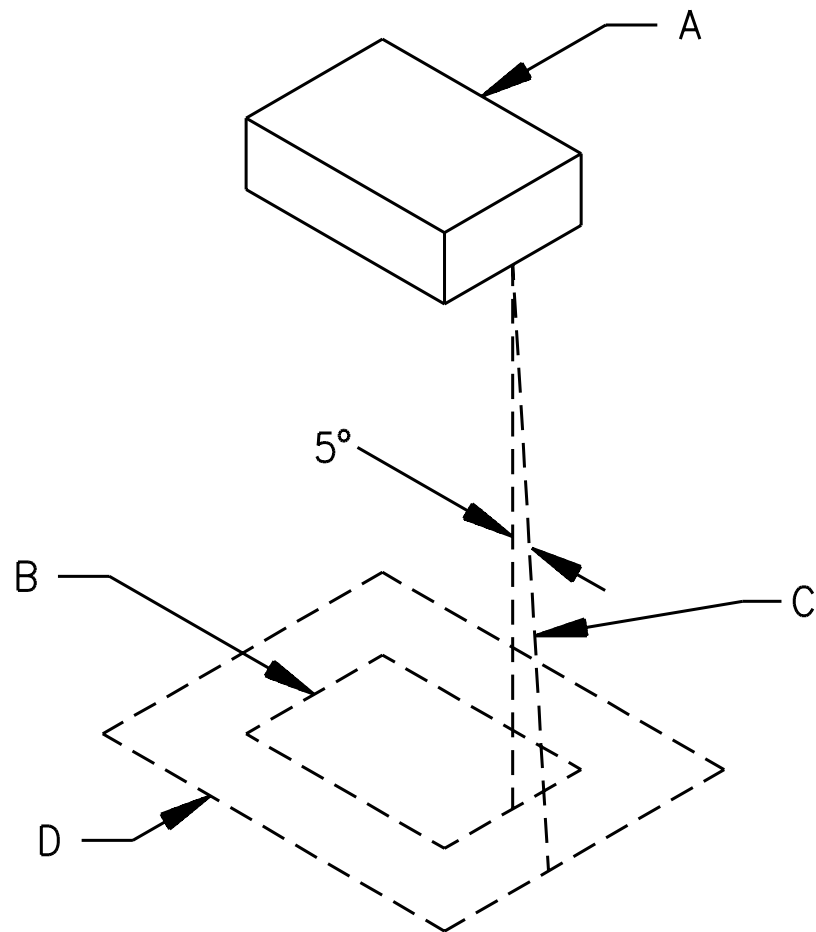
7.13 The requirement in 7.12 will necessitate the use of a barrier material that resists ignition:

- a) Under a motor unless:
 - 1) The structural parts of the motor or of the appliance provide the equivalent of such a barrier;
 - 2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the appliance when the motor is energized under each of the following fault conditions:
 - i) Open main winding;
 - ii) Open starting winding;
 - iii) Starting switch short-circuited; and
 - iv) For a permanent-split-capacitor motor the capacitor is short circuited. The short circuit is to be applied before the motor is energized and the rotor is to be blocked; or
 - 3) The motor is provided with a thermal motor protector (a protective device that is sensitive to temperature and current) that will prevent the temperature of the motor windings from becoming more than 125°C (257°F) under the maximum load under which the motor will run without causing the protector to cycle and from becoming more than 150°C (302°F) with the rotor of the motor locked; and
- b) Under wiring, unless it is neoprene- or thermoplastic-insulated.

It will also necessitate that a switch, relay, solenoid, or the like be individually and completely enclosed, except for terminals, unless it can be shown that malfunction of the component would not result in a possible fire or there are no openings in the bottom of the appliance enclosure.

7.14 The barrier mentioned in 7.13 shall be horizontal, shall be located as indicated in Figure 7.3, and shall not be an area less than that described in that illustration. Openings for drainage, ventilation, and the like may be employed in the barrier, provided that such openings would not permit molten metal, burning insulation or the like to fall on combustible material.

Figure 7.3
Location and extent of barrier



SA0604

Notes:

A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded, and will consist of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. When moving, the line is always:

- a) Tangent to the component;
- b) 5 degrees from the vertical; and
- c) So oriented that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

7.15 The arrangement and guarding of parts of an appliance shall permit easy and proper installation and removal of strainers, baskets, and the like that must be removed, cleaned, and refilled by the user. The removal and replacement of these vessels and their ingredients shall not result in damage to or contamination of wiring, electrical components, or other parts.

7.16 The assembly described in 7.15 shall be such as to minimize the likelihood of spillage on live parts, including magnet wire.

7.17 Cast- and sheet-metal portions of the enclosure shall not be thinner than indicated in Table 7.1 unless the enclosure is found to be acceptable when judged under considerations such as those mentioned in 7.3 and 7.18.

Table 7.1
Minimum acceptable thicknesses of enclosure metal

Enclosure metal	At small, flat, unreinforced surfaces and at surfaces that are reinforced by curving, ribbing, and the like (or are otherwise of a shape and/or size) to provide adequate physical strength		At surfaces to which a wiring system is to be connected in the field		At relatively large unreinforced flat surfaces	
	Inches	(mm)	Inches	(mm)	Inches	(mm)
Die-cast metal	3/64	1.2	–	–	5/64	2.0
Cast malleable iron	1/16	1.6	–	–	3/32	2.4
Other cast metal	3/32	2.4	–	–	1/8	3.2
Uncoated sheet steel	0.026 ^a	0.66 ^a	0.032	0.81	0.026	0.66
Galvanized sheet steel	0.029 ^a	0.74 ^a	0.034	0.86	0.029	0.74
Nonferrous sheet metal	0.036 ^a	0.91 ^a	0.045	1.14	0.036	0.91

^a Thinner sheet metal may be employed if found to be acceptable when the enclosure is judged under considerations such as those mentioned in 7.3 and 7.18.

7.18 In addition to being considered with reference to the factors mentioned in 7.3 an enclosure of sheet metal is to be judged with respect to its size, shape, and the thickness of metal considering the intended use of the appliance.

7.19 A cord-connected appliance that is provided with keyhole slots, notches, hanger holes, and the like for hanging on a wall shall be constructed in such a manner that the hanging means shall not be accessible without removing the appliance from the wall.

Exception: A separate wall mounted battery charger for use with an appliance shall comply with the requirements in the Standard for Battery Chargers for Charging Engine-Starter Batteries, UL 1236.

7.20 Cord connected wall-mounted appliances employing a permanently fastened mounting bracket shall be removable from the bracket without the use of a tool.

8 Overcurrent-Protective Devices

8.1 A protective device shall be wholly inaccessible from outside the appliance except that the operating handle of a circuit breaker, the operating button of a manually operable motor protector, and similar parts may project outside the appliance enclosure.

8.2 If an appliance is provided with a single-pole overcurrent protective device and is required to employ a polarized plug, the overcurrent protective device shall be connected to the ungrounded conductor of the power-supply cord of an appliance. Table 11.3 specifies the polarity identification of the power-supply cord conductors.

Exception: For portable, non-automatically starting appliances employing a motor rated 1-hp or less intended to be operated on a nominal 120 volts branch circuit and employing a plug rated at 15-amperes, an overcurrent protective device within the appliance is not prohibited from being located in either conductor of the power-supply cord, when the overcurrent protective device acts only as a supplementary overcurrent protector.

9 Mechanical Assembly

9.1 An appliance shall be so assembled that it will not be affected adversely by the vibration of normal operation. Brush caps shall be tightly threaded or otherwise designed to prevent loosening.

9.2 A switch, a lampholder, and attachment-plug receptacle, a motor-attachment plug, or similar components shall be mounted securely, and, except as noted in 9.3 and 9.4, shall be prevented from turning. See 9.5.

9.3 The requirement that a switch be prevented from turning may be waived if all four of the following conditions are met:

- a) The switch is to be of a plunger or other type that does not tend to rotate when operated (a toggle switch is considered to be subject to forces that tend to turn the switch during normal operation of the switch);
- b) The means for mounting the switch makes it unlikely that operation of the switch will loosen it;
- c) The spacings are not to be reduced below the minimum required if the switch rotates; and
- d) The normal operation of the switch is to be by mechanical means rather than by direct contact by persons.

9.4 A lampholder of the type in which the lamp cannot be replaced (such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel) need not be prevented from turning if rotation cannot reduce spacings below the minimum required values.

9.5 The means for preventing the turning mentioned in 9.2 is to consist of more than friction between surfaces – for example, a lock washer, properly applied, is acceptable as the means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

9.6 Small molded parts such as brush caps, shall be constructed to have the mechanical strength and rigidity to withstand the stresses of actual service. Brush caps shall be secured or located to be protected from mechanical damage which might result during normal use.

9.7 Receptacles mounted to and supported by a cover shall be secured by more than one screw or shall be a device assembly or box cover intended for securing by a single screw.

10 Protection Against Corrosion

10.1 Except as noted in 10.2, iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, if the failure of such unprotected parts would be likely to result in a condition that can cause risk of fire, electric shock or injury to persons.

10.2 In certain instances where the oxidation of iron or steel due to the exposure of the metal to air and moisture is not likely to be appreciable – thickness of metal and temperature also being factors – surfaces of sheet steel within an enclosure and the inside surface of sheet steel enclosures may not be required to be protected against corrosion. The requirement in 10.1 does not apply to bearings, cast-iron parts, laminations, and shafts or to minor parts of iron or steel as washers, screws, and the like.

11 Power Supply Connections – Cord-Connected Appliances

11.1 Cords and plugs

11.1.1 A cord-connected appliance (an appliance intended to be connected to the power-supply circuit by means of a flexible cord) shall be provided with an appropriate length of flexible cord and an attachment plug for connection to the supply circuit.

11.1.2 The flexible cord may be attached permanently to an appliance or may be in the form of a detachable power-supply cord with appropriate means for connection to the appliance. A hand-supported appliance employing a detachable power-supply cord shall include a positive means for retaining the appliance coupler body to the appliance during use. Typical retaining means may include a friction type fit coupled with a rib-type construction, snap-type fit or similar techniques. Friction type fit alone does not meet the intent of the requirement.

Exception No. 1: A hand-held appliance is not required to employ a retaining means if the supply voltage is 30 V (42 V peak) or less.

Exception No. 2: A hand-held appliance rated over 30 V (42 V peak) is not required to employ a retaining means if it complies with the requirements for Appliance Coupler Retention, Section 56.

11.1.3 Except as noted in 11.1.4, 11.1.5, and 11.1.6, the flexible cord provided on a portable, under-cabinet or wall-mounted appliance shall be Type HPN, SPT-2, SVO, SVT, SVTO, or shall be of a type at least equally as serviceable for the particular application including its resistance to oil for the particular application. Rubber insulated cords shall be an oil resistant type.

11.1.4 The flexible cord on a knife sharpener and on a battery-charger unit from which a battery-operated appliance is removed for use may be Type SPT-1.

11.1.5 A hand-supported product weighing 1.50 lb (0.68 kg) or less and having a power supply cord of the coiled type and a maximum extended length of 7.0 ft (2.1 m), may employ a Type SPT-1 cord, or shall be of a type at least equally as serviceable for the particular application including its resistance to oil.

11.1.6 A flexible cord on an appliance intended for outdoor use, shall be:

- a) An outdoor use type (suffix W); and
- b) At least a Type SJW or SJTW.

11.1.7 The flexible power-supply cord shall not be smaller than 18 AWG (0.82 mm²), shall be rated for use at a voltage not less than the rated voltage of the appliance, and shall have an ampacity as given in Table 400-5(A) of the National Electrical Code, ANSI/NFPA 70, not less than the current rating of the appliance. For reference purposes, an abbreviated table showing the ampacities for flexible cord with two current-carrying copper conductors is shown in Table 11.1.

Table 11.1
Ampacities for flexible cords

Conductor size		Ampacity (Amperes)
AWG	(mm ²)	
18	(0.82)	10
17	(1.04)	12
16	(1.31)	13
14	(2.08)	18
12	(3.31)	25

11.1.8 The power supply cord length shall be as outlined in Table 11.2.

Table 11.2
Power supply cord lengths

Type of appliance	Minimum acceptable length		Maximum acceptable length	
	Feet	Meters	Feet	Meters
Intended for outdoor use	6	1.82	—	—
Hand-supported ¹	5	1.52	—	—
Counter-supported	2	0.61	—	—
Floor-supported cart or stand	6	1.82	—	—
Wall-mounted	2	0.61	4.5 ²	1.4 ²

¹ See also 11.1.5.
² The cord may have a maximum length of 7 ft (2.1 m), if a means is provided for storing the excess length of cord.

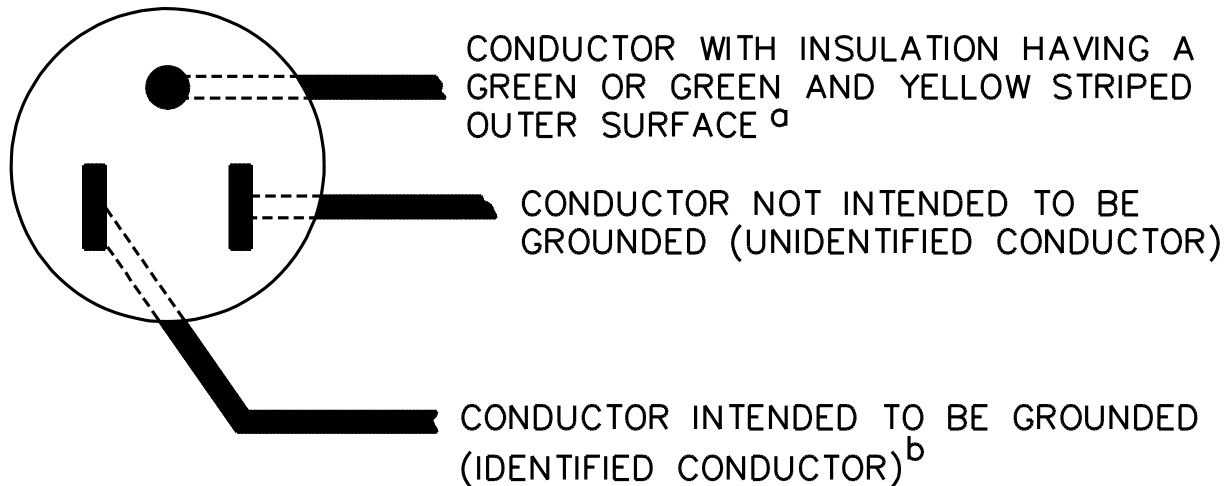
11.1.9 The attachment plug shall be of a type with a current rating not less than the rated current of the appliance, and the voltage rating equal to the rated voltage of the appliance.

11.1.10 The attachment plug of the power-supply cord of an appliance intended to be connected to a nominal 120 V circuit, and provided with a 15- or 20-ampere general-use receptacle shall be of the 3-wire grounding type. The attachment plug of the power-supply cord of an appliance provided with a manually operated, line-connected, single pole switch for appliance ON-OFF operation or an Edison-base lampholder shall be of the 2-wire polarized or 3-wire grounding type.

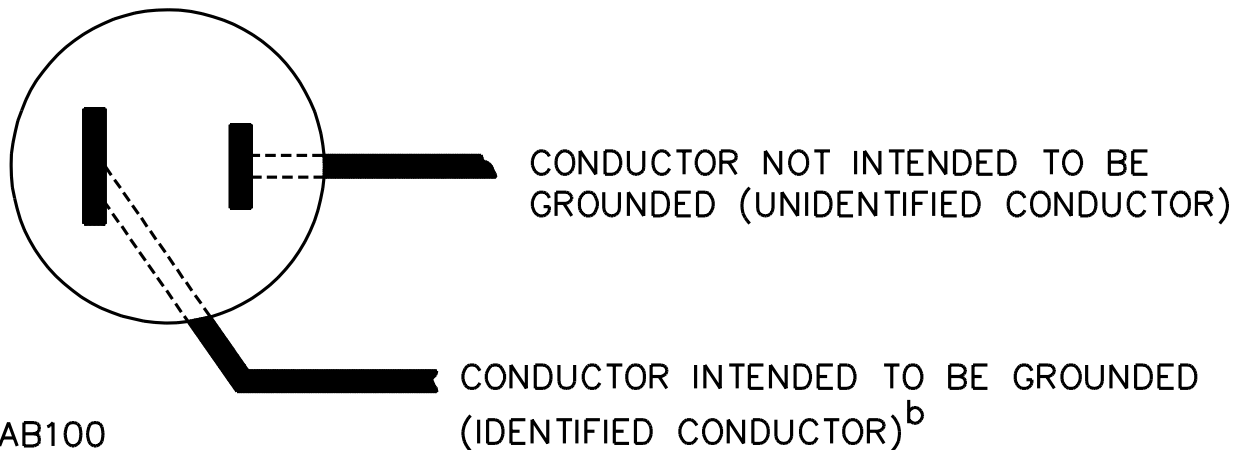
11.1.11 If a 3-wire grounding-type attachment plug or a 2-wire polarized attachment plug is provided on an appliance intended to be connected to a nominal 120 V circuit, the attachment plug connections shall comply with Figure 11.1 and the polarity identification of the flexible cord shall comply with Table 11.3.

Figure 11.1
Connection to attachment plugs

CONNECTIONS OF CORD CONDUCTORS TO GROUNDING – TYPE ATTACHMENT PLUG (FACE OF PLUG REPRESENTED)



CONNECTIONS OF CORD CONDUCTORS TO POLARIZED ATTACHMENT PLUG (FACE OF PLUG REPRESENTED)



^a The blade to which the green conductor is connected may have a U-shaped or circular cross section.

^b Signifies a conductor identified in accordance with Table 11.3.

Table 11.3
Polarity identification of flexible cords

Method of identification	Acceptable combinations		
		Conductor intended to be grounded ^{a, b}	All other conductors ^a
Color of braids on individual conductors	A	Solid white or gray– without tracer	Solid color other than white or gray – without tracer
	B	Color other than white or gray, with tracer in braid	Solid color other than white or gray – without tracer
Color of insulation on individual conductors	C ^c	Solid white or gray	Solid color other than white or gray
	C1 ^d	Solid light blue	Solid color other than light blue, white, or gray
Color of separators	D ^d	White or gray	Color other than white or gray
Other means	E ^e	Tin or other white metallic coating on all strands of the conductor	No tin or other white metallic coating on the strands of the conductor
	F ^e	A stripe, ridge, or groove on the exterior surface of the cord	

^a A conductor finished to show a green color with or without one or more yellow stripes or tracers is to be used only as an equipment grounding conductor.
^b The grounded (identified) conductor is the neutral supply conductor.
^c Only for cords – other than Types SP-1, SP-2, SPT-1, and SPT-2 – having no braid on any individual conductor.
^d For jacketed cord.
^e Only for Types SP-1, SP-2, SPT-1, and SPT-2 cords.

11.1.12 The attachment plug of the power-supply cord of an appliance shall have an ampacity not less than the rated current of the appliance, or the input current under maximum normal load conditions, whichever is greater, and a voltage rating not less than the rated voltage of the appliance. When an appliance is able to be adapted for use on two or more different values of voltage by field alteration of internal connections, the attachment plug provided with the appliance shall be rated for the voltage for which the appliance is connected when shipped from the factory.

11.1.12 effective December 1, 2004

11.1.13 The conductor of the power-supply cord that is intended to be grounded shall have the following items connected to it:

- a) The screw shell of an Edison-base lampholder; and
- b) The terminal or lead of a receptacle intended to be grounded.

Table 11.3 identifies the supply cord conductor intended to be grounded.

11.1.14 An appliance employing a polarized detachable power-supply cord shall not accommodate a non-polarized cord.

11.2 Pin terminals

11.2.1 An appliance intended for use with a detachable power-supply cord shall not be provided with terminal pins that will accommodate a standard flatiron or appliance plug.

11.2.2 If an appliance is provided with pin terminals, the construction of the appliance shall be such that live parts will not be exposed to unintentional contact both during and after normal placement of the intended female fitting on the pins.

11.2.3 A pin guard is required, such that:

- a) A straight edge nominally 1/16 inch (1.6 mm) thick placed in any position, across and in contact with edges of the pin terminal opening without the fitting cannot be made to contact any current-carrying pin; and
- b) With the fitting aligned with the pins and the face of the fitting in a plane located perpendicular to the end or ends of the farthest projecting current-carrying pins, the probe illustrated in Figure 7.1 shall not touch any current-carrying pin while the probe is inserted through any opening which is then present.

11.3 Strain relief

11.3.1 Strain relief shall be provided to prevent a mechanical stress on a flexible cord from being transmitted to terminals, splices, or interior wiring. See 54.1

11.3.2 A clamp may be used on Types SPT-1, SPT-2, SVT and SVTO flexible cords protected by varnished-cloth tubing, phenolic, vulcanized fiber or the equivalent under the clamp, if the strain relief assembly complies with the requirements in 54.3. Thermoplastic tubing is not acceptable over thermoplastic cords.

Exception: A non-metallic clamp may be used on Types SPT-1, SPT-2, SVT, and SVTO flexible cords without tubing, fiber or equivalent protection under the clamp if it complies with the requirements in 54.3.

11.3.3 Means shall be provided to prevent the supply cord from being pushed into the enclosure of an appliance through the cord-entry hole when such displacement results in:

- a) Subjecting the supply cord to mechanical damage;
- b) Exposing the supply cord to a temperature higher than that for which it is rated;
- c) Reducing spacings (such as to a metal strain-relief clamp) below the minimum required values; or
- d) Damaging internal connections or components.

To determine compliance, the supply cord shall be tested in accordance with Section 55, Push Back Relief Test.

11.3.4 The flexible cord shall be restrained from any rotation that causes movement of internal wiring at splices and terminals.

11.3.5 If a knot in a flexible cord serves as strain relief, a surface with which the knot may come in contact shall be free from projections, sharp edges, burrs, fins, and the like, which may cause abrasion of the insulation of the conductors.

11.4 Cord bushings

11.4.1 At a point where a flexible cord or internal wiring passes through an opening in a wall, barrier, or enclosing case, and if subject to motion (flexing), there shall be an appropriate bushing or the equivalent which shall be substantial, reliably secured in place, and shall have a smooth, well-rounded surface against which the insulation may bear. If Type SPT-1 or SPT-2 is employed, if the wall or barrier is of metal, and if the construction is such that the cord may be subjected to strain or motion an insulating bushing shall be provided.

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

11.4.3 Vulcanized fiber may be employed if the bushing is not less than 3/32 inch (2.4 mm) thick and is so formed and secured in place that it will not be affected adversely by moisture in normal use of the appliance.

11.4.4 At any point in an appliance, a bushing of the same material as, and molded integrally with the supply cord is acceptable on a Type SPT-1 or heavier cord if the built-up section is not less than 1/16 inch (1.6 mm) thick at the point where the cord passes through the enclosure.

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

12 Power Supply Connections – Permanently-Connected Appliances

12.1 General

12.1.1 Except as noted in 12.1.3, a permanently connected appliance (an appliance intended for permanent connection to the power supply) shall have provision for connection of one of the wiring systems that, in accordance with the National Electrical Code, ANSI/NFPA 70, is appropriate for the appliance.

12.1.2 Sheet metal to which a wiring system is to be connected in the field shall have a minimum thickness of 0.032 inch (0.81 mm) if uncoated steel, a minimum thickness of 0.034 inch (0.86 mm) if galvanized steel, and a minimum thickness of 0.045 inch (1.14 mm) if nonferrous.

12.1.3 A stationary appliance may be acceptable if provided with a short length (a maximum of 8 ft or 2.44 m) of Type S, SO, ST, or STO cord and an attachment plug for supply connection. The investigation of such a feature will include consideration of the utility of the appliance and the necessity of having it readily detachable from its source of supply by means of the plug.

12.1.4 A terminal compartment or box in which connections to the power supply circuit will be made shall be located such that:

- a) During the making of and inspection of electrical connections in the compartment, internal wiring and electrical components will not be exposed to mechanical abuse or stress; and
- b) After the appliance has been installed as intended, such connections will be readily accessible for inspection.

12.1.5 A terminal compartment shall be so attached to the appliance as to be prevented from turning with respect to the wiring terminals.

12.2 Wiring terminals

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

12.2.2 A permanently connected appliance shall be provided with wiring terminals for the connection of the conductors having an ampacity in accordance with the National Electrical Code, ANSI/NFPA 70, or the appliance shall be provided with leads for such connection.

12.2.3 A wiring terminal shall be provided with a soldering lug or pressure terminal connector securely fastened in place (for example, firmly bolted or held by a screw), except that a wire-binding screw may be employed at a wiring terminal intended to accommodate a 10 AWG (5.3 mm²) or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in position.

12.2.4 A wiring terminal shall be prevented from turning.

12.2.5 Except as noted in 12.2.6, the free length of a lead inside an outlet box or wiring compartment shall be 6 inches (152 mm) or more if the lead is intended for field connection to an external circuit.

12.2.6 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 an adverse condition.

12.2.7 A wire-binding screw at a wiring terminal shall not be smaller than No. 10, except that a No. 8 screw may be used at a terminal intended for the connection of a 14 AWG (2.1 mm²) or smaller conductor, and a No. 6 screw may be used for the connection of a 16 or 18 AWG (1.3 or 0.82 mm²) conductor. See 12.2.8.

12.2.8 It should be noted that, according to the National Electrical Code, ANSI/NFPA 70, 14 AWG (2.1 mm²) is the smallest conductor that may be used for branch-circuit wiring, and thus is the smallest conductor that may be anticipated at a terminal for connection of a power-supply wire.

12.2.9 A terminal plate tapped for a wire-binding screw shall be of metal with a minimum thickness of 0.050 inch (1.27 mm) and shall not have less than two full threads in the metal, except that a special alloy plate a maximum of 0.050 inch (1.27 mm) thick and a minimum of 0.030 inch (0.76 mm) thick is acceptable if the tapped threads have appropriate mechanical strength.

12.2.10 A terminal plate formed from stock having the minimum required thickness, as given in 12.2.9, may have the metal extruded at the tapped hole to provide two full threads for the binding screw.

12.2.11 Uprturned lugs or a cupped washer shall be capable of retaining a supply conductor of the size indicated in 12.2.2 under the head of the screw or washer.

12.2.12 A wire-binding screw shall thread into metal.

12.3 Grounded terminals and leads

12.3.1 A permanently connected appliance employing a lampholder of the Edison-screw-shell type, or a single-pole switch or overcurrent protective device other than an automatic control, shall have one terminal or lead identified for the connection of the grounded conductor of the supply circuit. The identified terminal or lead shall be the one that is electrically connected to screw shells of lampholders and to which no switches or overcurrent protective devices of the single-pole type other than automatic controls without a marked OFF position are connected.

12.3.2 A terminal intended for the connection of a grounded supply conductor shall be of or plated with metal that is substantially white in color and shall be readily distinguishable from the other terminals, or proper identification of that terminal shall be clearly shown in some other manner, such as on an attached wiring diagram. A lead intended for the connection of a grounded power-supply conductor shall be finished white or natural grey color and shall be readily distinguishable from the other leads.

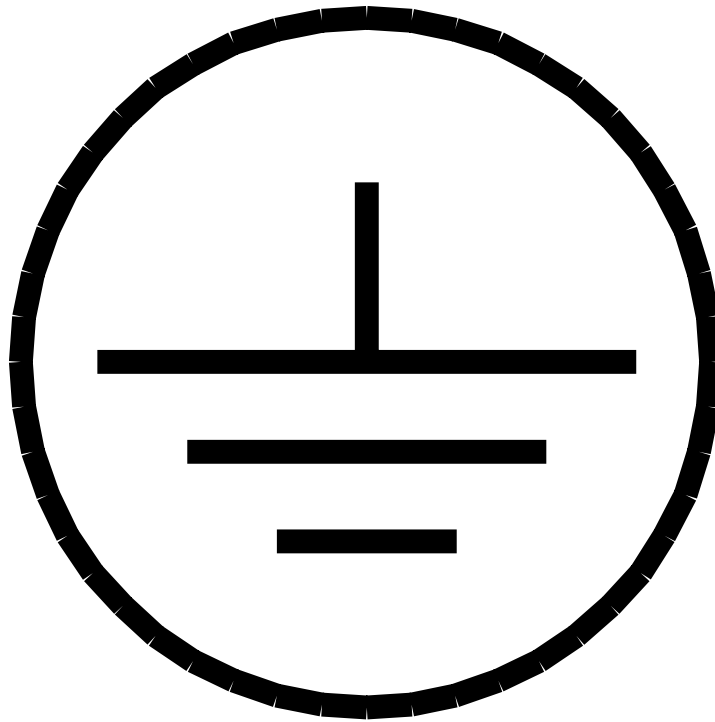
12.3.3 The surface of an insulated lead intended solely for the connection of an equipment-grounding conductor shall be green with or without one or more yellow stripes, and no other lead shall be so identified.

12.3.4 A terminal solely for connection of an equipment-grounding conductor shall be capable of securing a conductor of the size intended for the particular application, in accordance with the National Electrical Code, ANSI/NFPA 70.

12.3.5 A wire-binding screw intended for the connection of an equipment grounding conductor shall be identified by:

- a) Use of a green-colored head that is slotted or hexagonal, or both; or
- b) The grounding symbol illustrated in Figure 12.1 on or adjacent to the terminal or on a wiring diagram provided on the product.

Figure 12.1
Grounding symbol



12.3.6 A pressure wire connector intended for the connection of such a conductor shall be identified by:

- a) Being marked "G," "GR," "GND," "Ground," "Grounding," or the like; or
- b) A marking on a wiring diagram provided on the appliance; or
- c) The grounding symbol illustrated in Figure 12.1 on or adjacent to the terminal or on a wiring diagram provided on the product.

12.3.7 The wire binding screw or pressure wire connector shall be located that it is unlikely to be removed during servicing of the appliance.

13 Internal Wiring

13.1 The internal wiring and connections between parts of an appliance shall be enclosed or guarded, except that a length of flexible cord may be employed for external connections if flexibility is essential.

13.2 For the purpose of these requirements the internal wiring of an appliance is considered to be all the interconnecting wiring from the point where the power-supply cord of a cord-connected appliance enters the enclosure, or from the wiring terminals or leads for power-supply connections of a fixed appliance, even though some of this may be in the form of flexible cord.

13.3 The protection of insulated wiring and of wire providing grounding continuity, as required by 13.1, is considered to exist if, when judged as though it were magnet wire, the wiring is acceptable according to 7.8. Internal wiring not so protected may be accepted if it is so secured within the enclosure that it is unlikely to be subjected to stress or physical abuse.

13.4 Unless it is to be judged as an uninsulated live part, insulated internal wiring of an appliance (including a grounding conductor) shall consist of wire that is appropriate for the particular application, when considered with respect to:

- a) The temperature and voltage to which the wiring is likely to be subjected;
- b) Exposure to oil, grease, or other substances likely to have a deleterious effect on the insulation;
- c) Exposure to moisture; and
- d) Other conditions of service to which it is likely to be subjected.

13.5 Thermoplastic-insulated wire employed for internal wiring shall be standard building wire or appliance-wiring material that is provided with insulation appropriate for the purpose.

13.6 Wiring shall be protected from sharp edges (including male screw threads), burrs, fins, moving parts, and other agents that might abrade the insulation of conductors.

13.7 A hole by which insulated wires pass through a sheet metal wall within the overall enclosure shall be provided with a smoothly rounded bushing or shall have smooth surfaces, free of burrs, fins, sharp edges, and the like, upon which the wires may bear, to prevent abrasion of the insulation.

13.8 Insulated wires may be bunched and passed through a single opening in a metal wall within the enclosure of the appliance.

13.9 All splices and connections shall be mechanically secure and shall provide an effective electrical contact.

13.10 A soldered connection shall be such that mechanical security will be provided. If the nature and/or location of a soldered connection is such that loosening of the solder is likely to occur, and if such loosening of the solder will result in any grounding or short-circuiting of live parts or other adverse condition, the connection shall be made mechanically secure before being soldered.

13.11 A wire-binding screw or nut shall be provided with means to prevent it from being loosened due to vibration if such loosening might result in a risk of fire, electric shock or injury to persons.

13.12 A risk of fire, electric shock or injury to persons is not considered to result if a spade lug with upturned ends or a closed-loop lug is used.

13.13 Unless spacings cannot be reduced so as to create a risk of fire, electric shock or injury to persons, a splice shall be provided with insulation equivalent to that of the wires involved.

13.14 In a determination of whether or not splice insulation consisting of coated-fabric, thermoplastic, or other material is acceptable, consideration is to be given to such factors as its dielectric properties, heat-resistance and moisture-resistance characteristics, and the like. Thermoplastic insulating tape wrapped over a sharp edge is not acceptable. An insulated splicing device is acceptable within the limits of its voltage and temperature ratings.

13.15 Stranded internal wiring shall be so connected to a wire-binding screw that loose strands of wire will be prevented from contacting other live parts not always of the same polarity as the wire and from contacting dead metal parts. This may be accomplished by use of pressure thermal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or other equivalent means.

13.16 An internal wiring bushing of neoprene or polyvinyl chloride may be used anywhere inside an appliance if the edges of the hole in which the bushing is mounted are smooth and free from burrs, fins and the like.

14 Live Parts

14.1 A current-carrying part shall be of silver, copper, a copper alloy or other material equivalent for the purpose.

14.2 Plated iron or steel may be used for a current-carrying part:

- a) Whose temperature during normal operation is more than 100°C (212°F);
- b) Within a motor or associated governor; or
- c) If acceptable in accordance with 2.1.

Plain (unplated) iron or steel is not acceptable. The foregoing restrictions do not apply to stainless steel and other corrosion-resistant alloys.

14.3 An uninsulated live part shall be so secured to the base or mounting surface 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.

14.4 Friction between surfaces is not acceptable as the sole means to prevent the turning of a live part, but a lock washer properly applied is acceptable for this purpose.

15 Electrical Insulation

15.1 Insulating washers, bushings, and the like, and bases or supports for the mounting of live parts shall be of a moisture-resistant material that is acceptable for the particular application.

15.2 Insulating material employed in an appliance is judged with respect to its use in the particular application. Materials such as mica, some molding compounds, and certain refractory materials are capable of being used as the sole support of current-carrying parts; and some other materials that are not intended for general use, such as magnesium oxide, are capable of being used in conjunction with other insulating materials when so located and protected such that the risk of physical injury and the absorption of moisture are reduced. If a separate investigation is required to determine the fitness of a material as an insulator, the key factors to be examined are its physical strength, dielectric-properties, insulation-resistance, heat-resistant qualities, the degree to which it is enclosed or protected, and any other features pertinent to the risk of electric shock, fire and injury to persons involved, in conjunction with the conditions of actual service. All of the properties mentioned above are to be investigated with respect to the effects of thermal aging.

15.3 Screws or other fastenings used to mount or support small fragile, insulating parts are not to be so tight as to crack or break such parts with expansion and contraction.

15.4 Vulcanized fiber may be used for insulating bushings, washers, separators, and barriers, but not as the sole support for uninsulated live parts if shrinkage, moisture absorption, or warpage may introduce current leakage or other adverse conditions. Thermoplastic materials may be employed for the sole support of uninsulated live parts if found to have physical strength and rigidity, resistance to heat, resistance to flame propagation, dielectric strength, and other properties appropriate for the application. All of the properties mentioned above are to be considered with respect to the effects of thermal aging.

15.5 A small molded part, such as a terminal block, shall have such physical strength and rigidity that it will withstand the stresses of actual service.

16 Motors

16.1 General

16.1.1 A motor shall be acceptable for the particular application, and shall be capable of handling the "maximum normal load" of the appliance as described in 36.1.11 – 36.26.2 without introducing a risk of fire, electric shock, or injury to persons.

16.1.2 A motor winding shall be resistant to the absorption of moisture and shall be formed and assembled in a uniform manner, such as free of loose turns, irregular crossovers, and poor ties.

16.1.3 With reference to the requirement in 16.1.2, magnet wire is not required to be additionally treated to resist absorption of moisture, but fiber slot liners, cloth coil wrap and similar moisture-absorptive materials should be provided with impregnation or otherwise treated to resist moisture absorption.

16.1.4 A brush holder assembly shall be constructed so that if a carbon brush becomes worn away to the maximum possible extent, the spring or other parts of the assembly shall not defeat the required spacings between live parts and dead metal parts, or result in a live part becoming accessible.

16.1.5 Motors that are provided with thermoplastic coil forms or thermoplastic insulating material shall comply with the requirements for Thermoplastic Coil Forms and Thermoplastic Insulating Material, Section 60.

16.2 Overload protection

16.2.1 An appliance employing a motor rated at 1 hp or less and intended to be automatically controlled, as indicated in 16.2.2, shall incorporate thermal or overcurrent protection in accordance with 16.2.5.

16.2.2 An appliance is considered to be automatically controlled under any one or more of the following conditions:

- a) If the repeated starting of the appliance, beyond one complete predetermined cycle of operation, to the point where some form of limit switch opens the circuit, is independent of any manual control.
- b) If, during any single predetermined cycle of operation, the motor is caused to stop and restart one or more times.
- c) If, upon energizing the appliance, the initial starting of the motor may be intentionally delayed beyond normal, conventional starting.
- d) If, during any single predetermined cycle of operation, automatic changing of the mechanical load may reduce the motor speed to the point of reestablishing the starting-winding connections to the supply circuit.

16.2.3 An automatically controlled blender is considered to comply with 16.2.1 if it is provided with locked-rotor protection in accordance with 16.2.5.

16.2.4 The motor of an ice cream freezer (bucket type), butter churn or pasta mixer-extruder shall comply with the locked rotor protection in 16.2.5.

Exception: An ice cream freezer, butter churn or pasta mixer-extruder motor is considered to comply with the requirement in 16.2.4, if when the ice cream freezer, butter churn or pasta mixer-extruder container and the driven member are frozen together, the motor is energized and the temperature limits specified in 16.2.5 are not exceeded.

16.2.5 Motor-overload protection required for an appliance shall consist of one of the following:

- a) Thermal protection complying with the applicable requirements in the Standard for Overheating Protection for Motors, UL 2111.

Exception No. 1: For an appliance that includes a control that positively and reliably limits the length of the time the appliance can operate, the duration of the temperature test and the endurance test, both under locked-rotor conditions, may be less than that specified but shall not be less than the time the appliance can operate.

Exception No. 2: A motor intended to move air only by means of an air-moving fan that is integrally attached, keyed, or otherwise fixed to the motor shaft is not required to have running-overload protection.

Exception No. 3: A shaded-pole motor with a 2:1 or smaller ratio between locked-rotor and no-load currents and a 1 A or smaller difference between no-load and locked-rotor currents is considered to have acceptable overload protection if it is protected against locked-rotor conditions only.

- b) Impedance protection complying with the Standard for Overheating Protection for Motors, UL 2111, when the motor is tested as used in the appliance under locked-rotor conditions.
- c) Other protection that is shown by test to be equivalent to the protection as specified in (a).

16.2.6 The functioning of a motor-protective device provided as part of an appliance (whether such device is required or not) shall not result in a risk of fire or injury to persons. Compliance shall be determined by the following:

a) Limited Short Circuit Test in accordance with the Standard for Overheating Protection for Motors, UL 2111, and one of the following or combination thereof:

- 1) 16.2.1 (for automatically-controlled appliances);
- 2) Continuous Operation Test (for appliances actuated by a momentary contact switch), Section 46;
- 3) Abnormal Operation Test (for appliances with metal or partly-metallic enclosures), Section 47; or
- 4) Enclosures of Polymeric Material for Portable Appliances (for appliances with polymeric enclosures), Section 58.

b) For appliances provided with an automatic reset or user-resettable overload-protective device where automatic restarting would result in a risk of injury to persons, each of three representative appliances shall be energized and have their rotors stalled until the overload-protective device opens. While still energized, and the rotor no longer stalled, the representative appliances shall then be allowed to cool down until the overload-protective device closes. The representative appliance shall not automatically restart or have the possibility of accidentally being restarted. A distinct and deliberate motion shall be required to restart the representative appliance.

16.2.6 effective December 1, 2004

17 Switches

17.1 A switch shall be appropriate for the particular application, and shall have a current and voltage rating not less than that of the load which it controls when the appliance is operated normally.

17.2 In applying the requirement in 17.1 to a switch controlling a motor, it is required that the switch be appropriate for use with a motor load or have a suitable rating not less than that of the controlled motor. See 52.1 and 53.1.

17.3 If, when energized, an appliance has moving parts that are likely to cause injury to persons, a motor control switch, other than a momentary-contact switch, on the appliance shall have a plainly identified OFF position, or ON and OFF positions and be marked in accordance with 17.4 or 17.5 as applicable.

17.4 With reference to the requirement in 17.3, the OFF position of the switch shall be marked with either one or both of the following:

- a) The word "OFF", or its equivalent (for example, "STOP"); or
- b) The symbol shown in Figure 17.2.

17.5 With reference to the requirement in 17.3, the ON position of the switch, when identified, shall be marked with one or both of the following, as determined by the marking of the OFF position of the switch:

- a) The word "ON", or its equivalent (for example, "START") when the OFF position of the switch is marked with the word "OFF", or its equivalent (for example, "STOP"); or
- b) The symbol shown in Figure 17.1, when the OFF position of the switch is marked with the symbol shown in Figure 17.2.

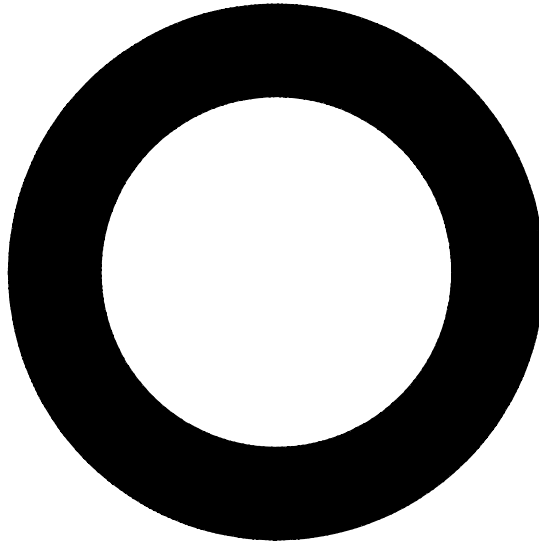
See also 68.6.

Figure 17.1
Symbol for ON position



IEC 417, Symbol 5007

Figure 17.2
Symbol for OFF position



IEC 417, Symbol 5008

17.6 If a portable appliance employs a motor rated at more than 1/3 horsepower, a motor-control switch for the motor shall be provided in the appliance. See 19.8.

17.7 An appliance shall not employ a through-cord switch.

17.8 A manually operated, line-connected, single pole switch, a triac controlling a motor, or other control device, intended for appliance ON-OFF operation shall be connected to the ungrounded conductor of the power-supply cord. Table 11.3 specifies the polarity identification of the power-supply cord conductors.

17.8 effective December 1, 2004

18 Capacitors

18.1 A capacitor of a capacitor motor and a capacitor connected across the line (such as a capacitor for radio-interference elimination) shall be housed within an enclosure or container that protects the plates against physical damage and prevents the emission of flame or molten material resulting from failure of the capacitor. Except as noted in 18.2 and 18.4, the container shall be sheet steel having an average thickness of 0.020 inch (0.51 mm) or shall be so constructed as to afford equivalent protection.

18.2 The container of a capacitor may be of sheet metal less in thickness than that mentioned in 18.1 or of other appropriate material if the capacitor is mounted in an enclosure that houses other parts of the appliance and if such a box, case, and the like is acceptable for the enclosure of live parts.

18.3 Under both normal and abnormal conditions of use, a capacitor employing a dielectric medium more combustible than askarel shall not cause or increase a risk of electric shock or fire and shall be protected against expulsion of the dielectric medium.

18.4 The individual enclosure of an electrolytic capacitor with means for venting is required to be such as to provide protection against physical injury only and the requirement for minimum enclosure thickness does not apply. The individual enclosure of an electrolytic capacitor not provided with means for venting and with an opening more than 1/16 inch (1.6 mm) wide between the capacitor enclosure and the motor need not comply with the requirement for enclosure thickness given in 18.1, if it is found acceptable in accordance with the following. Several samples of the capacitor mounted in the usual manner and with cotton placed around openings in the enclosure, are to be subjected to such over voltage as to cause failure. If the cotton ignites upon failure of the capacitor, the results are not acceptable.

18.5 The voltage rating of a capacitor, other than a motor capacitor, shall be no less than the maximum steady-state potential to which the capacitor is subjected during operation of the appliance.

19 Spacings

19.1 A circuit derived from a source of supply classified in 5.15 as a line-voltage circuit by connecting a resistance in series with the supply circuit as a means for limiting the voltage and current, is not considered to be a low-voltage circuit as described in 5.16.

19.2 All uninsulated live parts connected to different (line-voltage, low-voltage) circuits shall be spaced from one another as though they were parts of opposite polarity, in accordance with the requirements in 19.4 and 19.5 and shall be judged on the basis of the highest voltage involved.

19.3 The spacing between uninsulated live parts of opposite polarity and between such parts and dead metal which may be grounded in service is not specified for parts of circuits that are classified as low-voltage in 5.16.

19.4 The spacing between wiring terminals (see 12.2.1) of opposite polarity, and the spacing between a wiring terminal and any other uninsulated metal part (dead or alive) not of the same polarity, shall not be less than 1/4 inch (6.4 mm) between terminals and other uninsulated metal parts not always of the same polarity (applies to the sum of the spacings involved where an isolated dead part is interposed).

19.5 Except as noted in 19.7 and 19.9, the spacing between uninsulated live parts of opposite polarity, uninsulated live parts and a dead metal part that is exposed to contact by persons or that may be grounded, and uninsulated live parts and uninsulated (or not acceptably insulated) parts in the secondary circuit, shall not be less than the value indicated in Table 19.1. If an uninsulated live part is not rigidly fixed in position (by means other than friction between surfaces), or if a movable dead metal part is in proximity to an uninsulated live part, the construction shall be such that the required minimum spacing will be maintained.

Table 19.1
Minimum spacings at other than supply wiring terminals

Table 19.1 effective December 1, 2004

Potential involved, volts	Rating of motor employed [Motor diameter 7 inches (178 mm) or less ^a]	Minimum Spacings	
		Over surface inch (mm)	Through air, inch (mm)
0 – 130	1/3 horsepower (250 W output) or less	1/16 (1.6)	1/16 (1.6)
	More than 1/3 horsepower	3/32 (2.4)	3/32 (2.4)
131 – 250	All motors	3/32 (2.4)	3/32 (2.4)

NOTE – Film-coated wire is considered to be an uninsulated live part.

^a This is the diameter, measured in the plane of laminations of the circle circumscribing the stator frame, excluding lugs, fins, boxes, and similar parts used solely for motor mounting, cooling, assembly, or connection.

19.6 In applying Table 19.1 to an appliance incorporating two or more motors of different sizes, the spacings inside each motor are judged on the basis of the size of that motor and the spacings elsewhere in the appliance are judged on the basis of the size of the largest motor in the appliance.

19.7 The spacing requirements given in 19.4 do not apply to the inherent spacings of a component of the appliance, such as a snap switch; such spacings are judged on the basis of the requirements for the component.

19.8 In the application of 16.2.1 and Table 19.1 to a motor not rated in horsepower, use is to be made of the appropriate table of the National Electrical Code, ANSI/NFPA 70 which gives the relationship between horsepower and full-load currents for motors. For a universal motor, the table applying to a single-phase, alternating current motor is to be used if the appliance is marked for use on alternating current only; otherwise, the table applying to direct-current motors is to be used.

19.9 If an isolated dead metal part is interposed between or is in close proximity to live parts of opposite polarity, to a live part and an exposed dead metal part, or to a live part and a dead metal part that may be grounded, the spacing may not be less than 3/64 inch (1.2 mm) between the isolated dead metal part and any one of the other parts previously mentioned, provided the total spacing between the isolated dead metal part and the two other parts is not less than the value indicated in Table 19.1.

19.10 Except as indicated in 19.11, an insulating lining or barrier of vulcanized fiber or similar materials employed where spacings would otherwise be unacceptable shall not be less than 1/32 inch (0.8 mm) thick and shall be so located or of such material that it will not be adversely affected by arcing; except that vulcanized fiber not less than 1/64 inch (0.4 mm) thick may be used in conjunction with an air spacing of not less than 50 percent of the spacing required for air alone.

19.11 Insulating material having a thickness less than that indicated in 19.10 may be used if, upon investigation, it is found to be appropriate for the particular application.

19.12 A printed wiring board with spacings between opposite polarity circuits (other than a low-voltage circuit, see 19.3) less than those required is acceptable provided that the spacings:

- a) Are located on a portion of the printed wiring board provided with a conformal coating that complies with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and the dielectric voltage-withstand test described in 37.6; or
- b) Are located on the load side of a resistor such that a short circuit from the load side of the resistor to the other side of the line does not result in the resistor power dissipation exceeding the resistor wattage rating; or
- c) Comply with the spacing requirements in the Standard for Solid-State Controls for Appliances, UL 244A; or
- d) Comply with the applicable requirements in the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840.

20 Grounding

20.1 Required grounding

20.1.1 The following types of appliances shall have provision for grounding:

- a) An appliance for use in damp or wet locations (see 5.9, 5.10, and 5.22);
- b) An appliance intended for outdoor use;
- c) An appliance intended to be used on a circuit operating at more than 150 V to ground; and
- d) An appliance intended for permanent connection to the supply source.

Exception: An appliance intended to operate at a nominal potential of 240 V and any other potential greater than 150 V is to be provided with means for grounding in accordance with 20.2.2, unless the marked rating on the appliance is 120/240 V and the appliance is wired for a nominal 120 V connection, or the appliance is otherwise marked to indicate that it is to be connected to a circuit operating at 150 V or less to ground.

20.1.1 effective December 1, 2004

20.2 Continuity

20.2.1 If a grounding means is provided on an appliance, whether required or not, all exposed dead metal parts and all dead metal parts within the enclosure which are exposed to contact during any servicing operation and which are likely to become energized shall be connected to the grounding means. Servicing here mentioned means user servicing, not repairs made by a qualified service man.

20.2.2 The following are considered to constitute means for grounding:

- a) In an appliance intended to be permanently connected by a metal-enclosed wiring system – a knockout or equivalent opening in the metal enclosure of the appliance.
- b) In an appliance intended to be permanently connected by a nonmetal-enclosed wiring system (for example, nonmetallic-sheathed cable) – an equipment-grounding terminal or lead.
- c) In a cord-connected appliance – an equipment-grounding conductor in the cord.

20.2.3 An appliance marked as being provided with double insulation shall not be provided with a means for grounding.

20.3 Grounding identification

20.3.1 The grounding conductor of a flexible cord shall be green with or without one or more yellow stripes. The grounding conductor shall be secured to the frame or enclosure of the appliance by means of a screw that is not likely to be removed during any servicing operation not involving the power-supply cord, or by other equivalent means. Solder alone shall not be used for securing the grounding conductor. The grounding conductor shall be connected to the fixed member of a grounding-type attachment plug except that the grounding member of the plug on a portable hand-guided or hand-supported appliance may be of the movable, self-restoring type. Servicing as mentioned in this paragraph includes repair of the appliance by a qualified service person.

20.3.2 If means for grounding is provided on the appliance even though not required, it shall comply with the pertinent requirements in this section of the Standard.

21 Flooding of Live Parts

21.1 A counter-top appliance shall preclude the following actions when such action would result in risk of fire or electric shock. Compliance shall be determined by the Flooding of Live Parts Tests, Section 40, the Test for Deterioration of Parts Subject to Flexing, Section 41, the Test for Reliability of Parts Not Subject to Flexing, Section 42, and the Insulation Resistance Test, Section 43:

- a) Overflow of liquids into the electrical or motor enclosure of the appliance (40.1);
- b) Drawing of liquids into the electrical or motor enclosure of the appliance (40.2); and
- c) Malfunction of a timer switch or of a float- or pressure-operated switch, deterioration or damage of a boot or diaphragm, or the deterioration and reliability of seals and gaskets, resulting in the entrance of liquid into the electrical or motor enclosure of the appliance (Sections 41, 42, and 43).

21.1 effective December 1, 2004

21.2 If the failure of a liquid container provided as part of an appliance would result in a risk of fire or electric shock, the container shall be of a material which is compatible with the liquid intended to be used therein.

PROTECTION AGAINST PERSONAL INJURY

22 General

22.1 If the operation and maintenance of an appliance by the user involves possible personal injury, protection shall be provided for the reduction of such a condition to an acceptable degree.

22.2 In applying the requirement of 22.1 consideration shall be given to reasonably foreseeable misuse of the appliance.

22.3 The acceptability of a guard, a safety release, an interlock, and the like and whether or not such a device is required, is to be determined from a study of the complete appliance, its operating characteristics, and the likelihood of an injury resulting from a cause other than gross negligence. The study is to include consideration of the results of a malfunction of any one component, but not more than one component at a time unless one malfunction contributes to another. If the study shows that a malfunction of a particular component can result in a risk of injury to persons, that component is to be investigated for reliability.

22.4 If a malfunction or breakdown of an electronic component, located in any circuit of the product, results in increased risk of injury to persons, such as a loss of OFF control or unexpected operation, that circuitry shall comply with the requirements in the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991. A single malfunction is to be considered at a time.

Exception: For an appliance with electronic controls with a "STOP" position, see 24.4.

22.4 effective December 1, 2004

22.5 Specific tests, constructions, markings, guards, and the like are detailed for some appliances. Such detailed requirements apply to common constructions; specific features and appliances not covered herein are to be given separate consideration.

22.6 An enclosure, a frame, a guard, a handle, or the like shall not be sufficiently sharp to constitute a risk of injury to persons during normal maintenance and use.

Exception No. 1: A part or portion of a part needed to perform a working function need not comply with this requirement.

Exception No. 2: A part or portion of a part inaccessible to the probe illustrated in Figure 7.1 need not comply with this requirement.

22.7 Compliance with the requirement of 22.6 is determined by applying the test procedures, equipment, and acceptance criteria described in the Standard for Tests for Sharpness of Edges on Equipment, UL 1439.

23 Attachments

23.1 Various functional attachments that are made available or recommended by the manufacturer for use with the basic appliance shall be included in the evaluation of the appliance. Unless recommended by the manufacturer, not more than one attachment shall be evaluated at a time with the appliance.

23.2 The literature accompanying a package containing a basic appliance and various attachments intended to be marketed as a complete unit shall indicate what attachments are intended for use with the basic appliance.

23.3 If an attachment is packaged and marketed separately from the basic appliance and recommended for use with it by the manufacturer of the basic appliance, it shall have an assigned catalog number (or equivalent). Also, information packaged with the basic appliance shall identify by catalog number, series number, or the like, the attachments which are intended for use with the basic appliance. Identification [catalog number(s), model number(s), series, and the like] of the basic appliance with which the attachment is intended to be used shall appear at the following locations:

- a) On the package housing the attachment; and
- b) On information material furnished with the attachment or on the attachment itself.

Exception: The package housing an attachment intended for use with all models of a specific type of basic appliance may be marked "For Use With (Company Name) (Type of Basic Appliance)."

23.4 The important safeguards, where applicable to the attachment, shall be packaged with the attachment.

24 Moving Members

24.1 A moving external member and its attachment to the appliance shall be constructed of such material, and in such manner, as to reduce the likelihood of its malfunction, its unintentional release, and its loosening of a part that can become a risk of injury to persons.

24.2 To determine if an appliance with a series motor complies with the requirement in 24.1, the appliance is to be operated at a voltage equal to 1.3 times the rated voltage for 1 minute with no externally added load. After the test, parts that can cause an injury shall not have worked loose.

24.3 An appliance employing a moving part which, if it becomes disengaged would create a risk of injury to persons, shall be provided with a means to retain the part in place under conditions of use.

24.4 An appliance employing exposed moving parts and electronic controls with a "STOP" position, where a single malfunction of a component can cause unexpected operation, shall be constructed with a red light which flashes only when the appliance is energized and when the motor is in a stop condition but not OFF. See also 66.25 and 70.32.

24.4 effective December 1, 2004

25 Stability

25.1 The stability of a counter-top appliance shall be such that it will not be overturned readily while in any position that might be encountered during normal use of the appliance, including positions that might be encountered prior to and after operation.

25.2 To determine if an appliance complies with the requirement in 25.1, the appliance is to be placed, with the motor switched off, in a position as described in 25.4 on a plane inclined at an angle of 10 degrees to the horizontal, the power-supply cord resting on the inclined plane in the most unfavorable position. If, however, the appliance is such that, were it to be tilted to an angle of 10 degrees when standing on a horizontal plane, a part of it not normally in contact with the supporting surface would touch the horizontal plane, the appliance is to be placed on a horizontal support and tilted in the most unfavorable direction through an angle of 10 degrees. The results are considered to be acceptable if the appliance does not overturn. Combination appliances shall be tested for the most unfavorable condition. One attachment will be used at a time.

25.3 An appliance intended to be filled with liquid by the user in normal use, is to be filled with water to its rated capacity, or if unmarked it is to be filled to the top. A can opener is to be tested without the can in place. A salad maker or food grinder is to be tested empty.

25.4 Tests are to be conducted under the most unfavorable conditions but with the appliance unenergized. The appliance is to be placed on an inclined plane with all doors, drawers, and other movable or adjustable parts in the position tending to decrease the stability. If tested on a horizontal plane the appliance is to be tipped in the direction of least stability. The appliance is to be tested in all possible positions that might typically be encountered while the appliance:

- a) Is in a position of being assembled or prepared prior to operation – for example, positioning parts of the appliance prior to adding food or functional attachments;
- b) Is in a position as if being used to perform one of its intended functions – for example, blending, or mixing; and
- c) Is in a position of being disassembled or cleaned after operation – for example, with functional attachments removed.

25.5 An appliance that is adjustable in dimensions is to be adjusted to the position most likely to cause it to overturn.

26 Stability – Floor Supported Carts and Stands

26.1 A floor-supported appliance cart or stand employing polymeric materials in its construction shall withstand the temperature-stability condition described in 26.2 without any shrinkage, warpage, or other distortion of the polymeric materials that results in an appliance cart or stand performing unacceptably when subjected to the requirements of 26.3 – 26.10.

Exception: A polymeric decorative part or a similar part shall comply with the requirement of 58.2.2.

26.2 The complete assembly, appliance and cart or stand, shall be placed in an air-circulating oven for 7 hours. The oven is to be maintained at a temperature of 70°C (158°F). The appliance is not to be operating during the test.

26.3 During the temperature-stability test described in 26.2, an appliance intended for use with a companion cart or stand is to be positioned on the cart or stand in accordance with the recommended instructions.

26.4 A cart or stand with the intended appliance in place, that weighs 10 lbs (4.5 kg) or more shall not tip over when it is placed at the center of an inclined plane that makes an angle of 10 degrees with the horizontal and turned to the position most likely to cause tip-over.

26.5 The test mentioned in 26.4 is to be separately conducted under conditions most likely to cause tip-over. If the appliance is positioned on the stand or cart, consideration shall be given to all accessories or options intended for use with the appliance. The cart or stand, with or without the appliance, shall be arranged in its intended position with all doors, drawers, casters, wheels, and other appurtenances in the position that results in the least stability. The assembly is to be tipped in the direction most likely to overturn the cart or stand, or the combination of an appliance with either the cart or stand. Legs and other means of support may be blocked to preclude the cart or stand from sliding.

26.6 A cart or stand intended to be floor supported shall be constructed so that permanent deformation or damage that results in a risk of injury to persons does not occur when it is subjected to the following:

- a) A weight that exerts a force of three times its intended appliance load or 100 lbf (444.8 N) whichever is greater, and an evenly distributed load that exerts a 25 lbf (111.2 N) on each shelf or drawer. A drawer shall be in fully opened position.
- b) A force of 50 lb (222.4 N) applied for 1 minute to any appurtenance accessible to a child.

26.7 To determine compliance with 26.6(a), the appliance is to be placed on the cart or stand and the additional weight added to the top of the appliance. Each shelf or drawer, if provided, is to be loaded with a uniform load that exerts a 25 lbf (111.2 N). If polymeric materials are employed in the construction of the cart or stand, the test is to be conducted before and after the temperature-stability test referred to in 26.1. The load is to be applied for 1 minute with the cart or stand at room temperature.

26.8 To determine compliance with 26.6(b), the force is to be applied through the end of a 2 inch (50.8 mm) diameter right circular cylinder. The force is to be applied to a shelf, drawer, dowel rung support, or equivalent part that is within 30 inches (762 mm) of the floor and is likely to support some or all of a child's weight. The force is to be applied for 1 minute with the cart or stand at room temperature.

26.9 A cart or stand shall withstand a single impact of 5 ft-lbf (6.8 N-m) without resulting in a risk of injury to persons or adversely affecting the stability. The force is to be applied to any part of the stand or cart in accordance with the test procedure outlined in 26.10.

26.10 The impact force is to be imparted by swinging a 2-inches (50.8-mm) diameter steel sphere weighing 1.18 lbs (0.535 kg) from a height that will produce the impact specified in 26.9, 58.5.3.5, and Figure 58.4 illustrate the appropriate test apparatus.

26.11 An appliance cart or stand provided with wheels or casters, for mobility, shall employ a mechanical means other than friction, to secure the wheels or casters in place.

27 Enclosure and Guards

27.1 Except as indicated in 27.2, moving parts that may cause injury, shall be enclosed. See also 27.4.

27.2 Moving parts that are necessarily exposed to perform the work function need not be enclosed but, when necessary, guarding is to be provided. The extent of guarding is to be based on the following factors:

- a) The degree of exposure needed;
- b) Sharpness of moving parts;
- c) Likelihood of unintentional contact therewith;
- d) Speed of the moving part; and
- e) Likelihood that parts of the body or clothing would be endangered by the moving part.

These factors are to be considered with respect to both intended operation of the appliance and its reasonably foreseeable misuse.

27.3 Among the factors to be considered in judging the acceptability of a guard are:

- a) Removability without the use of tools;
- b) Removability for user servicing and the need for and ease of replacement;
- c) Strength and rigidity. See also 58.5.1.3;
- d) Completeness;
- e) Creation of additional risks of personal injury such as pinch points; and
- f) The necessity for additional handling because of the increased need for user servicing (such as for cleaning and unjamming).

27.4 A moving part is considered to be acceptably enclosed if it cannot be contacted with the probe illustrated in Figure 7.1.

27.5 If complete guarding of an obvious moving part that may cause injury to persons defeats the utility of the appliance, such as the cutting blades of a knife:

- a) An appropriate control shall be provided; and
- b) An appropriate caution marking shall be provided in the instruction booklet warning the user against the potential risk of injury.

27.6 It shall not be possible to actuate an interlock with the probe indicated in Figure 7.1.

27.7 A feeding mechanism, either manual or automatic, shall be so constructed or guarded to reduce to an acceptable degree, the likelihood or necessity of the operator's fingers being in an area that could afford injury.

27.8 A pusher shall be provided when continuous manual feeding of an appliance is necessary.

28 Switches, Controls, and Interlocks

28.1 A device that automatically starts an appliance shall not be employed unless it can be demonstrated that automatic starting can not result in injury to persons.

28.2 The requirement in 28.1 necessitates the use of an interlock (see 5.14), if movable parts or the like might involve risk of injury upon the automatic starting or restarting of the motor.

28.3 The OFF position of a main ON/OFF switch other than a momentary-contact type shall be such that the operator can determine by visual inspection that the appliance is off.

28.4 If an interlock is actuated by movement of a guard, the construction shall be such that the guard is in place when the switch permits operation of the parts being guarded. With the guard removed, the construction shall comply with 28.6.

28.5 For a multiple-purpose appliance, operation of a switch for one function shall not cause a risk of injury at another function.

28.6 The actuator for an interlock shall be so located that unintentional operation is unlikely.

28.7 The actuator described in 28.6 may be guarded by recessing, ribs, barriers, or the like.

28.8 Operation in normal use shall not inconvenience the operator so as to encourage deliberate defeat of an interlock.

28.9 An interlock shall not be capable of being defeated by food materials that could accumulate with normal use of the appliance.

28.10 An interlock shall not be capable of being defeated readily:

- a) Without damaging the appliance;
- b) Without making wiring connections or alternations; or
- c) By using materials that are readily available.

28.11 An appliance employing a switch with an auto-pulse function (such as an ice pulse function on a blender) shall be constructed so that the blades do not fully stop rotating between pulses. The blades shall fully stop rotating only when the appliance switch is in the OFF position.

Exception No. 1: An appliance employing a switch with an auto-pulse function meets the intent of the requirement when the time between pulses is a maximum of one second.

Exception No. 2: An appliance employing a switch with an auto-pulse function meets the intent of the requirement if, when the auto-pulse function is activated, a visual indication is employed to notify the user, such as a light, or a depressed button that activates a mechanical switch.

28.11 effective December 1, 2004

29 Surface Temperatures

29.1 During the temperature test, a temperature on the surface of an appliance that may be contacted by the user shall be not more than the value indicated in Table 29.1.

Table 29.1
Maximum acceptable surface temperature^a

Location	Composition of surface ^{b,c}	
	Metal	Non-metallic
Handles, levers, or knobs likely to be grasped for lifting, carrying or holding	50°C (122°F)	60°C (140°F)
Handles or knobs which are connected, but do not involve lifting, carrying, or holding and other surfaces subject to contact in operation and user maintenance	60°C (140°F)	85°C (185°F)
Surfaces other than a heating function surface and known to be hot due to proximity to the heating function surface	70°C (158°F)	95°C (203°F)

^a All temperature limits are based on a 25°C (77°F) ambient temperature.

^b If the temperature on a rivet or screw in a barrier or handle, which could be contacted, touched and the like in the normal lifting, carrying or holding action, exceeds the values given, it is to be recessed at least 1/2 the diameter of the hole and the hole shall be no larger than 3/8 inch (9.5 mm) in diameter.

^c Coatings or special materials will be considered on an individual basis. A handle, knob, grip or the like that is made of nonmetallic material and is plated or clad with metal having a thickness of 0.005 inch (0.127 mm) or less is considered a nonmetallic part. This also applies to metal-foil pressure sensitive labels should they meet the above thickness requirement.

30 Appliances

30.1 All knives

30.1.1 A knife shall be provided with a momentary contact switch that cannot be locked in the ON position.

30.1.2 A guard, recess, or a mechanical interlock as mentioned in 30.2.2 and 30.2.3 shall withstand the abuse to which a knife is likely to be subjected.

30.2 Cord-connected knives

30.2.1 The switch shall be positioned for positive control and shall be provided with guarding, recessing, spring force, or the like that makes it unlikely the knife might be unintentionally energized by the operator or when the knife is resting against the edge of a 1 inch (25.4 mm) thick surface, simulating a cutting board.

30.2.2 A permanent, legible, cautionary marking shall be provided on the external surface of the knife to indicate that the cord is to be disconnected when handling the blades; except that such marking may be omitted if a positive means is provided to prevent unintentional operation of the switch. Also see 66.5.

30.2.3 If a positive means is provided to prevent unintentional operation of the switch as indicated in 30.2.2, a marking such as: "Engage lockout before handling blades," or the equivalent, shall be provided on the external surface of the knife except that such marking may be omitted if the requirement in 30.2.2 is met.

30.3 Battery-operated knives

30.3.1 A battery-operated knife shall be provided with:

- a) A positive means to prevent unintentional operation; and
- b) An electrical or mechanical lockout to prevent operation when handling the blades.

30.3.2 A permanent, legible, cautionary marking shall be provided on the external surface of the knife that indicates that the switch is to be locked in the OFF position when handling the blades. The OFF position of a mechanism accomplishing this shall be plainly marked and visible to the operator. The marking OFF may be omitted if the OFF position is readily apparent. Also see 66.6.

30.4 Blenders

30.4.1 A positive means (not friction alone) shall be provided to prevent a blender cutting assembly from disengaging from the blender container during any normal operating position.

30.4.2 To determine that a construction complies with 30.4.1, the container assembly is to be placed on the base in any position that permits normal operation.

30.4.3 An open-top container of a blender or a blender-type drink mixer shall be provided with a cover having one or more openings. Each cover opening shall not have a dimension larger than 2-5/8 inches (66.7 mm) or less than 1 inch (25.4 mm).

Exception No. 1: When a cover is provided with more than one cover opening, and one of the cover openings is located near the edge of the cover and intended for pouring, the dimension of the pouring opening is able to be less than 1 inch (25.4mm).

Exception No. 2: When a cover is provided with a cover opening that is intended for pouring, the Blender Cover Opening Splash Test, Section 44, is to be conducted.

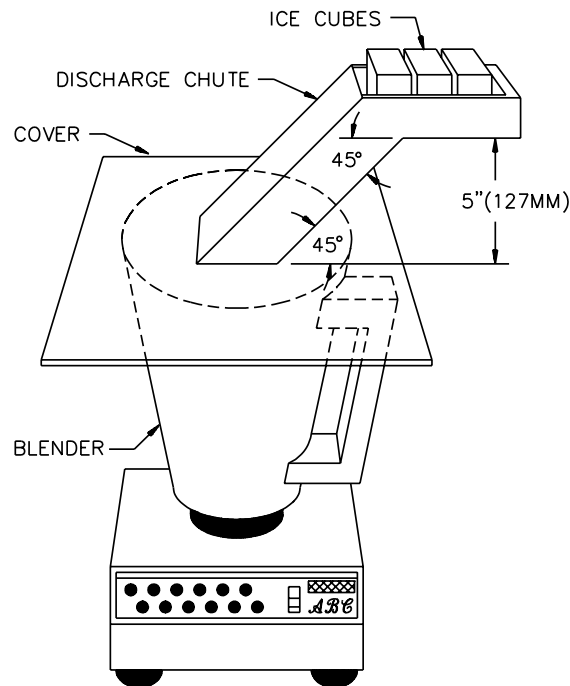
30.4.3 effective April 6, 2006

30.4.4 An appliance employing a moving part that, if it becomes disengaged, would create a risk of injury to persons shall be provided with a means to retain the part in place under conditions of use.

30.4.5 A blender container shall not break or crack during normal use.

30.4.6 To determine if an open top blender container complies with 30.4.5, the blender container is to be mounted in the test fixture as described in Figure 30.1. Each sample container, see 30.4.8, is then to be subjected to an impact of three ice cubes. While energized, the ice cubes are to be released one at a time until one is consumed, then another ice cube released for a total of three. The container is to be initially dry at room temperature $77 \pm 3.6^{\circ}\text{F}$ ($25 \pm 2^{\circ}\text{C}$).

Figure 30.1
Open top blender container test



SB1672

30.4.7 The ice cubes shall be made in a tray containing 24 oz (700 cm³) of distilled nonaerated water and providing 14 cubes. The ice cubes shall be maintained at a temperature of 32°F (0°C) or less prior to the test. The ice cubes when moved from storage are to be used within 5 minutes.

30.4.8 A total of three containers shall be tested as follows:

- a) For a multiple speed blender, each container is to be tested at high, medium, and low speeds (one ice cube per speed).
- b) For a two speed blender, two containers are to be used for the high speed and one container for the low speed.
- c) For a single speed blender, three containers are to be used.

30.4.9 To determine if a closed top blender container complies with 30.4.5, the blender is to be tested as mentioned in 30.4.6 – 30.4.8 except that the test fixture shown in Figure 30.1 is not to be used. Instead, the ice cubes are to be placed in the container prior to the blender being energized.

Exception: If the motor stalls, the blender is to be turned off and then back on to free the ice cubes. If stalling continues, 1 oz (30 ml) of water is to be added.

30.5 Food processors

30.5.1 A food processor is considered to comply with the requirement in 27.7 if the average inside diameter (one-half the sum of the maximum and minimum dimensions) of the feed opening is less than 2-1/2 inches (63.5 mm) with no dimension greater than 3 inches (76.2 mm), and the cutters are recessed not less than 4 inches (102 mm) below the plane of the opening. If the average inside diameter is reduced to 2 inches (50.8 mm), the distance may be reduced to 3-1/2 inches (88.9 mm).

30.5.2 For a food processor provided with a discharge chute, the discharge chute shall comply with the feed-opening dimensions of 30.5.1.

Exception: If the construction of the discharge opening is such that any moving part, accessible through that opening, does not present a risk of injury to persons, the discharge chute need not comply with this requirement.

30.5.3 A food processor shall be provided with a cover actuated interlock to restrict access to moving parts involving risk of injury to persons. The interlock arrangement shall be such that each of the following conditions is met:

- a) When the cover is removed, the moving parts shall stop within 4 seconds.
- b) If the cover can actuate the interlock switch without the cover being properly locked in place, any access opening to moving parts that can be created by the misalignment shall have a maximum vertical dimension of not more than 1 inch (25.4 mm) between the bowl and cover. A force of 1 lbf (4.4 N) is to be employed to move the cover.

30.5.4 The interlock system required by 30.5.3, including a braking system if one is provided, shall be capable of completing 10,000 cycles of operation in the intended manner without malfunction. At the start of the test and upon completion of the test, the 4 second stop time shall not be exceeded. The test shall be conducted so that each of the following conditions is met:

- a) The appliance shall be operated at its highest speed setting until it reaches its maximum speed under the no-load condition.
- b) The blade resulting in the longest stop time shall be used.
- c) The cycling rate shall be such that the motor temperature does not exceed the winding temperatures obtained during the Normal Temperature Test, Section 36.

30.5.5 S-blade and slicing blade cutting assemblies provided with food processors, shall be provided with stems, finger holes, grips, handles or the like to minimize the risk of a cut-type injury during insertion and removal.

30.6 Food choppers

30.6.1 A food chopper shall be provided with a cover actuated interlock which complies with the requirements in 30.5.3.

30.6.2 The interlock system mentioned in 30.6.1, including a braking system if one is provided, shall be tested in accordance with the requirements in 30.5.4, excluding (b).

30.6.3 The S-blade cutting assembly provided with a food chopper shall employ stems, finger holes, grips, handles, or the like to minimize the risk of a cut-type injury during insertion and removal of the assembly.

30.7 Meat grinders and pasta extruding attachments

30.7.1 A meat grinder or pasta extruding attachment is considered to comply with the requirement in 27.7 if the average inside diameter (one-half the sum of the maximum and minimum dimensions) of the throat of a hopper or tubular feed opening for manual feeding is less than 2-1/2 inches (63.5 mm), and no dimension is greater than 3 inches (76.2 mm), or if the maximum diameter of the openings in a nonremovable guard is less than 2-1/2 inches (63.5 mm), provided the cutters are recessed not less than 4 inches (102 mm) below the plane of the opening. If the average inside diameter is reduced to 2 inches (50.8 mm), the distance to the cutter may be reduced to 3-1/2 inches (88.9 mm).

30.8 Coffee grinders

30.8.1 The enclosure of a coffee grinder is considered to comply with the requirement in 22.1 if:

a) At the feed opening:

1) The diameter is less than 2-1/2 inches (63.5 mm) or maximum diagonal dimension of the opening is less than 3 inches (76.2 mm), and the maximum extremity of a moving part that can cause injury to persons is recessed not less than 3-1/2 inches (88.9 mm) from the nearest edge of the plane of the opening; or

2) A guard is provided that does not permit access to a moving part that can cause injury to persons when the cover is open.

b) At the discharge opening:

1) The diameter 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), and the maximum extremity of a moving part that can cause injury to persons is recessed not less than 3-1/2 inches (88.9 mm) from the nearest edge of the plane of the opening;

2) A guard or guards are provided to limit the maximum width of the opening to 3/8 inch (9.5 mm) at the point of exposure to the risk of injury to persons, and the closest point of a moving part that can cause injury to persons is recessed at least 1/4 inch (6.4 mm) from the nearest edge of the guards where it limits the opening to 3/8 inch (9.5 mm);

3) A guard is provided that automatically covers the opening when the discharge container is removed; or

- 4) The discharge opening is in the horizontal plane, its diameter is less than 2-1/2 inches (63.5 mm) or the maximum diagonal dimension is less than 3 inches (76.2 mm) and the distance from a moving part that can cause injury to persons to the nearest edge of the plane of the opening is not less than 2 inches (50.8 mm). A 3/8 inch (9.5 mm) diameter rod is not to contact a moving part that can cause injury to persons when it is inserted into the opening a distance of 3-1/2 inches (88.9 mm) or less.

30.9 Vegetable shredders/slicers and centrifugal juicers

30.9.1 In accordance with the requirements in 27.7, a vegetable shredder/slicer or centrifugal juicer shall comply with the following:

- a) The inside diameter of the throat of a hopper feed opening for manual feeding, or any other opening, shall be a maximum of 3 inches (76.2 mm); and
- b) Moving parts that may cause injury to persons shall be a minimum of 4 inches (101.6 mm) below the plane of the throat of the opening.

Exception: If the average inside diameter of the throat of a hopper feed opening (one half the sum of the maximum and minimum dimensions) is reduced to 2 inches (50.8 mm), the distance to the moving parts may be a minimum of 3-1/2 inches (88.9 mm) below the plane of the throat of the opening.

30.9.2 A vegetable shredder or slicer that has feed openings with a minor dimension a maximum of 3 inches (76.2 mm) and a major dimension a maximum of 5 inches (127 mm) shall be provided with an integrally mounted food pusher. The pusher shall automatically return to the closed position upon being released. (For example – gravity biased, spring loaded, and the like.)

30.9.3 For a vegetable shredder/slicer provided with a discharge chute, the discharge chute shall comply with the feed-opening requirements in 30.9.1.

Exception: If the construction of the discharge opening is such that any moving part, accessible through that opening, does not present a risk of injury to persons, the discharge chute need not comply with this requirement.

30.9.4 A vegetable shredder/slicer shall be provided with a cover-actuated interlock which complies with the requirements in 30.5.3. The interlock system, including a braking system when one is provided, shall be tested in accordance with the requirements in 30.5.4.

Exception: Cone-type shredders/slicers are not required to have an interlock.

30.9.4 effective December 1, 2004

30.9.5 A centrifugal juicer shall be provided with an interlock to restrict access to the juicing disk. The interlock system shall be capable of completing 6000 cycles of operation in the intended manner without malfunction. The test shall be conducted under the following conditions:

- a) The appliance shall be operated at its highest speed setting until it reaches its maximum speed under the no load condition.
- b) The cycling rate shall be such that the motor temperature does not exceed the winding temperature obtained during the Normal Temperature Test, Section 36.

30.9.5 effective December 1, 2004

30.10 Ice-cube crushers

30.10.1 The enclosure of an ice-cube crusher is considered to comply with the requirement in 22.1 if:

a) At the feed opening:

1) The diameter is less than 2-1/2 inches (63.5 mm) or maximum diagonal dimension of the opening is less than 3 inches (76.2 mm), and the maximum extremity of a moving part that can cause injury to persons is recessed not less than 3-1/2 inches (88.9 mm) from the nearest edge of the plane of the opening; or

2) A guard is provided that does not permit access to a moving part that can cause injury to persons when the cover is open.

b) At the discharge opening:

1) The diameter 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), and the maximum extremity of a moving part that can cause injury to persons is recessed not less than 3-1/2 inches (88.9 mm) from the nearest edge of the plane of the opening;

2) A guard is provided that automatically covers the opening when the discharge container is removed;

3) The discharge opening is in the horizontal plane, its diameter is less than 2-1/2 inches (63.5 mm) or the maximum diagonal dimension is less than 3 inches (76.2 mm) and the distance from a moving part that can cause injury to persons to the nearest edge of the plane of the opening is not less than 2 inches (50.8 mm). A 3/8 inch (9.5 mm) diameter rod is not to contact a moving part that can cause injury to persons when it is inserted into the opening a distance of 3-1/2 inches (88.9 mm) or less; or

4) With the discharge container removed, if one is provided, the probe illustrated in Figure 58.7 cannot be made to touch a moving part that can cause injury to persons.

i) A discharge container is provided as part of the appliance that significantly closes off the accessibility of the ice discharge opening when the appliance is operating;

ii) An "ice jam mechanism" (serving as a guard in the closed position) is provided, which substantially releases the normal stationary crushing parts when the mechanism is in the unlocked position; and

iii) The appliance is marked adjacent to the jam release control knob, lever, or equivalent with the marking indicated in 66.16(c).

Exception No. 1: These requirements for the discharge opening do not apply to a drum (cone) type ice crusher where the leading edge of a moving part that can cause injury to persons cannot be contacted by the user and the maximum speed of a moving part that can cause injury to persons is less than 1500 revolutions per minute.

Exception No. 2: These requirements for the discharge opening may not apply to an ice cube crusher employing flail type hammers provided that:

- a) *The tips of the flails are well rounded and smooth;*
- b) *The flails do not extend more than 0.025 inch (0.64 mm) beyond the plane of the opening; and*
- c) *An ice catch container or the equivalent is provided.*

30.11 Wand-type mixers

30.11.1 A hand-held wand-type mixer shall be provided with a momentary contact ON/OFF switch having the following features:

- a) A distinct and separate motion, in addition to gripping the product, shall be required to energize the unit;
- b) The motion shall not be easily defeatable;
- c) A single motion shall be required to de-energize the unit; and
- d) The switch shall not be capable of locking in the ON position.

30.11.2 A wand-type mixer is considered to comply with 27.1 if it is provided with top and side blade guarding that affords the necessary protection for the blade against contact with sides/bottom of bowl surfaces, and the user against inadvertent blade contact. Any openings in the top and side blade guarding shall not permit the entrance of the flat end of a 3/8 inch (9.5 mm) diameter rod, when placed perpendicular to the guard. As an alternate means of evaluation, any openings in the guarding shall not permit contact of the flat end of a 5/16 inch (8 mm) diameter rod of unlimited length with the blades, when placed at an angle of 45 degrees to the drive shaft. The bottom circular opening shall not be guarded in a manner that would interfere with the intended operation of the appliance.

30.11.3 Slicing/cutting assemblies provided with wand-type mixers shall be provided with a means to minimize the risk of a cut-type injury (such as stems, finger holes, grips handles and the like) during insertion and removal.

30.12 Coffee mills

30.12.1 A coffee mill shall be provided with a cover actuated interlock to prevent access to moving parts involving a risk of injury to persons. The interlock arrangement shall be such that each of the following conditions is met:

- a) When the cover is removed, the moving parts shall stop within 4 seconds.
- b) If the cover can actuate the interlock switch without the cover being properly locked in place, any access opening to moving parts that can be created by misalignment shall have a maximum vertical dimension of not more than 1 inch (25.4 mm) between the bowl and cover. A force of 1.0 lbf (4.4 N) is to be applied to remove the cover.

30.12.2 The interlock system mentioned in 30.12.1 including a braking system, if one is provided, shall be capable of completing 6000 cycles of operation in the intended manner without malfunction. At the start of the test, and upon completion of the test, the 4 second stop time shall not be exceeded. The test shall be conducted so that each of the following conditions is met:

- a) The appliance shall be operated at its highest speed setting until it reaches its maximum speed under the no-load condition.
- b) The blade resulting in the longest stop time shall be used.
- c) The cycling rate shall be such that the motor temperature does not exceed the winding temperatures obtained during the Normal Temperature Test, Section 36.

30.13 Pasta mixer-extruders

30.13.1 A pasta mixer-extruder shall be provided with a cover actuated interlock over the mixing chamber to protect against access to moving parts involving risk of injury to persons. The interlock arrangement shall complete 6000 cycles of operation without malfunction.

PERFORMANCE

31 General

31.1 Values of voltage and current are root-mean-square values, unless otherwise stated.

31.2 An appliance having both alternating-current and direct-current ratings is to be tested with the appliance connected to an alternating-current supply and again to a direct-current supply, unless it can be established that one test will result in the maximum operating conditions.

31.3 All operational tests shall be conducted with the appliance connected to a supply circuit of the maximum rated frequency and having the voltage specified in Table 31.1, unless otherwise noted in the standard.

31.3 effective December 1, 2004

Table 31.1
Test voltages

Table 31.1 effective December 1, 2004

Rated voltage (V)	Test voltage (V)
110 – 120	120
220 – 240	240
NOTE: If the rated voltage is not within the given ranges, the appliance is to be tested at its rated voltage but not less than 120 V.	

31.4 An appliance rated 50 – 60 Hz is to be tested both at 50 and 60 Hz, where performance is frequency dependent, unless it can be established that one test will result in the maximum operating conditions. Universal motors are generally considered not frequency dependent.

31.5 Wherever cloth is mentioned in the abnormal tests, the cloth is to be bleached cheesecloth, running 14 – 15 yd²/lb (approximately 26 – 28 m²/kg) and having what is known in the trade as a "count of 32 by 28," that is, for any square inch, 32 threads in one direction and 28 threads in the other direction (for any square centimeter, 13 threads in one direction and 11 in the other direction).

32 Leakage Current Test

32.1 The leakage current of a cord-connected appliance rated for a nominal 120 V or 240 V supply when tested in accordance with 32.3 – 32.7 shall not be more than:

- a) 0.5 mA for an ungrounded (two-wire) portable, stationary, or fixed appliance;
- b) 0.5 mA for a grounded (three-wire) portable appliance; and
- c) 0.75 mA for a grounded (three-wire) 3-wire or 4-wire stationary or fixed appliance employing a standard attachment plug rated 20 A or less.

32.1 effective December 1, 2004

32.2 Leakage current refers to all currents, including capacitively coupled currents, which may be conveyed between exposed conductive surfaces of an appliance and ground or other exposed conductive surfaces of an appliance.

32.3 All exposed conductive surfaces are to be tested for leakage currents. The leakage currents from these surfaces are to be measured to the grounded supply conductor individually as well as collectively where simultaneously accessible and from one surface to another where simultaneously accessible. Parts are considered to be exposed surfaces unless guarded by an enclosure considered to provide protection against the risk of electric shock as defined in 7.5 – 7.11. Surfaces are considered to be simultaneously accessible when they can be readily contacted by one or both hands of a person at the same time. These measurements do not apply to terminals operating at voltages which are not considered to involve the risk of electric shock.

32.4 If a conductive surface other than metal is used for the enclosure or part of the enclosure, the leakage current is to be measured using a metal foil with an area of 10 by 20 cm (3.9 by 7.9 inches) in contact with the surface. Where the surface is less than 10 by 20 cm, the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to affect the temperature of the appliance.

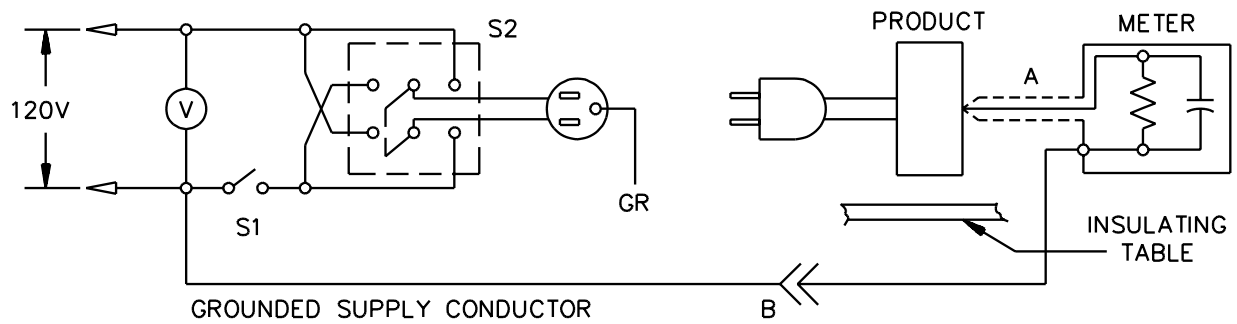
32.5 The measurement circuit for leakage current is to be as shown in Figure 32.1. The ideal instrument is defined in (a) – (d). The meter which is actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument.

- a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 μ f.
- b) The meter is to indicate 1.11 times the average of the full-wave rectified composite waveform of voltage across the resistor or current through the resistor.
- c) Over a frequency range of 0 – 100 khz, the measurement circuitry is to have a frequency response (ratio of indicated to actual value of current) equal to the ratio of the impedance of a 1500 ohm resistor shunted by a 0.15 μ f capacitor to 1500 ohms. At an indication of 0.5 or 0.75 mA, the measurement is to have an error of not more than 5 percent at 60 Hz.

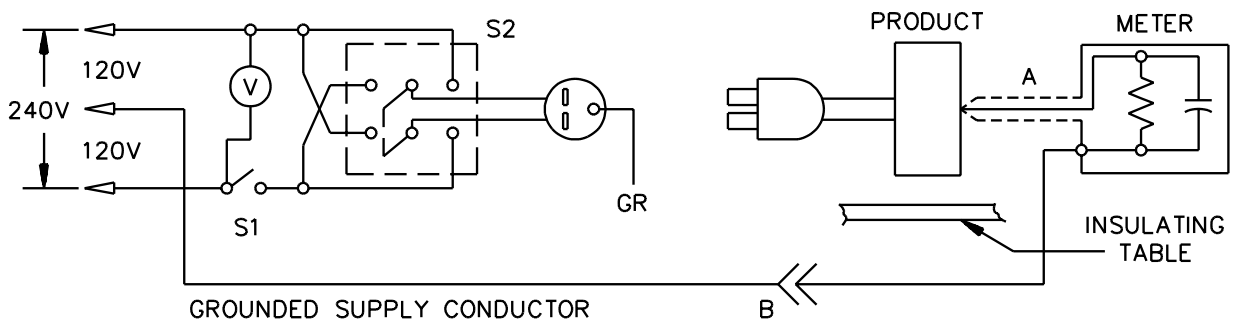
d) Unless the meter is being used to measure leakage from one part of an appliance to another, the meter is to be connected between the accessible parts and the grounded supply conductor.

Figure 32.1
Leakage-current measurement circuit

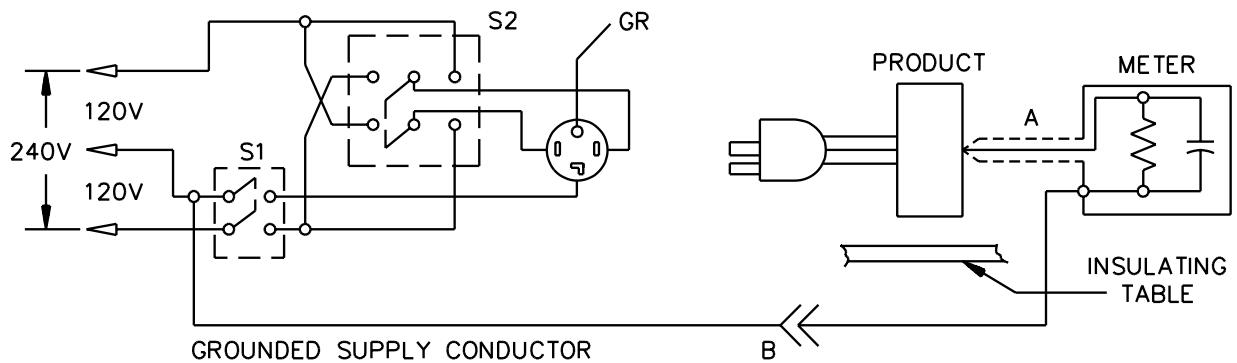
Figure 32.1 effective December 1, 2004



Appliance intended for connection to a 120-volt power supply.



Appliance intended for connection to a 3-wire, 240-volt power supply, as illustrated above.



Appliance intended for connection to a 4-wire, 120/240-volt power supply, as illustrated above.

A - Probe with shielded lead.

B - Separated and used as clip when measuring currents from one part of device to another.

LC100Q

32.6 A representative appliance is to be tested for leakage current starting with the as-received condition but with its grounding conductor, if any, open at the attachment plug. The as-received condition is without prior energization except as occurring as part of the production-line testing. The supply voltage is to be adjusted to 120 V or 240 V, in accordance with the rating of the product. The test sequence, with reference to the measuring circuit (Figure 32.1) is to be as follows:

- a) With switch S1 open, the appliance is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2 and with the appliance switching devices in all their normal operating positions.
- b) Switch S1 is then to be closed energizing the appliance, and within a period of 5 seconds, the leakage current is to be measured using both positions of switch S2, and with the appliance switching device in all their normal operating positions.
- c) The leakage current is to be monitored until thermal stabilization. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operation as in the Normal Temperature Test, Section 36.

32.6 effective December 1, 2004

32.7 Normally a representative appliance will be carried through the complete leakage-current-test program as covered by 32.6, without interruption for other tests. With the concurrence of those concerned, it is possible to interrupt the leakage-current tests for the purpose of conducting other non-destructive tests.

33 Operational Tests

33.1 Operation of an appliance while simulating anticipated conditions of use shall not increase the risk of fire, electric shock, or injury to persons.

33.2 In conducting the test, the conditions mentioned in the manufacturer's instructions, including cleaning, maintenance, and the use of accessories may be included or omitted so as to simulate reasonably foreseeable actions of the user.

34 Starting Current Test

34.1 Protection by fuses

34.1.1 Except as noted in 34.1.2 and 34.2.1, an appliance shall be capable of starting and operating on a circuit protected by an intended (non-time-delay) fuse having a current rating corresponding to that of the branch circuit to which the appliance should be connected.

34.1.2 The requirement in 34.1.1 does not apply if:

- a) The construction of the appliance or the nature of its usage is such that it is likely to be used continually on the same branch circuit after installation;
- b) The appliance will start and operate normally on a circuit protected by a time-delay fuse; and
- c) The appliance is marked in accordance with 65.8.

34.2 Other overcurrent protection

34.2.1 The requirement in 34.1.1 does not apply to a household appliance that would normally be used on a 15 or 20 A branch circuit, but the appliance shall start and operate on a circuit protected by a time-delay fuse having an ampere rating corresponding to that of the branch circuit on which the appliance would normally be used.

34.2.2 In a test to determine whether or not an appliance complies with the requirement in 34.1.1, the appliance is to be started three times, with the appliance at room temperature at the beginning of the test. Each start of the motor is to be made under conditions representing the beginning of normal operation (the beginning of the normal operating cycle, in the case of an automatic appliance), and the motor is to be given time to come to rest between successive starts. The performance is unacceptable if the fuse opens. Tripping of an overload protector provided as part of the appliance is also considered to constitute unacceptable performance.

35 Input Test

35.1 The measured input in watts or amperes to an appliance shall not exceed the marked rating by an amount greater than the deviation shown in Table 35.1 when the appliance is operated under a condition of maximum normal load as described in 36.1.11 – 36.26.2 and when connected to a supply circuit of maximum rated voltage and rated frequency.

Table 35.1
Input test deviations

Rated input, watts	Deviation (+/-)	Rated input, amperes	Deviation (+/-)
Up to and including 33.3	10 W	Up to and including 0.29	0.09 A
Over 33.3 up to and including 150	30 percent	Over 0.29 up to and including 1.3	30 percent
Over 150 up to and including 300	45 W	Over 1.3 up to and including 2.6	0.4 A
Over 300	15 percent	Over 2.6	15 percent

35.2 If an appliance is provided with various functional attachments, the marked electrical rating is determined per 35.1 when the appliance is operated with the attachment which results in the highest input. See 65.3 and 68.4.

35.3 The measured input in watts or amperes to an appliance may be less than the marked rating by an amount greater than the deviation shown in Table 35.1 if the temperature rises indicated in Table 36.1 are not exceeded when the appliance is subjected to an additional temperature test when loaded to nameplate rating (amperage or wattage). The duty cycle is to be the same as that established for the temperature test (36.1.11 – 36.26.2). If an appliance is provided with various functional attachments, the duty cycle shall be that which results in the highest temperatures. Multispeed appliances are to be operated at high speed for this test. During the conduct of this test, the appliance is to be connected to a 120 V, 60 Hz supply circuit. If it is not possible to artificially load the appliance to its marked rating (that is – due to motor stalling), the appliance is not considered to comply with the intent of the input test. If the load is to be increased by other than a food load, it is to be applied gradually (normally not over 5 seconds) before considering the on sequence of the duty cycle to have started.

35.4 For an appliance having a single voltage rating (such as 115 V) rather than being rated for a range of voltages (such as 110 – 120 V), maximum rated voltage is considered to be that single value of voltage. If the rating is given in terms of a range of voltages, maximum rated voltage is considered to be the highest value of the range.

36 Normal Temperature Test

36.1 General

36.1.1 An appliance, when tested under the conditions of "Maximum Normal Load" as described in 36.1.11– 36.26.2, shall not attain a temperature at any point high enough to constitute a risk of fire or to damage any materials employed in the appliance, nor shall the appliance show greater temperature rises at certain specified points than those indicated in Table 36.1 when operated at 120 V or 240 V, and in Table 36.2 when operated also at 127 V or 254 V.

36.1.1 effective December 1, 2004

Table 36.1
Maximum acceptable temperature rises at 120 V or 240 V

Table 36.1 effective December 1, 2004

Materials and component parts		°C	(°F)
1.	Varnished-cloth insulation	60	(108)
2.	Fuses	65	(117)
3.	Fiber employed as electrical insulation	65	(117)
4.	Wood and other combustible material	65	(117)
5.	Class A insulation systems on coil windings of motors ^a : Thermocouple method or Resistance method	85	(153)
6.	Transformers with Class 105 insulation systems: Thermocouple method	65 ^a	(117 ^a)
	Resistance method	75 ^a	(135 ^a)
7.	Transformers with Class 130 insulation systems: Thermocouple method	85 ^a	(153 ^a)
	Resistance method	95 ^a	(171 ^a)
8.	Class B insulation systems except as indicated in item 13: Thermocouple method	85	(153)
9.	Phenolic composition employed as electrical insulation or as a part depended upon to reduce the risk of fire, electric shock, or injury to persons	125 ^b	(225 ^b)
10.	Rubber- or thermoplastic-insulated wires and cords	35 ^{b,c}	(63 ^{b,c})
11.	Capacitors: Electrolytic	40 ^d	(72 ^d)
	Other types	65 ^e	(117 ^e)
12.	Class 105 insulation systems on windings of relays, solenoids, and the like: Thermocouple method	65	(117)
	Resistance method	85	(153)
13.	Class B insulation systems on coil windings of motors ^a : Thermocouple method or resistance method	105	(189)
14.	a) Copper, tinned or bare strands: 1) less than 0.015 inch diameter	125	(225)
	2) 0.015 inch diameter and larger	175	(315)

Table 36.1 Continued on Next Page

Table 36.1 Continued

Materials and component parts	°C	(°F)
b) Nickel, gold, or silver platings or combinations of those platings, over copper conductors	225	(405)
15. Class F insulation systems on coil windings of motors ^a : Thermocouple method or Resistance method	130	(234)
16. Class H insulation systems on coil windings of motors ^a : Thermocouple method or Resistance method	155	(279)

^a See 36.1.6 and 36.1.9.

^b The limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to compounds which have been investigated and found to have special heat-resistant properties.

^c Rubber-insulated conductors within a Class-A-insulated motor, rubber-insulated motor leads, may be subjected to a temperature rise of more than 35°C (63°F), provided that a braid is employed on the conductor. However, this does not apply to thermoplastic-insulated wires.

^d For an electrolytic capacitor which is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure may be more than 65°C (117°F).

^e A capacitor which operates at a temperature rise of more than 65°C (117°F) may be investigated on the basis of the marked temperature limit.

Table 36.2
Maximum acceptable temperature rises at 127 V or 254 V

Table 36.2 effective December 1, 2004

Materials and component parts	°C	(°F)
1. Class A insulation systems on coil windings of motors: Thermocouple or resistance method	100	(180)
2. Class B insulation systems on coil windings of motors: Thermocouple or resistance method	120	(216)
3. Class F insulation systems on coil windings of motors: Thermocouple or resistance method	145	(261)
4. Class H insulation systems on coil windings of motors: Thermocouple or resistance method	170	(306)

36.1.2 A thermal or overcurrent-protective device shall not open the circuit during the temperature test of the appliance mentioned in 36.1.1.

36.1.3 Temperatures are to be measured by thermocouples consisting of wires no larger than 24 AWG (0.21 mm²) and no smaller than 30 AWG (0.05 mm²), except that a coil temperature may be determined by the change-of-resistance method under the conditions indicated in 36.1.6.

36.1.4 The thermocouples and related instruments are to be accurate and calibrated in accordance with good laboratory practice. The thermocouple wire is to conform with the requirements specified in the Initial Calibration Tolerances for Thermocouples table in Temperature-Measurement Thermocouples, ANSI/ISA MC96.1.

36.1.5 A thermocouple junction and adjacent thermocouple wires are to be securely held in good thermal contact with the surface of the material whose temperature is being measured.

36.1.6 The temperature of a coil or a winding is to be determined by either the thermocouple or change-of-resistance method. A thermocouple is able to be used for determining temperatures of a coil or winding if it can be mounted, without removal of encapsulating compound or similar material:

- a) On the integrally applied insulation of a coil without a wrap; or
- b) On the outer surface of a wrap that is not more than 1/32 inch (0.8 mm) thick and consists of cotton, paper, rayon, or similar insulating material, but not of thermal insulating material.

For a thermocouple measured temperature of an a-c motor coil, the thermocouple is to be mounted on the integrally applied insulation on the conductor.

36.1.7 All values for temperature rises in Tables 36.1 and 36.2 are based on an assumed test area ambient temperature of 25°C (77°F); however, tests may be conducted at any ambient temperature within the range of 10 – 40°C (50 – 104°F).

36.1.8 The formulas for obtaining the temperature of copper and aluminum by the change-of-resistance method are as follows:

$$t_1 = \frac{R}{r} (234.5 + t_2) - 234.5 \text{ (copper)}$$

$$t_1 = \frac{R}{r} (225 + t_2) - 225.0 \text{ (aluminum)}$$

In which:

t₁ is the temperature in °C to be determined

t₂ is the known temperature in °C

R is the resistance in ohms at the temperature to be determined

r is the resistance in ohms at the known temperature

36.1.9 At a point on the surface of a winding of a relay, solenoid, and the like, for a Class 105 insulation system (item 12 of Table 36.1) where the temperature is affected by an external source of heat, the temperature rise measured by means of a thermocouple may be higher by 15°C (27°F) than the maximum indicated in Table 36.1 for 120 V. If the coil wrap is not caused to exceed its temperature limitation by radiation from an external source, the temperature of the coil may be measured by means of a thermocouple on the integral insulation of the coil conductors.

36.1.10 If an appliance incorporates a cord reel or storage compartment for the power-supply cord, one-third of the length of the cord is to be outside of the reel or storage compartment during the temperature test.

36.1.11 Maximum normal load is considered to be that load which approximates as closely as possible the most severe conditions of normal use. It is not a deliberate overload except as the conditions of actual use are likely to be somewhat more severe than the maximum load conditions that are recommended by the manufacturer of the appliance. Test loads that have been found to be close approximations of the most severe conditions of normal use are indicated in 36.2.1 – 36.2.6.2 for some common forms of appliances. However, appliances having features not contemplated in these test procedures may be tested as necessary to meet the intent of these requirements.

36.1.12 Combination type appliances such as can opener/knife sharpeners are to be tested individually for each function; the appliance is to be at room temperature at the beginning of each test unless it is intended that one type of function immediately be followed with another, such as to crush ice, then mix the crushed ice.

36.1.13 A multi-speed appliance intended for use with attachments shall be tested with the various attachments at the speed or speeds recommended for each attachment.

36.2 Food mixers

36.2.1 A household-type food mixer (a mixer for mixing batter, whipping potatoes, and similar operations) is to be operated for a total of 15 minutes in the intended manner, involving all the different speeds provided by the appliance, and with a load material having such consistency or viscosity as to be generally representative of actual service conditions. The appliance is to be operated through the entire sequence of speeds (increasing from the lowest speed to the highest speed and then decreasing back to the lowest speed) in accordance with the following:

$$T = \frac{15 \text{ min}}{2N - 1}$$

in which:

T is the time at each speed and

N is the number of speed settings.

36.2.2 Dry 50 – 80 core sand is to be used as a load for the type of food mixer mentioned in 36.2.1. The beater blades are to extend as nearly as possible to the bottom of the mixing bowl, and the depth of the level sand is to be such as to cover approximately 80 percent of the blade length when the blades are stationary. If this quantity of sand is enough to stall the blades of a multiple-speed machine on the low speed, just enough sand may be removed to permit motion of the blades for the low-speed operation only.

36.2.3 If a mixing bowl is not provided by the manufacturer, a bowl with a height of 5-1/8 inches (13.0 cm) and an inner diameter of 6-3/4 inches (17.2 cm) at the top tapering down to 6.0 inches (15.2 cm) at the bottom is to be used. The inner surface of the bowl is to be smooth and the bottom is to blend smoothly.

36.3 Blending mixers

36.3.1 A blending mixer of the type intended to reduce a combination of solid vegetables or fruit and a liquid to a blend of the two (a blender, emulsifier, or liquidizer) is to be tested as follows: The appliance is to be subjected to 10 cycles of operation, with each cycle consisting of 3 minutes of operation followed by a 1 minute off period. For each cycle, a single-speed mixer is to be loaded to capacity with a mixture of diced carrots and water. The capacity of the mixer is to be determined in accordance with 36.3.2. The input measurement is to be recorded 30 seconds after the first load cycle begins. If the appliance stalls at the beginning of any cycle, the obstruction is to be removed and the test continued. If it stalls while running, the obstruction is to be removed and the entire test restarted after the appliance has cooled to room temperature. If the appliance stalls more than twice while running, the results of the test are not acceptable. A multispeed mixer is to be tested at its highest and lowest speed in the manner just described, except that the load for the test at the lowest speed is to consist of water alone. The foregoing does not apply to any appliance intended for operation without liquid – such an appliance is to be given separate consideration, with the load and duty cycle selected in such a manner as to take into account the intended use.

Exception No. 1: If the construction of the blender is such that it cannot be operated for 3 minutes without being restarted, each cycle is to be run at the maximum cycle time of the blender unless the cycle is less than 1 minute. If the cycle is less than 1 minute, the blender is to be recycled to obtain 1 minute cycles.

Exception No. 2: If the blender is provided with a momentary contact switch with no means for locking it in the on position, each cycle shall consist of 1 minute of operation followed by a 1 minute off period.

36.3.2 The blending mixer capacity is to be determined by loading the mixer with a mixture of diced carrots and water in the ratio of 2 to 3 by weight, with approximately half of the weight of carrots consisting of pieces having a maximum dimension of less than 1/2 inch (12.7 mm) and the remainder consisting of pieces having a maximum dimension between 1/2 and 3/4 inch (12.7 and 19.1 mm). The mixture is then to be placed in the blender mixer container to the marked capacity of the container or the maximum amount recommended in the instruction material packaged with the blender, whichever is greater. The blending mixer is to be operated at its highest speed at the rated voltage until the mixture is well blended. If spill-over of the mixture occurs while the mixer is running at its highest speed, then the amount of mixture present in the container prior to spill-over is the amount to be used in the test described in 36.3.1. If the mixture level is below the lip of the mixer container while the mixer is running at its highest speed, additional mixture is to be added until the mixture level reaches the lip of the mixer container. The amount of mixture remaining in the mixer container, after replacement of the cover, is the amount to be used in the test described in 36.3.1. Any spill-over that occurs due to the replacement of the cover is to be ignored.

36.4 Liquid mixers

36.4.1 A liquid mixer is to be operated for 10 complete cycles, each cycle consisting of 3 minutes of operation with the maximum capacity water load, followed by a 1 minute idling period. During the idling period, the liquid container is completely removed from the driving mechanism. If adverse operation and/or abuse to the rotating drive coupling could occur during normal removal and/or replacement of the liquid container, the 1 minute period between water loads is to be with the drive coupling not rotating but with the motor running or the unit is to be deenergized if necessary to stop the rotation of the drive coupling. A liquid mixer so tested shall have operating instructions provided which describe this method of usage, that is, that the driver is to be stopped when removing or replacing the liquid container.

36.4.2 The liquid-mixer capacity mentioned in 36.4.1 is to be the amount of water which completely fills the container with the unit operating at the highest speed setting if a multispeed motor is used. The container cover is to be removed when capacity is determined.

36.5 Juice extractors

36.5.1 The input to a reamer-type juice extractor is to be measured extracting juice from oranges which have been cut approximately in half. For the temperature test a reamer-type juice extractor is to be operated for 24 complete cycles – each cycle consisting of 1/4 minute of the actual extraction operation or its equivalent, to be followed by a 1/4 minute idling period with the motor on but without added load on the reamer.

36.5.2 For a reamer-type juice extractor provided with a momentary-contact switch, the motor is to be deenergized between extractions.

36.5.3 The input to a centrifugal fruit juice extractor is to be measured extracting the juice from celery and spinach. For the temperature test, a centrifugal type juicer for fruits and vegetables is to be operated juicing two bunches of celery, (1-3/4 lb or 0.8 kg per bunch minimum) after which it is to be cleaned and then immediately followed with the juicing of 4 lbs (1.8 kg) of spinach. The force applied when pushing food through the centrifugal fruit juicer is to be 1.1 lbf (5 N). If, during the operation of the unit, the juicer becomes so clogged that it begins to vibrate excessively, the appliance is to be turned off and cleaned. Then it is to be turned on and the juicing operation is to be continued until the celery and spinach are consumed.

36.5.3 effective December 1, 2004

36.6 Meat grinders

36.6.1 The input test on a meat grinder is to be made while the appliance is processing small pieces of beef [approximately 2 inch (51 mm) cubes] of a variety such as boneless chuck and during the test, the meat is to be self-fed into the grinder without the application of external pressure to force it in. During the temperature test on a meat grinder, the appliance is to be operated without load, (except that small pieces of meat are to be dropped in occasionally to lubricate the cutting piece) and the temperatures are to be measured when they have become constant.

36.7 Baby-food grinders

36.7.1 The input test on a baby-food grinder is to be conducted while the appliance is processing small pieces of cooked roast beef. Starting with the appliance at room temperature the food tube is to be filled with the cooked roast beef and with the food pusher, pressure is to be applied to maintain the food in contact with the cutter. The force applied when pushing food through the baby-food grinder is to be 1.1 lbf (5 N). During the temperature test on the baby-food grinder, the appliance is to be operated grinding 8 oz (227 g) of cooked roast beef. Small pieces of cooked roast beef are to be placed into the food tube. Pressure is to be maintained on the pusher to maintain the grinding action. When this quantity is ground, the food tube is to be refilled while the appliance is continuously operating. The test is continued until 8 oz (227 g) are consumed.

36.7.1 effective December 1, 2004

36.8 Baby-food choppers

36.8.1 The input test on a baby-food chopper is to be conducted while the appliance is processing 3 oz (85 g) of small pieces of beef placed in a bowl. During the temperature test, the appliance is to be operated under a duty cycle of 15 seconds chopping, followed by 1 minute OFF, during which time the chopped meat is to be emptied and 3 more oz (85 g) are to be added until a total of 9 oz (255 g) has been consumed.

36.9 Meat slicers

36.9.1 The input to a meat slicer is to be measured with the slicer operated without load. During the temperature test, the slicer is to be operated without load until temperatures have become constant. Temperatures are to be measured when they have become constant.

36.10 Churns

36.10.1 The input to a butter churn is to be measured while making butter. For the temperature test, the churn is to be operated under the following conditions until butter is produced. The churn is to be loaded to the capacity which it will accommodate without spillage while operating with a mixture consisting of eight parts of heavy cream to one part buttermilk – the mixture having been kept at a temperature of 18°C (64°F) for several hours prior to the test. Operation is to be discontinued within 3 minutes after the first evidence of butter formation appear.

36.11 Knife sharpeners

36.11.1 The input and temperature tests on a knife sharpener (or a combination appliance having a knife-sharpening function) are to be performed with the appliance operating continuously for 10 minutes under a no-load condition. The test is to be terminated immediately after the 10 minute period.

36.11.1 effective December 1, 2004

36.12 Can openers

36.12.1 The input test on a can opener is to be conducted with the can opener opening a No. 3 steel can [having a 4-1/4 inch (108 mm) cover diameter]. The temperature test is to be conducted opening five No. 3 size steel cans in succession with an off time of 15 seconds maximum between the opening of each can. During this interval, the opened can and cover are to be removed from the mechanism and an unopened can is to be inserted into the mechanism.

36.12.1 effective December 1, 2004

36.13 Ice crushers

36.13.1 The input and temperature tests on an ice crusher (or a combination appliance having an ice-crusher attachment) are to be performed with the appliance crushing 6 lbs (2.7 kg) of ice cubes. The ice cubes are to be any solid shape with the cube weight no less than 0.7 oz (20 g). If the size cubes described above do not pass through the inlet chute of the appliance, the amount of water used per tray in preparing the ice cubes can be reduced, but the total weight of ice cubes used should be 6 lbs (2.7 kg).

36.14 Vegetable shredders

36.14.1 The input test on a vegetable shredder is to be conducted with the shredder using the various attachments provided, and slicing or shredding the various foods intended as indicated in the literature provided with the shredder. The temperature test is to be performed with the appliance shredding cabbage for 4 cycles, each cycle having a 3 minute shredding period followed by a 1 minute idling period – the motor on but without vegetable load on the shredding mechanism. The force applied when pushing food through the vegetable shredder is to be 1.1 lbf (5 N). The cutting mechanism (cutter blade, cone, or similar devices) is not to be removed during the idling period.

36.14.1 effective December 1, 2004

36.15 Ice cream mixer freezers (bucket type)

36.15.1 The test on a counter-top ice cream freezer is to be conducted using an ice cream mix provided in the manufacturer's instructions. The ice cream container is to be filled to 2/3 of its volume unless the manufacturer's instructions indicate otherwise. The ice bucket is to be filled with a mixture of ice and rock salt according to the manufacturer's instructions. The freezer is to be operated continuously (a minimum of 20 minutes) until a sludge-type ice cream mixture forms (maximum of 40 minutes).

36.16 Coffee mills/grinders

36.16.1 The input test of a coffee mill/grinder is to be conducted by operating the product, processing coffee beans in the intended manner for each type of grinding possible (fine, coarse, percolator, drip, and the like). The temperature test is to be conducted processing coffee beans at the grinding setting that resulted in the highest input in the intended manner until a total of 1 lb (0.45 kg) of coffee beans has been processed as follows:

- a) A product with a bean hopper capacity of 1 lb or more is to be operated continuously.
- b) A product with a bean hopper capacity of less than 1 lb is to be operated continuously grinding until the hopper is empty. A 1 minute OFF period is to be allowed while the hopper is refilled to the maximum capacity recommended in the Instruction Manual, or inferred by a fill mark located on the hopper.
- c) A coffee mill/grinder which cannot be operated without a supplied ground coffee catch container in place is to be operated until such a container is filled. A 1 minute OFF period is to be allowed while the container is emptied.
- d) A product of the batch type is to be filled to the recommended capacity and operated continuously until the coffee is completely processed as specified in the Instruction Manual. A 1 minute OFF period is to be allowed while the processing chamber is emptied and refilled. A batch type product is one that processes coffee beans with blades as opposed to a grinding mill, and also one in which the processed coffee remains in the processing chamber until it is removed.

36.17 Knives

36.17.1 The input current or wattage is to be measured while cutting approximately 3 inch (76 mm) diameter hard salami, approximately 3-1/2 inch (89 mm) square processed cheese, and approximately 5 inch (127 mm) diameter pumpernickel bread. Six different people are each to make three cuts on each food item. The readings recorded are to be the maximum current or wattage measured for any particular cut. The average wattage obtained during the input test is to be used for the temperature test. The electric knife is to be operated under loaded conditions for 15 minutes, using a mechanical load placed on the blades to simulate cutting of food at the rate of 10 cuts per minute. Each simulated cut is to be made by gradually applying the mechanical load to the knife so that the input to the knife increases from the no-load value to the average value determined during the input measurement during the first second of the cut. This average value is to be maintained for 4 seconds, after which the load is to be withdrawn so that the input returns to the no-load value during the last second of the cut.

36.18 Food choppers

36.18.1 The input test on a food chopper is to be conducted with the appliance chopping various foods such as meats, hard cheese, and the like, in the quantities recommended in the Instruction Manual. For each food load tested, the average input under load is to be recorded.

36.18.2 The temperature test on a food chopper is to be performed with the appliance operating for 10 cycles. Each cycle of operation is to consist of an on time of 15 seconds or the time specified in the manufacturer's instructions, whichever is greater, followed by a 1 minute OFF period. The chopper is to be filled with the type of food which resulted in the highest input during the input test described in 36.18.1, in the quantities recommended in the Instruction Manual. When a feed chute is provided, the force applied when pushing food through the food chopper is to be 1.1 lbf (5 N).

36.18.2 effective December 1, 2004

36.19 Food processors

36.19.1 The input test on a food processor is to be conducted in the following manner:

- a) Metal cutting-mixing blade (S-blade) – The appliance is to be operated with the metal cutting-mixing blade installed as described in the manufacturer's Instruction Manual while processing the various foods such as meats, hard cheese, and similar foods, in the quantities recommended in the Instruction Manual. The average input under load of each food tested is to be noted.
- b) Slicing discs, shredding discs, or both – The disc is to be installed in the food processor as intended. The food processor is to be operated as described in the Instruction Manual, slicing or shredding various foods such as cucumbers, potatoes, carrots, hard cheese, hard meats, sausage, and similar foods. The food is to be placed in the feed chute and pressure is to be applied on the food pusher to maintain the cutting action without forcing the process. The average input under load of each food tested is to be noted.

Exception: The input test on a food processor provided with a discharge opening is to be conducted using the various attachments provided, with the food processor slicing or shredding the various foods intended as indicated in the Instruction Manual provided with the appliance.

36.19.1 effective December 1, 2004

36.19.2 The temperature test is to be performed in the following manner:

- a) Metal cutting-mixing blade (S-blade) –
 - i) For a food processor supplied with mixing attachments or instructions for mixing dough, the cutting-mixing blade is to be installed in the appliance as intended. The appliance is to be operated for 4 cycles of operation. Each cycle of operation is to consist of 3 minutes on followed by a 1 minute OFF period. The bowl is to be filled with dry 50 – 80 core sand, which is to be changed and replaced with fresh sand after each cycle to a level which causes an input (wattage) to the appliance equal to the average input noted in the input test when processing the food which resulted in the highest input. The amount of sand employed is not to exceed the maximum capacity of (total amount containable by) the bowl.

ii) For a food processor not intended for mixing dough, the temperature test is to be performed with the appliance operating for 10 cycles. Each cycle of operation is to consist of an on time of 15 seconds or the time specified in the manufacturer's instructions, whichever is greater, followed by a 1 minute OFF period. The food processor is to be filled with the type of food which resulted in the highest input during the input test described in 36.19.1, in the quantities recommended in the Instruction Manual.

b) Slicing disc, shredding disc, or both – The disc to be tested is to be installed in the food processor bowl as intended. The appliance is then to be operated for 4 cycles of operation, slicing or shredding the food that caused the highest input to the appliance as noted during the input test. During each cycle of operation the bowl is to be filled to its maximum capacity or to a maximum-fill indicator, if provided, with the food being processed, followed by a 1 minute OFF period. The force applied when pushing food through the food processor is to be 1.1 lbf (5 N).

Exception No. 1: The force applied when pushing cheese through a cheese grater attachment is to be 2.2 lbf (10 N).

Exception No. 2: The temperature test on a food processor provided with a discharge opening is to be conducted as follows:

a) The appliance is to be operated while slicing or shredding cabbage for 4 cycles, each cycle having a 3 minute shredding period followed by a 1 minute idling period. During the idling period, the motor is to be on without a load on the shredding mechanism. The cutting mechanism (cutter blade, cone, or similar devices) is not to be removed during the idling period.

b) The appliance is to be operated while slicing or shredding 5 lbs (2.3 kg) of cheese or other foods recommended by the manufacturer using the same cycling rate as in (a) of this Exception.

36.19.2 effective December 1, 2004

36.20 Battery-operated appliances

36.20.1 The input to the charger of a battery-operated appliance is to be measured while charging a completely discharged battery pack. The battery pack is to be discharged by operating the appliance continuously until the motor stops. At that time the input measurement is to be made. The temperature test is to be conducted as follows:

a) An appliance with the charger integral with the appliance is to be operated while charging a battery pack discharged completely as mentioned above until constant temperatures are attained. Temperatures are to be monitored during the entire charging operation so that temperatures in excess of the requirements would be recorded, if any.

b) For an appliance with a separate charger, the charger is to be operated with its accessible output terminals short-circuited until constant temperatures are attained.

36.21 Under-cabinet or wall-mounted appliances

36.21.1 An under-cabinet or wall-mounted appliance shall be mounted on a cabinet bottom and rear wall of a test corner, respectively. The sample is to be placed as closely to the test surfaces specified as construction will permit, or as specified in the Instruction Manual (see 72.1). For products not provided with instructions for mounting in specific locations, the rear and one side of the sample shall contact the vertical walls of the test corner that meet at right angles. In addition, an under-cabinet appliance shall contact a cabinet bottom, and a wall-mounted appliance shall contact a cabinet bottom or a counter top, whichever produces the highest temperature. The test corner is to consist of dull black-painted fir plywood not less than 3/8 inch (9.5 mm) thick, having such a width and height that the vertical walls extend not less than 2 ft (600 mm) beyond the physical limits of the appliance. The cabinet bottom is to be 12 inches (300 mm) deep, located 16 inches (400 mm) above the counter-top. The surface beneath the unit is to be a softwood surface covered with a double layer of white tissue.

36.22 Wand-type mixers

36.22.1 The carrot/water mixture described in 36.3.2 is to be added into a flat bottomed cylindrical bowl having a diameter of 4 inches (100 mm). The amount of the mixture placed in the bowl shall be 3/4 of the height of the shaft portion of the wand-type mixer. The mixture shall be changed and replaced with a fresh mixture after each of the five cycles required by the temperature test. Each of the five cycles shall consist of an ON period of one minute if no reference is made in the appliance Instruction Manual for mixing heavy batters, or three minutes if reference is made in the appliance Instruction Manual for recommending heavy batters; and an OFF period of one minute. During the ON period the wand-type mixer is to be turned on to its highest speed at the rated voltage.

36.23 Wand-type mixers with a milk shake attachment

36.23.1 For a wand-type mixer with a milk shake attachment, the input test is first to be conducted at the high speed setting, blending the maximum capacity mixture in accordance with the manufacturer's instructions. The input readings are to be taken 30 seconds after the start of the blending. The test is to be repeated with the maximum container capacity of water. The maximum container capacity is to be determined by filling the container to the point of no spillage during operation, either with the cover removed or to the maximum fill line with the cover on, whichever is greater. The temperature test is to be conducted blending the recipe or water load, whichever input is greater, for five cycles of operation at the high speed setting. Each cycle is to consist of a one minute ON period followed by a one minute OFF period. The load is to be changed after each ON cycle.

36.23.1 effective December 1, 2004

36.24 Pasta mixer-extruders

36.24.1 The input test on a pasta mixer-extruder appliance is to be conducted with the appliance mixing and extruding pasta in the intended manner. The input is to be noted using each extrusion die provided with the appliance. The temperature test is to be conducted preparing two batches of pasta. The extrusion die which resulted in the highest input during the input test is to be used for the extrusion process. A 1 minute OFF period is to be allowed between batches to clean the appliance. The mixing time and amount of ingredients are to be based on the manufacturer's instructions for preparation of a basic noodle recipe.

36.25 Pasta extruding attachments

36.25.1 A pasta extruding attachment is to be operated after two batches of pasta dough (basic noodle recipe as recommended in the instruction provided with the appliance) have been prepared with the basic appliance or dough preparing attachment. The temperatures obtained during the preparation of the dough are not to be evaluated. A one minute OFF period is to be allowed to permit the assembly of the extruder attachment to the basic appliance as intended. The unit is then to be operated in its heated condition extruding pasta in the intended manner using each extrusion die provided with the appliance. A temperature test is to be conducted extruding two batches of pasta dough (basic noodle recipe) previously prepared with another attachment. No OFF period is to be allowed during the extrusion process.

36.26 Handheld pizza cutters

36.26.1 A pizza cutter is to be used to cut a minimum of three pizzas. Six people are to be selected for the cutting operation. Each person is to make three cuts on each pizza. The overall average inputs are then calculated.

36.26.2 A mechanical load, based on the average value calculated from the Input Test in 36.26.1, may be utilized and placed on the blade to simulate cutting pizza. Eight simulated cuts are to be conducted at a rate of four cuts per minute. Each cut is to be made so that the input to the pizza cutter is at the average wattage determined during the Input Test. This value is maintained for eleven seconds, after which the load is to be withdrawn so that the input returns to the no-load value for four seconds. A total of fifteen seconds completes the cutting cycle. The unit is to be turned off when the eight cuts are completed. The entire method above is then to be repeated twice with an eight second OFF period between the repetitions.

37 Dielectric Voltage-Withstand Test

37.1 An appliance shall be capable of withstanding for 1 minute without an indication of unacceptable performance the application of a potential applied between live parts and accessible metal parts, between live parts of opposite polarity for a test on a capacitor as mentioned in (c) below, and between any points of the primary and secondary circuits. The appliance is to be at the maximum operating temperature reached in normal use. Except as noted in 37.4, the test potential shall be:

- a) 1000 V for an appliance employing a motor rated at 1/2 horsepower or less.
- b) 1000 V plus twice the rated voltage for an appliance employing a motor rated at more than 1/2 horsepower.
- c) 1000 V, or 1000 V plus the rated voltage (depending upon the value of the test potential applied to the appliance as a whole), between the terminals of a capacitor used for electromagnetic interference (EMI) reduction or arc suppression.
- d) 2500 V for an electric knife.

37.2 With respect to 37.1, an appliance having an enclosure construction partially or totally of insulating material is to have accessible surfaces of the insulating material closely wrapped in metal foil. The test potential is to be applied between live parts and the foil.

37.3 With respect to 37.1 and 37.2, a part is considered to be accessible if it can be contacted by the probe illustrated in Figure 7.1 when applied in all possible articulated positions, with and without the parts referenced in 7.11 in place.

37.4 When the appliance involves an isolating transformer or an autotransformer, the test potential for the secondary circuit is to be:

- a) 1000 V when the secondary operates at 51 – 240 V; or
- b) 500 V when the secondary operates at 50 V or less, except that this test does not apply when the secondary circuit is supplied from a Class 2 transformer.

37.4 effective December 1, 2004

37.5 To determine whether an appliance complies with the requirement in 37.1 and 37.4, the test potential is to be applied as described in 37.7 by means of test equipment having the characteristics outlined in 37.6.

37.6 The test equipment for conducting the dielectric voltage-withstand test is to have the following features and characteristics:

- a) A means for indicating the test voltage that is being applied to the appliance under test. This may be accomplished by sensing the voltage at the test leads or by an equivalent means.
- b) An output voltage that has:
 - 1) A sinusoidal waveform;
 - 2) A frequency that is within the range of 40 – 70 Hz; and

3) A peak value of the waveform that is not less than 1.3 and not more than 1.5 times the root-mean-square value.

c) A sensitivity of the test equipment that is such that when a resistor of 120,000 ohms is connected across the output, the test equipment does not indicate unacceptable performance for any output voltage less than the specified test voltage, and the test equipment does indicate unacceptable performance for any output voltage equal to or greater than the specified test value. The resistance of the calibrating resistor is to be adjusted as close to 120,000 as instrumentation accuracy can provide, but never more than 120,000 ohms.

Exception No. 1: The sensitivity of the test equipment may be reduced, a lower value of calibrating resistance may be used, when testing an appliance intended to be permanently wired or parts as mentioned in 37.1(c).

Exception No. 2: The sensitivity of the test equipment may be increased, a higher value of calibrating resistance may be used, if agreeable to those concerned.

37.7 The method of applying the test voltage to the appliance is to be such that there are not any transient voltages that result in the instantaneous voltage applied to the appliance exceeding 105 percent of the peak value of the specified test voltage. The applied potential is to be increased from zero at a substantially uniform rate so as to arrive at the specified test potential in approximately five seconds, and then, is to be maintained at the test potential for 1 minute. Manual control of the rate of rise may be used.

37.8 The printed foil pattern of a printed wiring board provided with a conformal coating as mentioned in 19.12(a), shall withstand the potential specified in 37.1(a) applied between printed wiring traces of opposite polarity for 1 minute without breakdown. Clean dry samples with the conformal coating are to be tested. The samples shall have been subjected to the production-soldering process. The components may be omitted for this test.

38 Leakage Current Following Humidity Tests

38.1 A cord-connected appliance shall comply with the Leakage Current Test, Section 32, following exposure for 48 hours to a moist air having a relative humidity of 88 ± 2 percent at a room temperature of $32.0 \pm 2.0^\circ\text{C}$ ($89.6 \pm 3.6^\circ\text{F}$).

a) The appliance is to be at a temperature just above the test chamber temperature when it is placed in a humidity room.

b) The appliance is to remain in the humidity chamber for 48 hours.

c) Following this exposure, while still in the test chamber, the sample is to be tested unenergized as indicated in 32.6(a).

d) The sample is then to be tested energized as indicated in 32.6 (b) and (c), except that the test may be discontinued when the leakage current has stabilized or decreased. This test may be made in the test chamber or immediately after the sample has been removed from the test chamber.

39 Leakage Current and Dielectric Voltage-Withstand Test (Repeated)

39.1 After exposure as described in 39.2, an electric knife or wand-type mixer shall comply with the requirement in 32.1 in a repeat leakage current test, except that the test shall be discontinued when the leakage current stabilizes.

39.2 An electric knife or wand-type mixer is to be connected to a supply circuit as described in 31.3 and the blades or shaft are to be immersed in a salt water solution (1/2 gram of sodium chloride per liter of distilled water) and then tilted upward appropriately 105 degrees to allow the water to run down the blades or shaft toward the enclosure. Twenty-five such operations are to be conducted at the rate of 10 operations per minute. This test is to be repeated on a second sample with the knife or wand-type mixer not operating.

39.3 A knife sharpener (or a combination appliance having a knife-sharpening function, including an appliance provided with a mechanical sharpening block):

- a) Shall comply with the leakage current requirements as stated in 32.1 after being conditioned as described in 39.4 and 39.5; and
- b) Shall comply with the dielectric voltage withstand requirements in 37.1 after being conditioned as described in 39.4 and 39.5.

39.3 effective December 1, 2004

39.4 The appliance is to be connected to a supply circuit as described in 31.3 and energized for 5 minutes. Five grams of 100 mesh electrolytic iron powder are to be dispersed onto the sharpener wheel in the area normally contacted by the knife. The filings are to be introduced onto the surface of the wheel by a 1/4 inch (6.4 mm) inside diameter tube.

39.5 After being energized for 5 minutes, the appliance is to be tilted to its balance point and then allowed to free fall to the supporting surface. After return to its normal at rest position, the free fall is to be repeated in three other directions, each displaced 90 degrees horizontally from the previous position.

40 Flooding of Live Parts Tests

40.1 To determine if a counter-top appliance that is provided with a container into which liquid is intended to be added by the user complies with 21.1(a) with respect to overflow, the appliance is to be positioned as intended for normal use, cover on but fill-hole or fill-holes open. The liquid container of the appliance is to be completely filled with a salt-water solution (1/2 gram of NaCl per liter of distilled water) and a further quantity equal to 15 percent of the capacity of the container is poured in steadily over a period of 1 minute. When the appliance is so designed that a liquid container is situated over the motor, the spillage test is made with the appliance switched off or in operation, whichever imposes the more severe condition. When the liquid container is not situated over the motor, the appliance is operated three times in the following manner: The liquid container is filled with the test solution, and the appliance is operated at the maximum speed setting until there is no more splashing. In between operations, the appliance is to be turned off and the liquid container re-filled with the test solution. During this conditioning, the appliance shall comply with the Leakage Current Test, Section 32. After this conditioning, the appliance shall comply with the Dielectric Voltage-Withstand Test, Section 37. See also 31.3.

40.1 effective December 1, 2004

40.2 To determine if a counter-top appliance complies with 21.1 (b) with respect to the drawing of liquids into the enclosure, the appliance is to be placed in a smooth bottomed shallow pan having at least twice the length and width of the bottom of the appliance being tested. The pan is to be filled to a depth of 1/16 inch (1.6 mm) with a salt-water solution (1/2 gram of NaCl per liter of distilled water), and the appliance operated at maximum speed for 1 minute. During this conditioning, the appliance shall comply with the Leakage Current Test, Section 32. Following this conditioning, the appliance shall comply with the Dielectric Voltage-Withstand Test, Section 37. See also 31.3.

Exception: A counter-top machine employing bottom vents and legs which space the vents more than 2 inches (50.8 mm) above the counter top is not required to be tested.

40.2 effective December 1, 2004

41 Test for Deterioration of Parts Subject to Flexing

41.1 The deterioration of a part made of rubber, plastic, or a similar material, which is subject to flexing shall not result in a risk of electric shock when subjected to the test described in 41.2.

Exception: Infrequent motion of small amplitude, such as that encountered during normal operation of a diaphragm covering a pressure-operated switch, is not determined to constitute flexing as far as these requirements are concerned.

41.1 effective December 1, 2004

41.2 To determine whether an appliance complies with 41.1, the part subject to flexing is to be completely removed to simulate its deterioration. The appliance is to be operated through one complete cycle of normal operation and subjected to the Flooding Test described in 40.1. The appliance is to be tested afterwards as follows:

- a) A cord-connected appliance shall comply with the Leakage Current Test, Section 32, and the Dielectric Voltage-Withstand Test, Section 37.
- b) A permanently-connected appliance shall comply with the Insulation Resistance Test, Section 43, and the Dielectric Voltage-Withstand Test, Section 37.

41.2 effective December 1, 2004

42 Test for Reliability of Parts Not Subject to Flexing

42.1 After the conditioning described in 42.2, a polymeric or elastomeric material used for a gasket, diaphragm, seal, or similar part, or a rubber part subject to hot soapy water during cleaning shall have a tensile strength of not less than 75 percent and elongation of not less than 60 percent of the values determined before conditioning. At the conclusion of the tests, there shall not be visible deterioration, deformation, melting, or cracking of the material and the material shall not harden as determined by normal hand flexing.

Exception No. 1: A material that has been investigated in accordance with 42.4 is not prohibited from having physical properties other than those specified.

Exception No. 2: A noncomposite material that has been found to comply with the requirements in the Standard for Gaskets and Seals, UL 157, and that complies with the minimum intended elongation and tensile strength after aging, is determined to be in compliance with these requirements.

Exception No. 3: A material or construction that has been investigated in accordance with 42.5 is not prohibited from having physical properties other than those specified.

42.1 effective December 1, 2004

42.2 A total of 20 pieces of each representative material is required for this test. Five pieces are to be tested for elongation in the as-received condition and 5 pieces are to be tested for tensile strength in the as-received condition. The 10 remaining pieces are to be placed in a circulating-air oven at a temperature of 69 – 70°C (156 – 158°F) for 168 hours. Five of the conditioned pieces are to be tested for elongation and the other 5 pieces are to be tested for tensile strength. The test methods and apparatus are described in the Standard for Test Methods for Rubber Properties in Tension, ASTM D412.

42.2 effective December 1, 2004

42.3 A gasket of material other than mentioned in 42.1, such as bonded cork or impregnated fiber, that is not known to be reliable, shall be investigated for equivalent resistance to aging and temperature. Absorptive materials, such as cork or fiber shall not be used where they contact a live part.

42.3 effective December 1, 2004

42.4 To determine compliance with Exception No. 1 to 42.1, a gasket, a diaphragm, or a seal of a counter-top appliance is to be oven conditioned as specified in 42.2. After the oven conditioning, instead of the tensile and elongation testing, the gasket, diaphragm, or seal is then to be installed in the associated counter-top appliance and subjected to the Flooding of Live Parts Tests described in 40.1 and 40.2. As an alternate test method, entire representative appliances are to be subjected to the accelerated-aging conditionings. When an entire appliance is subjected to the accelerated-aging test, the diaphragm or seal temperature shall be monitored and maintained at the oven temperature value indicated in 42.2. The entire appliance is then to be subjected to the Flooding of Live Parts Tests described in 40.1 and 40.2.

42.4 effective December 1, 2004

42.5 To determine compliance with Exception No. 3 to 42.1, one representative appliance is to be tested. The liquid container's bottom seals and the motor shaft seal of the appliance are to be removed one at a time. The liquid container is then to be completely filled with a salt-water solution (1/2 gram of NaCl per liter of distilled water) while on the base of the appliance as in normal use. The test is to be conducted with the appliance either switched off or in operation, whichever imposes the more severe condition. During this conditioning, the appliance shall comply with the Leakage Current Test, Section 32. Following this conditioning, the appliance shall comply with the Dielectric Voltage-Withstand Test, Section 37.

42.5 effective December 1, 2004

43 Insulation Resistance Test

43.1 Following the Test for Deterioration of Parts Subject to Flexing, Section 41, a permanently-connected appliance shall have an insulation resistance of at least 50,000 ohms between current-carrying parts and noncurrent-carrying parts.

43.1 effective December 1, 2004

43.2 Insulation resistance is to be measured by applying a direct-current potential of 250 volts between live parts and the enclosure and other exposed dead metal parts, using two voltmeters - one voltmeter being connected across the supply line and the other connected in series with one of the leads to the appliance being tested. Designating the reading of the line voltage as V_1 , the reading of the other voltmeter as V_2 , and the resistance of V_2 as R , the insulation resistance is to be calculated by the formula:

$$\text{Insulation Resistance} = \frac{(V_1 - V_2)R}{V_2}$$

43.2 effective December 1, 2004

44 Blender Cover Opening Splash Test

44.1 To determine compliance with Exception No. 2 of 30.4.3 for a blender with an opening in the cover that is intended for pouring, the blender is to be tested in accordance with 44.2 and 44.3 in order to determine the ability of the blender cover to keep the contents of the blender container from splashing out.

44.1 effective April 6, 2006

44.2 The container of a representative blender is to be filled to the maximum fill line (or maximum recommended level) with hot tap water at a temperature not exceeding $93.3 \pm 5.5^\circ\text{C}$ ($200 \pm 10^\circ\text{F}$). The exterior of the blender is to be wiped dry. The blender container is to be mounted on the blender and the blender is to be placed on a horizontal work surface that is dry. The cover opening intended for pouring is then to be opened and the blender operated for 15 seconds at the highest speed setting available. This operation is to be repeated two more times.

44.2 effective April 6, 2006

44.3 No water shall be observed splashing out of the cover opening. The work surface and blender exterior shall remain dry.

44.3 effective April 6, 2006

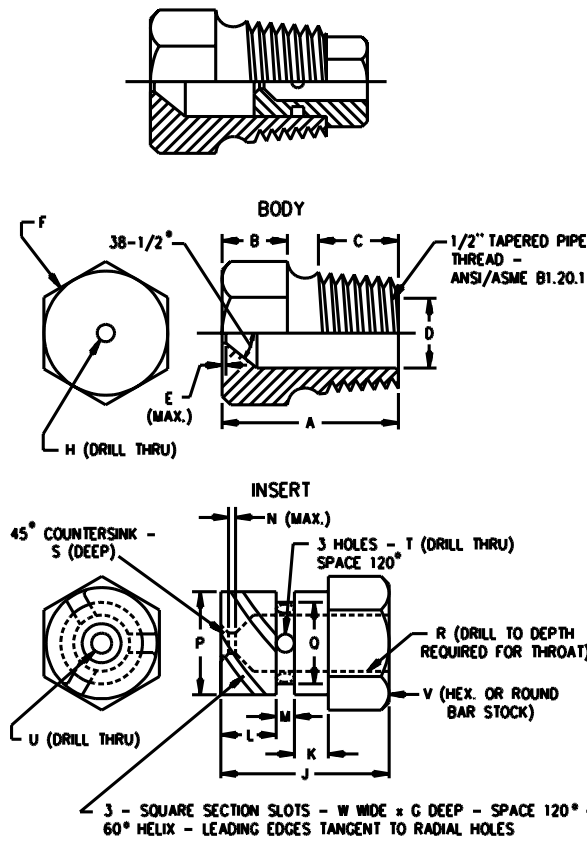
45 Resistance to Moisture Test

45.1 In a test to determine that an appliance intended for outdoor use complies with the requirement in 7.7, the appliance is to be subjected to a water spray test as described in 45.2. There shall be no obvious wetting of any electrical component, as evidenced by droplets of water on the component, and no water shall enter a compartment that houses field-installed wiring as a result of the water-spray test. After the test:

- a) The appliance shall comply with the requirements in 32.1 in a repeated leakage-current test, except that the test shall be discontinued when the leakage current stabilizes; and
- b) The appliance shall comply with the requirement in 37.1 in a repeated dielectric voltage-withstand test.

45.2 Compliance with the requirement in 45.1 is to be determined by mounting the appliance under the apparatus described in 45.3 and illustrated in Figures 45.1 and 45.2.

Figure 45.1
Water-spray-test spray head
ASSEMBLY^a



Item	inch	mm	Item	inch	mm
A	1-7/32	31.0	N	1/32	0.80
B	7/16	11.0	P	.575	14.61
C	9/16	14.0	Q	.576	14.63
D	.578	14.68	R	.453	11.51
E	.580	14.73	S	.454	11.53
F	1/64	0.40	T	1/4	6.35
G	c	c	U	1/32	0.80
H	.06	1.52	V	(No. 35) ^b	2.80
I	(No. 9) ^b	5.0	W	(No. 40) ^b	2.50
J	23/32	18.3			
K	5/32	3.97			
L	1/4	6.35			
M	3/32	2.38			

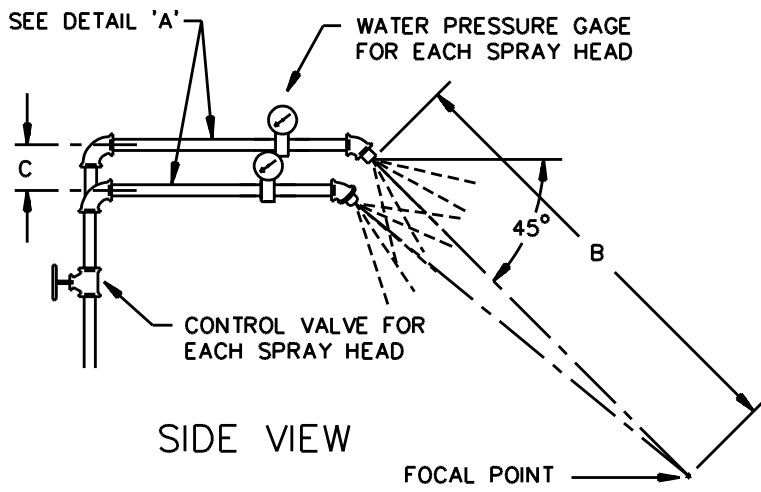
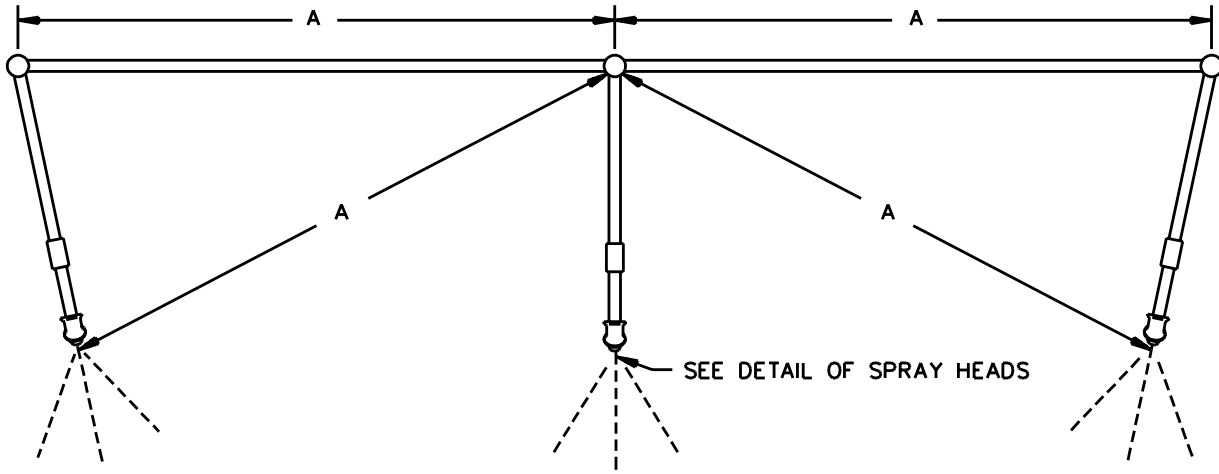
^a Nylon Rain-Test Spray Heads are available from Underwriters Laboratories

^b ANSI B94.11M Drill Size

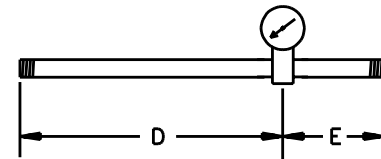
^c Optional - To serve as a wrench grip.

RT100E

Figure 45.2
Water-spray-head piping
PLAN VIEW



PIEZOMETER ASSEMBLY
DETAIL 'A'



Item	inch	mm
A	28	710
B	55	1400
C	2-1/4	55
D	9	230
E	3	75

RT101E

45.3 The water-spray test apparatus is to consist of three spray heads constructed in accordance with the details shown in Figure 45.1 and mounted in a water-supply pipe rack as shown in Figure 45.2. The water pressure is to be maintained at each spray head at approximately 5 lbf/in² (35 kN/m²). The distance between the center nozzle and the appliance is to be brought into a focal area of the three spray heads in such a position and under such conditions that water is most likely to enter, except that consideration is to be given to the normal mounting position.

46 Continuous Operation Test

46.1 A product, that is only actuated by a momentary contact switch and employs a shaded-pole motor shall not produce a fire or electric shock when tested in accordance with 46.2. Included is any appliance that employs a momentary contact switch that initiates an automatic cycle or a momentary contact switch that can be locked in the ON position by a mechanical feature.

Exception No. 1: This requirement does not apply to a product that is hand supported.

Exception No. 2: This requirement does not apply to a product that employs a momentary contact switch that is not subject to a continual mechanical load when not in use.

46.2 The appliance is to be:

- a) Connected to a supply circuit as described in 31.3 in series with a 20 A time-delay plug fuse;
- b) Placed on a white tissue paper covered softwood surface;
- c) Draped with a double layer of cheesecloth over the whole appliance with the cloth within 1/8 inch (3.2 mm) of the openings (if any) in the enclosure; and
- d) Grounded by means of a 3 A non-time-delay plug fuse connected between exposed metal parts and earth ground.

The appliance is to be allowed to operate continuously at no load for 7 hours or until burnout occurs. The results are considered to be acceptable if neither the cheesecloth nor the tissue paper is ignited, and if the 3 A grounding fuse is not open.

47 Abnormal Operation Test

47.1 A portable appliance having a polymeric enclosure is covered under the requirements for Enclosures of Polymeric Material for Portable Appliances, Section 58.

47.2 An appliance having a polymeric enclosure that is part metallic (having some accessible dead metal) is to comply with:

- a) Enclosures of Polymeric Material for Portable Appliances, Section 58, for the part of the enclosure that is polymeric; and
- b) 47.3 for that part of the enclosure having accessible dead metal.

47.3 An appliance having an enclosure that is of metal (accessible dead metal) after being tested in accordance with 47.4 shall:

- a) Comply with the Dielectric Voltage-Withstand Test, Section 37, with the potential applied between live parts and accessible metal parts;
- b) Not result in opening of the 3 A fuse;
- c) Not result in access to live parts; and
- d) Not result in ignition of the mounting surface or the cheesecloth as a result of emission of glowing or flaming materials.

47.4 The appliance is to be:

- a) Connected to a supply circuit as described in 31.3 (in series with a 30 A time-delay plug fuse);
- b) Placed on a white tissue paper covered soft wood surface;
- c) Draped with a single layer of cheesecloth shaped so that it touches the surface completely around the appliance and draped loosely over the appliance; and
- d) Grounded by means of a 3 A non-time-delay plug fuse connected between accessible metal parts and earth ground.

The appliance is to be operated continuously under a stalled condition (locked-rotor) as indicated in 47.5 and Table 47.1 for the specified time interval unless the appliance includes other controls (such as a timer) that will positively and reliably limit the duration of the operation to a shorter interval. The locked rotor test is to be conducted at different speed settings if the appliance has a multiple speed setting. Opening of the 30 A fuse is not cause for unacceptable results.

Table 47.1
Abnormal operation test locked rotor operation

Examples of appliances	
30 second locked rotor test	5 minute locked rotor test
Coffee Mill	Coffee Grinder
Hand Mixer	Stand Mixer
Can Opener, Manual	Build-in Mixer
Centrifugal Juicer	Blenders
Knife	Can Opener (other than manual)
Reamer, Juicer	Drink Mixer
Meat Grinder	Food Processor
Slicer	
Knife Sharpener	
Vegetable Shredder/Slicer	
Ice Crusher	

47.5 With respect to 47.3 and 47.4, a metal part is considered to be accessible if it can be contacted by the probe illustrated in Figure 7.1 when applied in all possible articulated positions, with or without the parts referenced in 7.11 in place.

47.6 Appliances that are hand held or hand supported, those which have to be kept switched on by hand or those which are continuously loaded by hand shall be tested for 30 seconds locked rotor operation. Appliances that are intended to be used unattended and do not have motors intended to be remotely or automatically controlled shall be tested for 5 minutes locked rotor operation.

48 Power Supplies and Battery Chargers Test

48.1 A power supply or battery-charging circuit for an appliance shall not produce a potential fire or electric shock condition should the battery or rectifier malfunction.

48.2 The appliance of 48.1 is to be tested on a 120 V or 240 V, 60 Hz supply circuit in series with a 20 A, time-delay plug fuse. The appliance is to be placed on a white tissue paper covered softwood surface.

48.2 effective December 1, 2004

48.3 The appliance of 48.1 is to have its transformer secondary windings short-circuited. A 3 A non-time-delay plug fuse is to be connected between the dead metal of the transformer core and earth ground. Operation is to be continued until temperatures stabilize or burnout occurs. Results are considered to be acceptable if:

- a) Either grounding and/or line fuses are not opened;
- b) The results of a repeated dielectric voltage-withstand test as described in 37.1 are acceptable; and
- c) There is no ignition of the tissue paper.

The test is to be conducted three times using new components when necessary only if burnout occurs.

48.4 The appliance of 48.1 is to have its battery connections short-circuited at the battery. A 3 A non-time-delay fuse is to be connected between the dead metal of the transformer core and earth ground. Operation is to be continued until temperatures stabilize or burnout occurs. Results are considered to be acceptable if:

- a) Either the grounding fuse/or line fuses are not opened;
- b) The results of a repeated dielectric voltage-withstand test as described in 37.1 are acceptable; and
- c) There is no ignition of the tissue paper.

The test is to be conducted three times using new components when necessary only if burnout occurs.

49 Electronic Control Circuits Test

49.1 A solid-state device (such as a rectifier or a transistor), a resistor, and a capacitor shall be subjected to the tests described in 49.2 – 49.4.

49.2 If an appliance employs one or more solid-state devices, a resistor or a similar component, no risk of fire, electric shock or risk of injury to persons shall develop when the circuit between any two terminals of any such component is opened or shorted; except that wire wound resistors are not to be shorted. If the appliance employs a capacitor in combination with one of the above-mentioned components, no risk of fire, electric shock or risk of injury to persons shall develop when the capacitor is short-circuited. Only one of the simulated fault conditions described above is to be imposed at one time. Exposed dead-metal parts of the appliance are to be connected through a 3 A fuse and the results are unacceptable if the fuse opens during the test. The test is to be conducted three times using new components when necessary only if burnout occurs.

49.3 Short-circuit tests for determining whether or not an appliance complies with the requirements in 49.2 are to take into account the normal usage of the appliance. For example, if the appliance is provided with a momentary-contact switch having no provision for being locked in the ON position, and if there is indication of malfunction (abnormal operation of the appliance, emission of smoke, failure of the appliance to operate in the normal manner, or other indication), the test is to be discontinued when the malfunction becomes evident. Otherwise the test is to be continued until ultimate results occur which usually requires 7 to 8 hours.

49.4 If an appliance is provided with means for controlling the speed, the test is to be conducted at both the maximum and minimum-speed settings of the control and can be conducted at interim speed settings.

50 Cut Strainer/Enclosure Stress Withstand Test

50.1 The following procedures are to be performed for a centrifugal juice extractor that uses a cutter strainer basket with a polymeric rim.

50.1 effective April 6, 2006

50.2 One group of three representative centrifugal juice extractor appliances are to be in as-received condition. Three equally spaced notches are to be cut into the plastic rim (or top ring) of the cutter strainer basket from each juice extractor to a depth not exceeding 0.12 inches (3.05 mm). The strainer basket is to be installed in the juice extractor as appropriate for normal operation. The appliance is then to be placed inside a protective enclosure, and is to be operated at its rated voltage for 30 seconds with the speed controls set at the highest speed.

50.2 effective April 6, 2006

50.3 If the strainer basket retains its structure after this operation, the depth of the notches is to be increased in 0.03 inch (0.76 mm) increments and operated in accordance with 50.2 until the strainer basket disintegrates. As required, the mesh is also to be deliberately damaged in order to induce the disintegration of the strainer basket.

50.3 effective April 6, 2006

50.4 Each of three additional representative strainer baskets and three juice extractor covers are to be immersed in a solution of Detergent Type B (as specified in IEC 60436), at a concentration of 3 grams/liter and a temperature of $65 \pm 1^\circ\text{C}$ ($140 \pm 1.8^\circ\text{F}$) for 48 hours; see 51.2 for composition of solution. The immersed strainer baskets and covers are then to be removed from the solution, rinsed with water, and stored at room temperature for 14 days.

50.4 effective April 6, 2006

50.5 Each of the strainer baskets conditioned in 50.4 are to be subjected to the procedures described in 50.2 and 50.3. Each conditioned juice extractor cover is to be installed on a juice extractor appliance that is intended to operate with that cover.

50.5 effective April 6, 2006

50.6 No parts of the strainer basket or other components of the juice extractor shall be ejected from the appliance. The top cover of the juice extractor shall also remain intact.

50.6 effective April 6, 2006

51 Operational Test Following Environmental Conditionings

51.1 The following procedures are to be performed, in the order shown, for a centrifugal juice extractor that uses a cutter strainer basket with either a polymeric or metallic rim. Each of three representative strainer baskets is to be tested.

51.1 effective April 6, 2006

51.2 Chemical stress test: Each strainer basket is to be immersed in a detergent solution (corresponding to Detergent Type B) at a concentration of 3 grams/liter and a temperature of $65 \pm 1^\circ\text{C}$ ($140 \pm 1.8^\circ\text{F}$) for 48 hours, then removed from the solution, rinsed with water, and stored at room temperature for 14 days.

NOTE: A Detergent Type B solution, as specified in IEC 60436, contains the following component compounds:

30.0% of Trisodium citrate dihydrate

12.0% of Sokalan CP5 compound (50% active substance)

2.0% of Plurafac LF403

25.0% of Sodium disilicate

23.0% of Sodium carbonate

5.0% of Sodium perborate monohydrate

2.0% of TAED

0.5% of Amylase

0.5% of Protease

100.0%

51.2 effective April 6, 2006

51.3 Thermal stress test: Each strainer basket is to be placed in a dry atmosphere at a temperature of $83 \pm 2^\circ\text{C}$ ($181.4 \pm 3.6^\circ\text{F}$) for one hour, then immersed in water at a temperature of $20 \pm 2^\circ\text{C}$ ($68 \pm 3.6^\circ\text{F}$). This procedure is to be performed a total of three times.

51.3 effective April 6, 2006

51.4 Impact test: Each strainer basket are dropped from a height of one meter onto a wooden floor in such a way that the axis of rotation is horizontal at the moment of impact. This procedure is to be performed a total of 12 times, with the strainer baskets being rotated by 30 degrees in each successive iteration to obtain 12 different points of impact.

51.4 effective April 6, 2006

51.5 Starting test: Each strainer basket is to be placed in a juice extractor appliance that is intended to operate with the strainer basket. The appliance is to be supplied with 1.06 times the rated voltage and then is to be operated for 15 seconds with the speed controls set at the highest speed, followed by a rest interval of 45 seconds. This procedure is to be performed a total of 25 times for each strainer basket.

51.5 effective April 6, 2006

51.6 A centrifugal juice extractor shall be capable of withstanding the stresses encountered during normal operation of the appliance. No parts of the strainer basket or other components of the juice extractor shall be ejected from the appliance. No cracks or other damage to any part of the assembled juice extractor shall be visible to the naked eye upon inspection.

51.6 effective April 6, 2006

52 Switch Overload Test

52.1 A switch or other device that controls a motor and has not been shown to be investigated for that purpose shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation, making and breaking the locked-rotor current of the motor. There shall not be electrical or mechanical malfunction of the device or undue pitting or burning of the contacts as a result of the overload test.

52.2 In a test to determine if a switch or other control device is capable of performing acceptably in the overload test mentioned in 52.1, the appliance is to be connected to a grounded power-supply circuit of rated frequency and voltage, with the rotor of the motor locked in position. During the test, exposed dead metal parts of the device are to be connected to ground through a 3 A non-time-delay plug fuse and the connection is to be such that any single-pole current interrupting device is in an ungrounded conductor of the supply circuit. If the machine is intended for use on direct current, exposed dead metal parts of the machine are to be so connected as to be positive with respect to a single-pole, current interrupting device. The device is to be operated at the rate of no more than 10 cycles per minute, except that a faster rate of operation is to be employed if agreeable to all concerned. The performance is unacceptable if the fuse in the grounding connection is opened.

52.3 A switch or other device that controls a solenoid, relay coil, or the like and has not been shown to be investigated for that purpose shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation as described in 52.4. There shall not be electrical or mechanical malfunction of the device, nor undue burning or pitting of the contacts as a result of the overload test.

52.4 In a test to determine if a switch or other control device complies with the requirements in 52.3, the appliance is to be connected to a supply circuit of rated frequency and 110 percent of maximum rated voltage. The load on the device under test is to be the same as that which is intended to control in normal service. During the test, exposed dead metal parts of the machine are to be connected to ground through a 3 A non-time-delay plug fuse, and the connection is to be such that any single-pole current interrupting device is in an ungrounded conductor of the supply circuit. The device is to be operated at a rate of not more than 10 cycles per minute except that a faster rate of operation is to be employed if agreeable to all concerned. The performance is unacceptable if the fuse in the grounding connection is opened during the test.

53 Switch Endurance Test

53.1 A switch that controls a motor and has not been shown to be investigated for that purpose shall be subjected to an endurance test consisting of 6000 cycles of operation, making and breaking the no-load current of the appliance. As a result of the endurance test:

- a) There shall not be any electrical or mechanical malfunction of the device or undue pitting or burning of the contacts; and
- b) The fuse in the grounding connection shall not open.

53.2 To determine if a switch complies with the endurance test mentioned in 53.1, the appliance is to be connected to a grounded power-supply circuit of rated frequency and voltage. During the test, exposed dead metal parts of the device are to be connected to ground through a 3 A non-time-delay plug fuse and the connection is to be such that any single-pole current interrupting device is in an ungrounded conductor of the supply circuit. If the machine is intended for use on direct current, exposed dead metal parts of the machine are to be so connected as to be positive with respect to a single-pole, current interrupting device. The device is to be operated at a rate of 6 – 10 cycles per minute, except that a faster rate of operation is to be employed if agreeable to all concerned.

54 Strain Relief Test

54.1 The strain relief means provided on an attached flexible cord, when tested in accordance with 54.2, shall withstand for 1 minute without displacement a direct pull of 35 lbf (156 N) applied to the cord, with the connections within the appliance disconnected.

54.2 A 35 lb (15.9 kg) weight is to be suspended on the cord and so supported by the appliance that the strain-relief means will be stressed from any angle which the construction of the appliance permits. The strain relief is not acceptable if, at the point of disconnection of the conductors, there is such movement of the cord as to indicate that stress would have resulted on the connections.

54.3 For the investigation mentioned in 11.3.2, each of six samples of the clamp that have been applied to the cord in the intended manner are to be used. One group of three samples are to be subjected to the dielectric voltage-withstand and strain relief tests in the as-received condition. The other group of three samples are to be placed in an air oven for 168 hours. The oven temperature is to be 10°C (18°F) higher than the maximum temperature measured on the cord at the strain relief device under normal operating conditions, but not less than 70°C (158°F) in any case. The samples, after being conditioned in the oven, are to be subjected to the dielectric voltage-withstand and strain relief tests. The value of the applied potential is to be as indicated in 37.1. The potential is to be applied between the conductors and, if the clamp is metal, the potential is to be applied between the conductors and the clamp. After cooling to room temperature the conditioned samples are to comply with the strain relief test requirements in 54.1 and the dielectric voltage-withstand requirements in 37.1.

55 Push Back Relief Test

55.1 To determine compliance with 11.3.3, a product shall be tested in accordance with 55.2 without occurrence of any of the conditions specified in 11.3.3 (a) – (d).

55.2 The supply cord is to be held up to 1 inch (25.4 mm) from the point where the cord emerges from the product and is then to be pushed back into the product. The cord is to be pushed back into the product in 1 inch (25.4 mm) increments until the cord buckles or the force to push the cord into the product exceed 6 lbf (26.7 N). The supply cord within the product is to be manipulated to determine compliance with 11.3.3.

56 Appliance Coupler Retention

56.1 If a handheld appliance rated over 30 V (42 V peak) employs a detachable power-supply cord without a positive means of retention, the retention means shall comply with the endurance test specified in 56.2. At the end of this test the retention means shall withstand for 1 minute a 1 lb (4.4 N) withdrawal force axially applied to the cord, without the appliance coupler becoming disengaged from the retention system.

56.2 The retention means is to be subjected to 1000 cycles of appliance coupler insertion and removal, with each cycle consisting of an insertion into and removal from the appliance. The insertion and removal of the appliance coupler is to be done at a rate not exceeding ten cycles per minute unless the manufacturer agrees to a faster rate. The appliance is not to be energized during the test.

57 Metal Enclosure Impact Tests

57.1 An appliance having an enclosure that is of metal shall comply with the tests outlined in 58.5.1.1 – 58.5.3.5, except that the ball impact value is to be 1.5 ft-lbf (2.03 J).

58 Enclosures of Polymeric Material for Portable Appliances

58.1 Scope

58.1.1 These requirements cover polymeric enclosures or parts of enclosures, of portable cord-connected food preparing appliances. For the purposes of the requirements in this section, an under-cabinet appliance is considered to be a portable appliance.

58.1.2 These requirements also cover polymeric decorative and similar parts that do not serve as part of the enclosure for electrical parts or provide for protection against injury to persons.

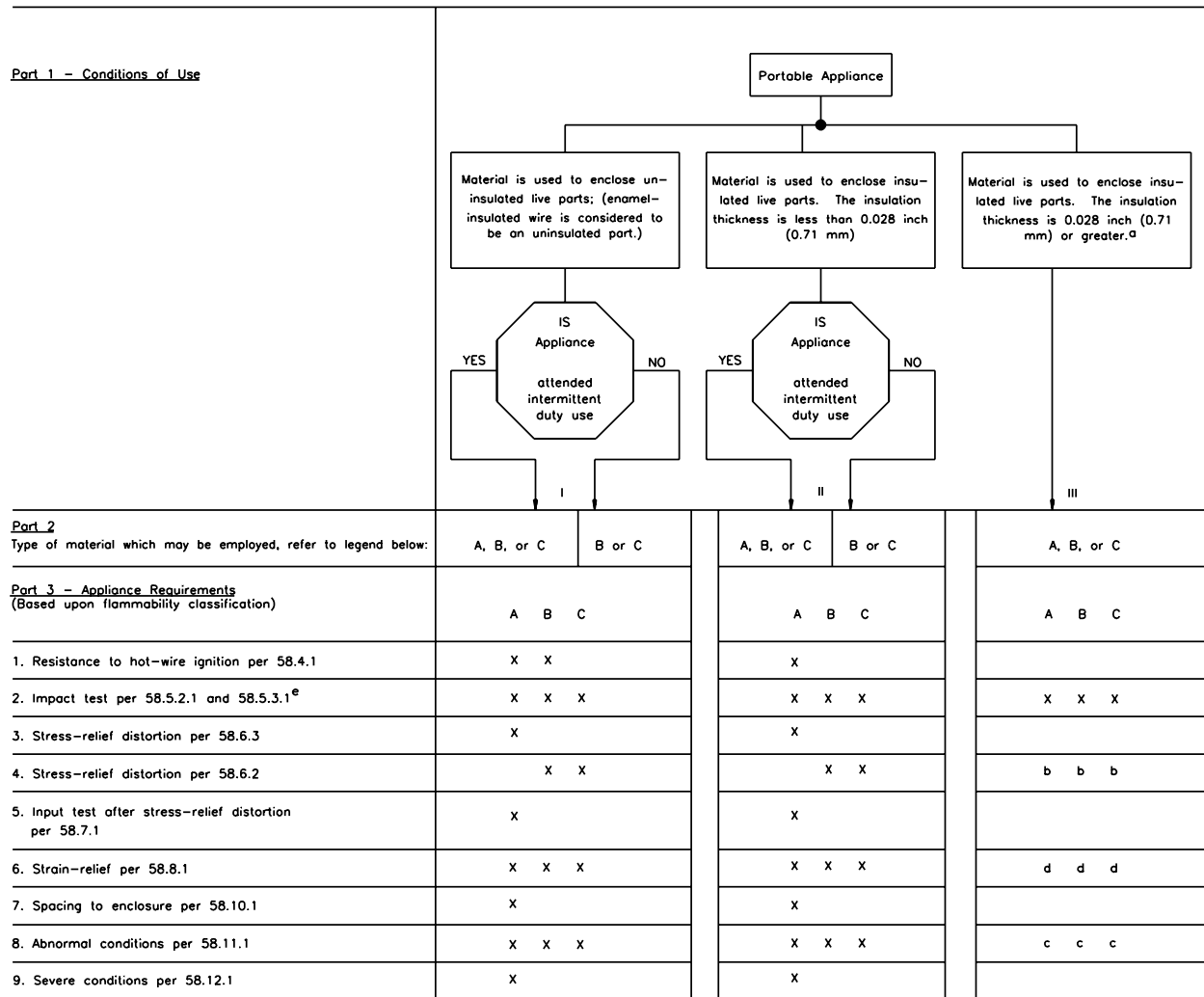
58.2 General

58.2.1 A portable cord-connected food-preparing machine having an enclosure of polymeric material, shall comply with thermal-aging 58.13.1 and the applicable requirements from Figure 58.1. The following steps are to be followed in the use of Figure 58.1.

- a) Select the appropriate path determined from the flow chart in Part 1 of Figure 58.1 that matches the conditions of use for the polymeric material under consideration.
- b) Remaining within the confines of the Column I, II, or III determined in Part 1, proceed to Part 2 of Figure 58.1. Pick out the letter or letters (denoting a material's flammability class; refer to Figure 58.1 legend) that are acceptable for the use application.
- c) The applicable requirements can be found in Part 3 of Figure 58.1 and those determined consistent with the conditions of use and the material flammability class found in Parts 1 and 2.

Figure 58.1
Test related to use of polymeric material for enclosures of portable appliances

Figure 58.1 effective December 1, 2004



SM498E

(Continued)

Figure 58.1 (Cont'd)
Test related to use of polymeric material for enclosures of portable appliances

Legend

A – A material classed as HB by means of the Horizontal Burning Test described in the requirements for tests for flammability of plastic materials for parts in devices and appliances, UL 94.

B – A material classed as V-0, V-1, or V-2 as defined in the Vertical Burning Test described in the requirements for tests for flammability of plastic materials for parts in devices and appliances, UL 94.

C – A material which when flame tested as used in the appliance, complies with the requirements of 58.3.1. The use of flame retardant coating applied to the inside of a polymeric enclosure when flame tested as used in the appliance is not intended unless the coating/material interface has been found to be usable by separate investigation.

Notes

X – Required Test

^aThe insulation thickness of the body material of component parts is considered equivalent to 0.028 inch (0.71 mm) insulation if the component has been judged on the basis of requirements covering the component in question.

^bOnly required if failure of the material will cause a stress on the junction between a lead and a terminal of a component. If the strain relief test is performed as intended for components with integral leads either as a separate test or as a part of the regular test procedure for the component, it shall be determined that failure of the material will not cause a stress on the junction between the lead and a terminal of the component.

^cOnly required if material is employed in the unattended mode.

^dThis test is required only if the strain-relief means are mounted on the polymeric enclosure.

^eImpact tests shall also be conducted on guards for hazardous moving parts (see 58.5.1.3).

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58.2.2 An external polymeric decorative part of the appliance, a polymeric part extending through the enclosure wall and considered likely to propagate flame, or a similar polymeric part not involved with protection against risk of fire, electric shock, or injury to persons shall be classified as HB, V-0, V-1, or V-2 as defined by the appropriate burning test in the Standard for Test for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, or the polymeric part as used in the appliance shall comply with the flame test of 58.3.1 .

Exception No. 1: This requirement does not apply to small parts whose maximum volume does not exceed 2 cm³ (0.12 in³), or whose maximum dimension does not exceed 3 cm (1.2 inches), and whose location does not result in the propagation of flame from within the appliance to the outside surface.

Exception No. 2: This requirement does not apply to polymeric parts – such as feed tray assemblies, food pushers, stands, food containers and bowls, and container covers – that are detachable without the use of tools and whose location is not likely to result in the propagation of flame from within the appliance to the outside surface.

58.3 Flammability of enclosure

58.3.1 When tested in accordance with 58.3.2 – 58.3.5, the enclosure shall not support combustion for more than 1 minute after the second application of the test flame as stated in 58.3.4. The results are not acceptable if complete consumption of the sample occurs during the application of the flame or within 1 minute after the application of the flame.

58.3.2 Three samples of the appliance are to be placed in a circulating-air oven maintained at a uniform temperature not less than 10°C (18°F) higher than the maximum temperature of the material measured under normal operating conditions, but not less than 70°C (158°F) in any case. The samples are to remain in the oven for 168 hours. After being allowed to cool to room temperature, the samples are to be tested in accordance with 58.3.3 – 58.3.5.

Exception: The test described in 58.3.3 – 58.3.5 may be conducted on three unconditioned samples if:

- a) It has been determined that the material used as the enclosure does not exhibit a reduction in its flame-resistant properties as a result of long-term thermal aging, and*
- b) The thermal-aging program used for such determination includes specimens having a thickness equal to or less than the wall of the polymeric enclosure.*

58.3.3 Three sections of the enclosure of the appliance most likely to be ignited are to be subject to the flame test described in 58.3.4. A different sample of the appliance is to be used for each section tested. In the performance of the test, the appliance is to be supported in its normal operating position in a draft-free location, and nonpolymeric portions of the enclosure in contact with or fastened to the polymeric portions are not to be removed. Insofar as possible, the internal mechanism of the appliance is to be in place.

58.3.4 The flame of the Bunsen burner is to be adjusted to have a 3/4 inch (19 mm) high yellow flame with no blue cone. Two 30 second applications of the tip of the flame are to be made to each section of the enclosure selected as indicated in 58.3.3, with a 1 minute interval between the applications.

58.3.5 With reference to 58.3.3, the sections most likely to be ignited are considered as those adjacent to coil windings, splices, open-type switches, component terminals and other arcing or sparking parts.

58.4 Resistance to hot-wire ignition

58.4.1 The polymeric material shall resist ignition for 7 seconds or longer when subjected to the hot wire ignition test described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

58.5 Impact

58.5.1 General

58.5.1.1 Counter-supported sections of an appliance having more than one section shall comply with the requirements applied for a counter-supported appliance. Hand-supported sections of an appliance having more than one section shall comply with the requirements applied for a hand-supported appliance.

58.5.1.2 An appliance which has the ability to be used both as a counter-supported appliance as defined in 5.8 and as a hand-supported appliance as defined in 5.13 shall comply with the requirements for both.

58.5.1.3 The appropriate impact test in accordance with 58.5.1.1 and 58.5.1.2 shall also be conducted on guards of moving parts capable of causing injury, such as food processor bowls and covers.

58.5.1.3 effective December 1, 2004

58.5.2 Hand-supported appliances

58.5.2.1 A hand-supported appliance shall withstand the drop impact described in 58.5.2.4 without occurrence of any one of the following conditions:

- a) Making live parts accessible to contact (use accessibility probe for determination as indicated in 58.9.1);
- b) Producing any other condition that would affect adversely the mechanical performance of the appliance; or
- c) Producing any other condition that would increase the potential of electric shock of the appliance.

58.5.2.2 With reference to 58.5.2.1(b), cracking or denting of the enclosure is not to affect the function of any safety or constructional features such as thermostats, over-load-protective devices, or strain relief. Cracking or denting of the enclosure is not to result in exposure of moving parts capable of causing injury as determined in 58.9.1.

58.5.2.3 With reference to 58.5.2.1(c), the appliance is to comply with the Dielectric Voltage-Withstand Test, Section 37, after being subjected to the impact.

58.5.2.4 Each of three samples of the appliance, without attachments, is to be subjected to the impact that results from its being dropped three times (a series) through a distance of 3 ft (0.91 m) to strike a flat hardwood surface in the positions most likely to produce adverse results. In each drop, the sample is to strike a surface of the enclosure different from those of the other two drops in the series.

Exception: If the manufacturer so elects, fewer samples may be used in accordance with Figure 58.2 wherein each series consists of three drops of the sample. The overall performance is acceptable upon completion of any one of the procedures represented in the figure.

**Figure 58.2
Procedure for impact test**

Series Number	Sample Number											
	1	2	3	1	2	3	1	2	3	1	2	3
1	↓ A	N	N	↓ A	N	N	↓ A	N	N	↓ A	N	N
2	↓ A	N	N	↓ A	N	N	↓ U	↓ A	N	↓ U	↓ A	N
3	↓ A	N	N	↓ U	↓ A	N	↓ A	N		↓ U	↓ A	

Arrows indicate sequence of test procedure

A – Acceptable results from drop

U – Unacceptable results from drop

N – No test necessary

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58.5.2.5 The hardwood surface mentioned in 58.5.2.4 is to consist of a layer of tongue-and-groove oak flooring mounted on two layers of 3/4 inch (19 mm) thick plywood. The oak flooring is to be nominally 3/4 inch by 2-1/4 inch (actual size 3/4 by 2-1/4 inch – 19 by 57 mm). The assembly is to rest on a concrete floor or an equivalent nonresilient surface.

58.5.3 Counter-supported appliances

58.5.3.1 A counter-supported appliance shall withstand the ball impact with the appliance restrained, as described in 58.5.3.4 without occurrence of any one of the following conditions:

- a) Making live parts accessible to contact (use accessibility probe as indicated in 58.9.1 and 58.9.2 for determination);
- b) Producing any other condition that affects adversely the mechanical performance of the appliance; or
- c) Producing other conditions that increase the risk of electric shock.

58.5.3.2 With reference to 58.5.3.1(b), cracking or denting of the enclosure is not to affect the function of any safety or constructional features such as thermostats, overload-protective devices, or strain relief. Cracking or denting of the enclosure is not to result in exposure of moving parts capable of injury, as determined in 58.9.1 and 58.9.2.

58.5.3.3 With reference to 58.5.3.1(c), the appliance is to comply with the Dielectric Voltage-Withstand Test, Section 37, after being subjected to the impact.

58.5.3.4 Each of three samples of the appliance is to be subjected to one impact. This impact is to be imparted by dropping or swinging a 2 inches (50.8 mm) diameter steel sphere, weighing 1.18 lbs (0.535 kg) from a height which will produce an impact of 0.75 ft-lbf (1.02 J). The sample is to be rigidly supported and the impact is to be made normal to the most vulnerable spots on the appliance enclosure that are exposed to a blow during normal use. A different spot on the enclosure is to be selected for each impact. Refer to Figure 58.3 with respect to the ball drop impact test and to Figure 58.4 for the ball pendulum impact test.

Exception: If the manufacturer elects, fewer than three samples may be used for the tests in accordance with Figure 58.2 wherein each series consists of one impact. The overall performance is acceptable upon completion of any one of the procedures represented in the figure.

58.5.3.5 With reference to Figures 58.3 and 58.4, the "H" designation represents the vertical distance the sphere must travel to produce the desired impact. For the pendulum impact, the sphere is to contact the test sample when the string is in the vertical position. The supporting surface is to be as described in 58.5.2.5. The backing surface for the pendulum impact is to consist of 3/4 inch (19 mm) plywood over a rigid surface of concrete or an equivalent nonresilient backing surface may be used.

Figure 58.3
Ball drop impact test

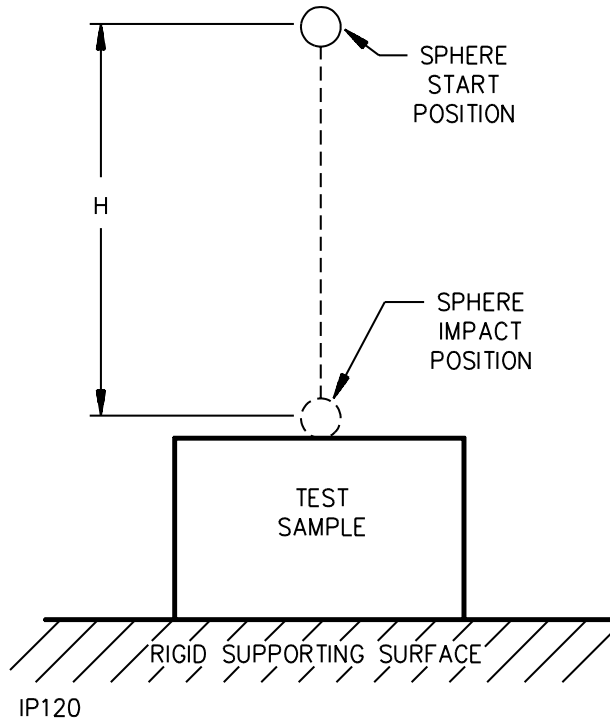
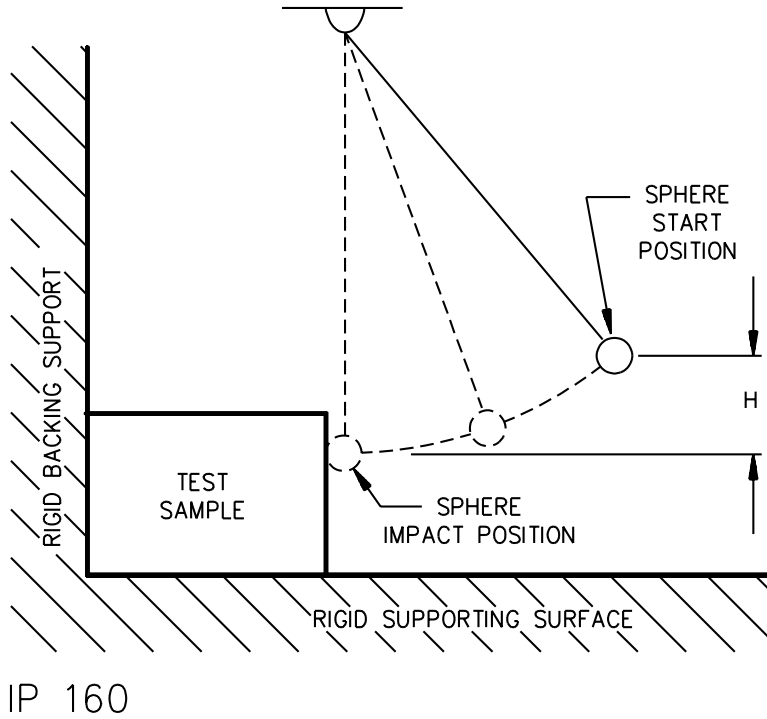


Figure 58.4
Ball pendulum impact test



58.6 Stress-relief distortion

58.6.1 Conditioning of the appliance as described in 58.6.2 and 58.6.3 shall not cause distortion of the enclosure that results in any of the following:

- a) Inability of the appliance to comply with the requirements for enclosure of live parts and integrity of the enclosure so affected that adequate mechanical protection is not afforded to internal component parts. (See 58.9.1 and 58.9.2); or
- b) Inability of the appliance power-supply cord to comply with the strain-relief requirements. (See 58.8.1).

Exception: If the stress relief distortion test of 58.6.2 or 58.6.3 results in non-compliance with 58.6.1 due to distortion at a location that did not attain the maximum temperature during the Normal Temperature Test, Section 36, or severe-use conditioning temperature test, then the following shall apply:

- a) The Normal Temperature Test, Section 36, or severe-use conditioning test, as applicable, shall be repeated to determine the maximum temperature of the area that exhibited distortion; and*
- b) Three additional samples of the entire appliance shall be subjected to the Stress-Relief Distortion Test of 58.6.2 or 58.6.3, as applicable, except that the oven temperature used for the conditioning test shall be based on the local material temperature determined under (a) of this exception, rather than the maximum overall enclosure temperature, but not less than 70°C (158°F). The samples so conditioned shall comply with 58.6.1.*

58.6.2 Based on Figure 58.1, three samples of the appliance employing a Type B or C material are to be placed in a circulating-air oven maintained at a uniform temperature at least 10°C (18°F) higher than the maximum temperature of the material measured under normal appliance-operating conditions, but not less than 70°C (158°F) in any case. The samples are to remain in the oven for 7 hours. After their careful removal from the oven and cooling to room temperature, they are to be investigated for compliance with 58.6.1.

58.6.3 Based on Figure 58.1, three samples of the appliance employing a Type A material are to be placed in a circulating-air oven maintained at a uniform temperature at least 10°C (18°F) higher than the maximum temperature of the material measured during the appliance conditioning described in 58.12.2 (b) and (c); but not less than 70°C (158°F) in any case. The samples are to remain in the oven for 7 hours. After their careful removal from the oven and cooling to room temperature, they are to be investigated for compliance with 58.6.1.

Exception: If burnout occurs during conditioning described in 58.12.2 (b) or (c) the maximum temperature measured on the sample that did not burn out is to be used. If burnout occurs during conditioning described in 58.12.2 (b) and (c), the maximum temperature measured under normal-operating conditions is to be used.

58.7 Input (repeated)

58.7.1 After being conditioned as described in 58.6.3, when operated at no load and rated voltage the appliance input current shall not be greater than 150 percent of the no-load current measured on an unconditioned sample as the result of any warping or other distortion of the enclosure.

58.8 Strain relief (repeated)

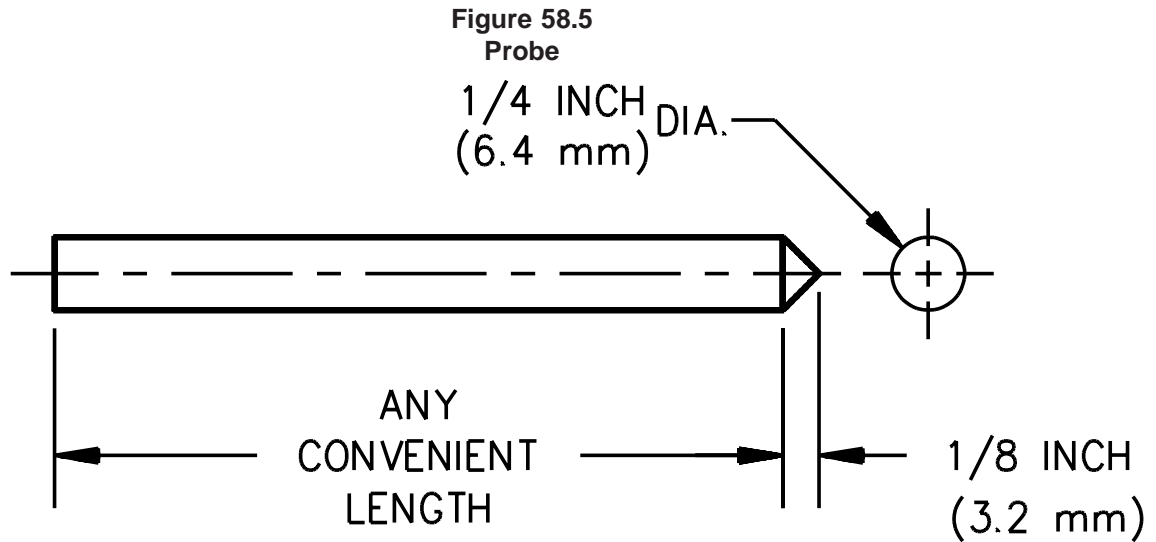
58.8.1 Following conditioning described in 58.6.2 and 58.6.3, after the samples have cooled to room temperature, they shall be subjected to the power supply-cord strain relief test described in 54.1.

58.9 Accessibility

58.9.1 An opening anywhere in the enclosure of a hand-supported appliance or in any portion of an appliance hand held in normal use is acceptable if a probe as illustrated in Figure 58.5, when inserted point first as far as possible into the opening;

- a) Does not enter the opening for a distance of more than 1/8 inch (3.2 mm); and
- b) Does not touch any uninsulated live part or magnet wire involving a risk of electric shock or moving part capable of causing injury.

Exception: If unacceptable results are obtained using the probe illustrated in Figure 58.5, the probe illustrated in Figure 7.1 may be used to determine that the part is not more accessible than with a sample prior to conditioning.



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58.9.2 In the enclosure of an appliance other than as described in 58.9.1, an opening which does not permit entrance of a 3/4 inch-diameter (19 mm) rod is acceptable if:

- a) A probe as illustrated in Figure 58.6 cannot be made to touch any uninsulated live part or moving part capable of causing injury when inserted through the opening; and
- b) A probe as illustrated in Figure 58.7 cannot be made to touch magnet wire when inserted through the opening.

Exception: If unacceptable results are obtained using the probe illustrated in Figure 58.6 and 58.7, the probe illustrated in Figure 7.1 may be used to determine that the part is not more accessible than with a sample prior to conditioning.

Figure 58.6
Probe

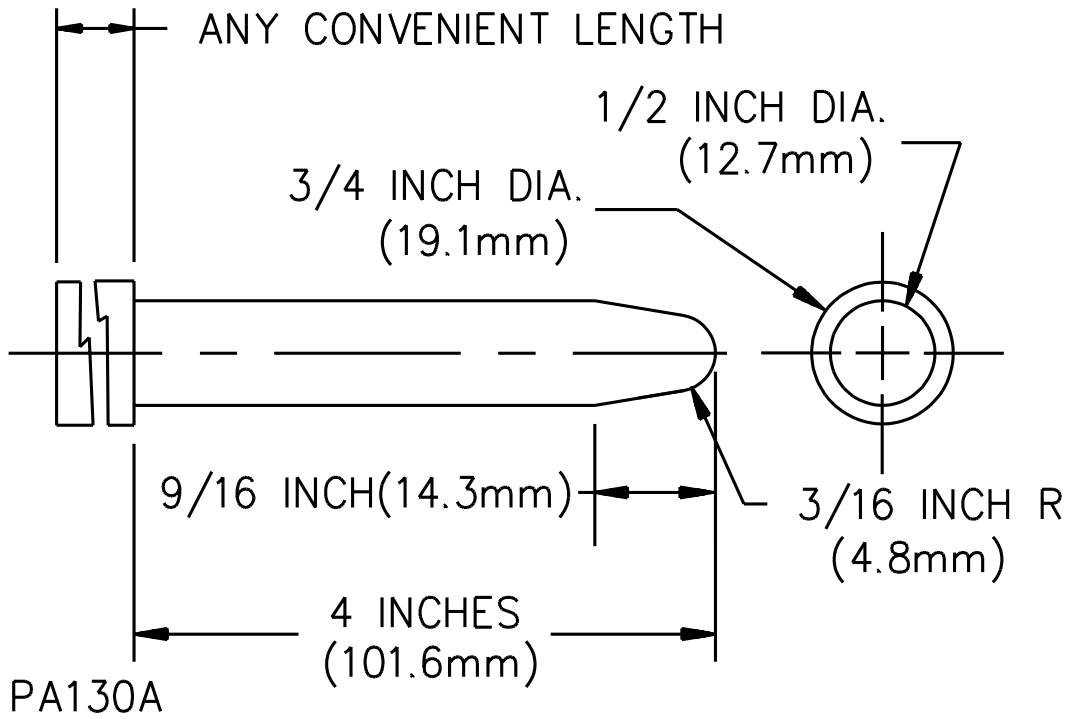
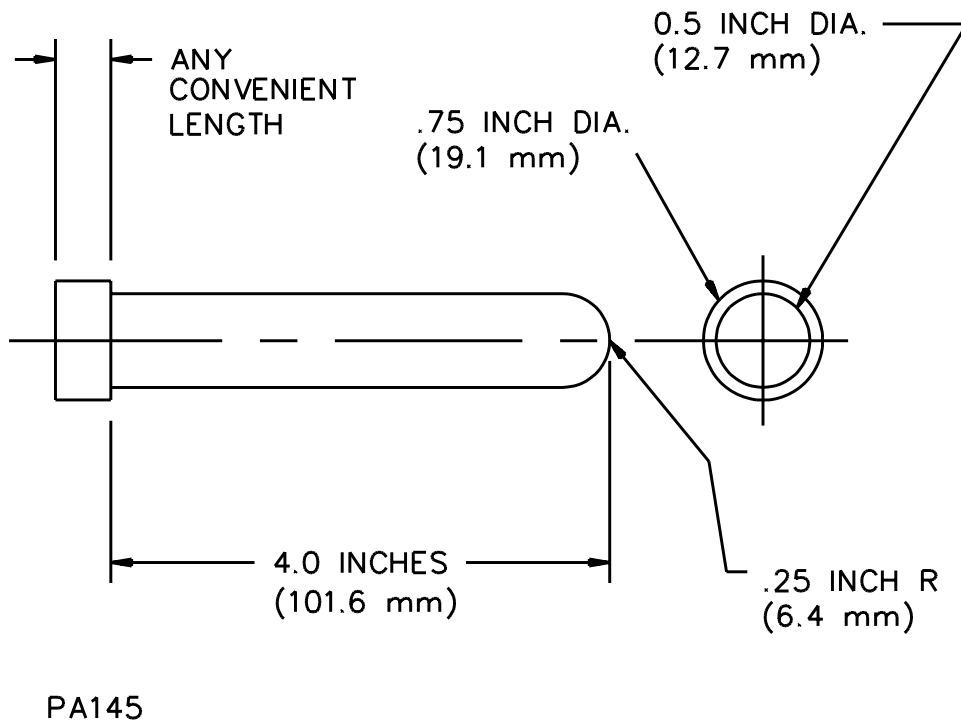


Figure 58.7
Probe



58.10 Spacings to enclosure

58.10.1 The spacings between the polymeric enclosure and:

- a) A nonarcing uninsulated live part (a bus bar, a connecting strap, a terminal, or the like) shall be not less than 1/32 inch (0.8 mm). If less than a 1/32 inch (0.8 mm) spacing is provided, the enclosure material shall comply with the requirements for direct support of live parts in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, unless an acceptable insulating barrier is provided.
- b) An arcing part (the commutator, unenclosed switch contacts, and the like) shall not be less than 1/2 inch (12.7 mm) except as indicated in 58.10.3.

58.10.2 The spacing mentioned in 58.10.1(b) is to be measured from the source of the arc. Examples of arcing parts are the interface of the brush and the commutator, and the interface of the switch contacts.

58.10.3 The spacing mentioned in 58.10.1(b) may be less than 1/2 inch (12.7 mm) but not less than 1/32 inch (0.8 mm) if the polymeric material resists ignition during 60 arcs when tested in accordance with 58.10.4 and 58.10.5.

58.10.4 Three specimens of the polymeric material, each 5 inches (127 mm) long, 1/2 inch (12.7 mm) wide, and having a thickness not more than the minimum enclosure thickness are to be tested.

58.10.5 The high current arc ignition test is to be performed as outlined in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

58.11 Abnormal operation

58.11.1 When tested in accordance with 58.11.2 there shall not be:

- a) Ignition of the mounting surface or the cheesecloth as a result of emission of glowing or flaming materials;
- b) Ignition of enclosure; or
- c) Access to live parts.

In addition, the appliance shall comply with the Dielectric Voltage-Withstand Test, Section 37.

58.11.2 The appliance is to be operated under the various conditions of abnormal operation, such as stalled-rotor operation at different speed settings. During the test, the appliance is to be draped with one layer of cheesecloth while resting on white tissue paper on a soft wood surface and operated continuously until the ultimate results have been determined. In most cases, continuous operation for 7 hours will be necessary in order to make sure that the ultimate results have been determined. Warping, breakage, expansion, or cracking of the enclosure material is acceptable if live parts are not exposed.

58.12 Severe-use conditions

58.12.1 Except as indicated in 58.12.4, the no-load current input of an appliance that has completed the procedures described in 58.12.2 without burning out electrically shall not be greater than 150 percent of the no-load current measured on an unconditioned sample.

58.12.2 The sample of the appliance is to be operated in accordance with the conditions indicated below. The maximum temperature of the enclosure material during the conditioning described in (b) and (c) are to be recorded unless burnout occurs.

- a) A sample of the appliance is to be operated with no load at rated voltage for 7 hours. This conditioning is to be waived for an appliance provided with a momentary contact line switch (one which requires constant pressure to hold it in the ON position) having no means for locking the switch in the ON position.
- b) A sample of the appliance is to be operated at 106 percent of rated voltage under these same conditions of use as for the Normal Temperature Test, Section 36.
- c) A sample of the appliance is to be operated at 94 percent of rated voltage under the same conditions of use as for the Normal Temperature Test, Section 36.

Exception: A manufacturer may elect to use the same sample for each conditioning provided that acceptable results are obtained.

58.12.3 During the overload conditioning mentioned in 58.12.2, any automatic reset or user resettable overload-protective device provided with the appliance is to be short circuited.

Exception: Any automatic reset or user resettable over-current or over-temperature protector can be maintained in the circuit during the test provided that the device opens the circuit in accordance with the locked-rotor temperature and endurance test requirements as described in 16.2.5.

58.12.4 An appliance that does not burn out during the conditioning mentioned in 58.12.2 and has a no-load current input more than the value indicated in 58.12.1 is to be operated with no load at rated voltage until burnout occurs.

58.12.5 Burnout of the appliance during the conditioning described in 58.12.2 is not to result in emission of glowing or flaming materials or ignition of the enclosure and is to comply with the requirements of 58.6.1(a) after cooling to room temperature. Three samples of the appliance shall be subjected to the specified conditioning to determine compliance.

58.13 Thermal aging

58.13.1 A material used for the enclosure of a portable cord-connected food-preparing appliance shall be resistant to thermal degradation at the maximum temperature to which it is exposed during normal use of the appliance. The thermal-aging characteristics of the material may be investigated by any one of the following procedures:

- a) The material shall have a temperature index, based on historical data or a long-term thermal aging program, described in the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, which indicates acceptability for use at the temperature involved; or
- b) The polymeric material can be considered appropriate from a thermal-aging standpoint if the maximum temperature to which it is exposed during normal use of the appliance does not exceed 65°C (149°F) for any unattended portable appliance and 80°C (176°F) for any attended portable intermittent-duty appliance.

58.14 Load test

58.14.1 A loading test is to be performed on an under-cabinet and wall-mounted appliance and an appliance provided with a hanging means (as described in 7.19). The test load is to consist of three times the combined weight of the appliance and the maximum normal load. A gradually increasing force is to be applied vertically through the center of gravity of the unit. The force is to be increased in a 5 to 10 second interval and then is to be maintained for 1 minute. For this test, the appliance should be mounted using the manufacturer's recommended surface/hardware combination that would result in a worst case application. The mounting means shall not break, loosen, or pull out of the wall or cabinet and the appliance shall not separate from the mounting means as a result of this test. There shall not be any damage to the appliance that would result in a risk of fire, electric shock or expose a moving part capable of causing injury. If the mounting assembly (mounting means or appliance retaining means) or enclosure or both is constructed of a thermoplastic material, the test shall be repeated on a sample subject to the stress-relief distortion test. (See 58.6.1 – 58.6.3). For products which are mounted for storage only, there is no added maximum normal load weight. For a blender the maximum normal load shall consist of the weight of the blender jar completely filled with the carrot-water mixture used in the Normal Temperature Test, Section 36.

Exception: The force applied to the mounting means of a wall mounted can opener shall be 25 lbf (111.4 N).

59 Enclosures of Polymeric Material for Stationary or Fixed Appliances

59.1 A stationary or fixed appliance that has an enclosure of polymeric material shall comply with the applicable requirements contained in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Exception: An under-the-cabinet-appliance is to comply with the requirements for Enclosures of Polymeric Material for Portable Appliances, Section 58.

60 Thermoplastic Coil Forms and Thermoplastic Insulating Material

60.1 General

60.1.1 A thermoplastic material used as functional insulation in a motor insulation system shall electrically isolate the windings and other live parts of the system from other live parts of opposite polarity or dead metal parts.

60.1.2 A thermoplastic material used as functional insulation in a motor insulation system shall have short-term electrical, mechanical, and thermal properties such that the ability of the material to serve as electrical insulation and maintain physical spacing between the coil and dead metal parts of the system is not impaired as determined by the requirements contained in this section.

60.1.3 If a thermoplastic material used as functional insulation in a motor insulation system melts or distorts during normal use, abnormal-use or a combination of both conditions, such melting or distortion shall not result in a risk of electric shock or fire.

60.2 Normal conditioning

60.2.1 After being subjected to the conditioning described in 60.2.2, a thermoplastic coil form or thermoplastic insulating material employed in a motor shall not noticeably soften or distort.

Exception: Thermoplastic coil forms or thermoplastic insulating material having a 105°C (221°F) or greater electrical relative thermal index for the minimum thickness employed in the coil form or insulating part need not be subjected to this conditioning.

60.2.2 Three representative motors shall be subjected to this test. The motors are to be placed for a period of seven hours in an air circulating oven in which the temperature is maintained at 100°C (212°F).

60.2.3 Following the conditioning described in 60.2.2, each motor shall withstand without breakdown the application of the dielectric voltage withstand potential specified in the Dielectric Voltage-Withstand Test, Section 37, between coil windings and the metal laminations or other dead metal parts.

60.3 Abnormal conditioning

60.3.1 After being subjected to the abnormal conditioning described in 60.3.2, a thermoplastic coil form or thermoplastic insulating material used in motors shall comply with the following conditions:

- a) The integrity of the material shall be such that the 3-ampere fuse specified in 60.3.2 remains intact during the test; and
- b) Any molten metal or flaming shall be confined within the enclosure of the electrical equipment in which the electrical component is used.

60.3.2 One representative appliance is to be subjected to the following conditioning. After the rotor or armature of the motor has been restricted from moving, the windings are to be energized by applying the rated voltage. The dead metal of the motor is to be connected to one side of the line through a 3-ampere non-time delay fuse. The conditioning is to be continued for 7 hours or until:

- a) Burnout of the motor occurs as a result of a winding opening, insulation melting, or the like;
- b) A reliable, nonuser-serviceable, protective device, such as a fuse, functions; or
- c) The maximum-size branch-circuit protective device used to protect the circuit to which the equipment is likely to be connected, and which is not rated less than 20 amperes, functions.

60.3.3 While still in a well-heated state following the conditioning described in 60.3.2 the appliance shall withstand without breakdown the application of the dielectric voltage withstand potential specified in the Dielectric Voltage-Withstand Test, Section 37. The dielectric potential is to be applied between current-carrying parts and accessible dead-metal parts of the appliance. The 3-ampere fuse is to be removed from the circuit during the application of the test potential.

60.4 Running-burnout conditioning

60.4.1 A thermoplastic coil form or thermoplastic insulating material employed in a motor with a stalled-rotor current greater than twice the normal operating current shall comply with all of the following after the running-burnout conditioning described in 60.4.2:

- a) The 3-ampere fuse described in 60.4.2 shall remain intact during the test.
- b) The thermoplastic insulating material shall show no appreciable softening or melting to affect spacing.
- c) Any molten metal or flaming shall be confined within the enclosure of electrical equipment within which the motor is used.

Exception: This test is not required to be conducted if the abnormal conditioning (stalled-rotor test) described in Section 60.3 continues for 7 hours without the occurrence of 60.3.2 (a), (b), or (c).

60.4.1 Exception effective April 6, 2006

60.4.2 Three representative appliances are to be subjected to this test. Each appliance is to be run without a load for 1 hour, immediately followed by operation at normal load for 1 hour. Immediately following this, the load is to be increased in steps of 10 percent of the rated current for each of four successive 1-hour periods, followed by two 1/2-hour periods, followed by eight 1/4-hour periods, followed by such additional periods of 5 minutes until the motor burns out. During the test, noncurrent-carrying metal parts of the motor that are insulated by the material under test are to be connected to ground through a 3-ampere, quick-acting fuse.

Exception No. 1: A motor which burns out in less than 1 hour of a no-load condition meets the intent of the requirement.

Exception No. 2: The test is not prohibited from being conducted on the motor itself when the construction of the appliance is such that the appliance motor is unable to be loaded to achieve burnout.

60.4.3 While still in a well-heated state following the conditioning described in 60.4.2 the appliance shall withstand without breakdown the application of the dielectric voltage withstand potential specified in the Dielectric Voltage-Withstand Test, Section 37. The dielectric potential is to be applied between current-carrying parts and accessible dead-metal parts of the appliance. The 3-ampere fuse is to be removed from the circuit during the application of the test potential.

60.4.4 The functioning of an over-temperature or overcurrent protective device is considered to be acceptable provided the appliance still complies with the requirements in 60.4.1 and 60.4.3.

MANUFACTURING AND PRODUCTION TESTS

61 Dielectric Voltage-Withstand Test

61.1 Each appliance shall withstand without breakdown as a routine production-line test, the application of an AC potential at a frequency within the range of 40 – 70 hertz or a DC potential between:

- a) The primary wiring, including connected components, and accessible metal parts that are capable of becoming energized; and
- b) Primary wiring and accessible low voltage (42.4 V peak or less) metal parts, including terminals.

61.1.1 The production-line test shall be conducted in accordance with either Condition A or Condition B of Table 61.1.

Table 61.1
Production-line test conditions

Rating of motor employed by appliance, horsepower	Condition A			Condition B		
	Potential, volts AC	Potential, volts DC	Time, seconds	Potential, volts AC	Potential, volts DC	Time, seconds
1/2 horsepower or less	1000	1400	60	1200	1700	1
More than 1/2 horsepower	$1000 + 2V^a$	$1400 + 2.8V^a$	60	$1200 + 2.4V^a$	$1700 + 3.4V^a$	1

^a Maximum rated voltage.

61.2 For an electric knife or wand-type mixer the test potential shall be 2500 V applied for one minute, or 3000 V applied for one second.

61.3 The appliance may be in a heated or unheated condition for the test.

61.4 The test shall be conducted with the appliance complete – fully assembled. It is not intended that the appliance be unwired, modified, or disassembled for the test.

Exception No. 1: Parts such as snap covers or friction-fit knobs that would interfere with the performance of the test need not be in place.

Exception No. 2: The test may be performed before final assembly if such a test represents testing the complete appliance.

61.5 If the appliance employs a solid-state component that can be damaged by the test potential, the test on each appliance may be conducted before the component is electrically connected. In such a case, additional testing is to be made of a random sampling of each day's production with the circuitry rearranged to reduce the likelihood of damage to any solid-state component but retaining representative dielectric stress of the circuit.

61.6 The test equipment when adjusted for production-line testing, is to produce an output voltage that is not less than the factory test value specified, nor is the magnitude of the test voltage to be greater than 120 percent of the specified test potential when the tester is used in each of the following conditions:

a) If the test duration is one second, the output voltage is to be maintained within the specified range:

- 1) When only a voltmeter having an input impedance of at least 2 megohms and a specimen of the product being tested are connected to the output terminals; and
- 2) When a relatively high resistance is connected in parallel with the voltmeter and the product being tested, and the value of the resistance is gradually reduced to the point where an indication of unacceptable performance just occurs.

b) If the test duration is one minute, the output voltage is to be maintained within the specified range, by manual or automatic means, throughout the one minute duration of the test or until there is an indication of unacceptable performance.

61.7 The specified control of the applied voltage, manual or automatic, shall be maintained under conditions of varying line voltage. Higher test potentials may be used if the higher dielectric stress is not likely to adversely affect the insulating systems of the product.

61.8 In addition to the characteristics indicated in 61.6, the test equipment is to have the following features and characteristics:

a) A means of indicating the test voltage that is being applied to the appliance under test. This may be accomplished by sensing the voltage at the test leads or by an equivalent means.

b) An output voltage that:

1) Has a sinusoidal waveform;

2) Has a frequency that is within the range of 40 – 70 Hz; and

3) Has a peak value of the waveform that is not to be less than 1.3 and not more than 1.5 times the root-mean-square value.

c) A means of effectively indicating unacceptable performance. The indication is to be:

1) Auditory if it can be readily heard above the background noise level;

2) Visual if it commands the attention of the operator; or

3) A device that automatically rejects an unacceptable product.

If the indication of unacceptable performance is auditory or visual, the indication is to remain active and conspicuous until the test equipment is reset manually.

d) When the test equipment is adjusted to produce the test voltage and a resistance of 120,000 ohms is connected across the output, the test equipment is to indicate an unacceptable performance within 0.5 second. A resistance of more than 120,000 ohms may be used to produce an indication of unacceptable performance, if the manufacturer elects to use a tester having higher sensitivity.

Exception: The sensitivity of the test equipment may be reduced, a lower value of resistance may be used, when testing an appliance intended to be permanently wired.

61.9 There is not to be any transient voltage applied to the appliance under test that results in the instantaneous voltage applied to the product exceeding 120 percent of the peak value of the test voltage that the manufacturer elects to use for this test. This requirement applies for the entire duration of the test, including the time that the voltage is first applied to the product and the time that the voltage is removed from this product.

61.10 During the test, enough of the primary switching components shall be in the ON position so that all primary circuitry will be stressed. Both sides of the primary circuit of the appliance are to be connected together to one terminal of the test equipment. The second equipment terminal is to be connected to accessible metal.

Exception: Appliances utilizing motors, relays, coils or transformers, having circuitry not subject to excessive secondary build-up in case of indication of unacceptable performance during the test, may be tested with only one side of the primary circuit connected to the dielectric test equipment.

62 Grounding Continuity Test

62.1 Each cord-connected appliance having provision for grounding shall be tested, as a routine production-line test, to determine grounding continuity between the grounding blade of the attachment plug and the accessible metal parts of the appliance that are likely to become energized.

62.2 Only a single test need be made if the accessible metal selected is conductively connected by design to all other accessible metal.

63 Polarization Test

63.1 As a routine production-line verification, each cord-connected appliance provided with a 2-wire polarized or 3-wire grounding attachment plug, shall be examined or tested for electrical continuity between the ungrounded circuit supply conductor of the attachment plug (see Figure 11.1 for attachment plug blade connections) and all components intended to be connected to the ungrounded conductor. If the continuity cannot be readily determined by visual inspection and component checking, an electrical continuity test is to be conducted.

64 Electrical Indicating Device

64.1 Any indicating device (an ohmmeter, a battery-and-buzzer combination, or the like) may be used to determine compliance with the continuity requirements in 62.1 and 63.1.

MARKINGS

65 General

65.1 An appliance shall be plainly marked where readily visible with:

- a) The manufacturer's name, trade name, or trademark;
- b) The date or other dating period of manufacture not exceeding any three consecutive months;
- c) A distinctive catalog number or the equivalent; and
- d) The electrical rating.

A date-code repetition time cycle shall not be less than 10 years.

Exception No. 1: The manufacturer's identification may be in a traceable code when the appliance is identified by the brand or trademark owned by a private labeler.

Exception No. 2: The date of manufacture may be abbreviated or in an established accepted code, or a code affirmed by the manufacturer. The code shall not require reference to the manufacturer's records to determine when the appliance was produced.

65.2 An appliance shall be marked, where readily visible, to indicate that the appliance is intended for household type usage, such as, "Household Use Only", "Household Type", and the like. Lettering shall not be less than 3/32 inch (2.4 mm) high.

Exception: An appliance that has been evaluated for a household and commercial application may be marked "Household and Commercial Use", if such use is intended.

65.3 The electrical rating shall include the voltage, frequency, and input amperes or watts. The ampere rating shall be included unless the full-load power factor is 80 percent or more or, for a cord-connected appliance, unless the rating is 50 W or less. If the input of a multipurpose appliance when using functional attachment is less than the minimum value in Table 35.1, including the allowable deviation, the input rating shall include the word "maximum", or "max."

65.4 A required marking shall be permanent (see 66.1.5) and shall comply with the Standard for Marking and Labeling Systems, UL 969. The markings shall be located on a part that cannot be removed without impairing the operation of the appliance unless the requirement specifically indicates otherwise.

65.5 A motorized, hand-supported part of a battery-type appliance shall be marked with the name or other identification of the manufacturer, and with the catalog number or equivalent indication of the appliance with which it is intended to be used, unless the part is integral with or is permanently electrically connected to the appliance.

65.6 If a manufacturer produces or assembles appliances at more than one factory, each finished appliance shall have a distinctive marking – which may be in code – by means of which it may be identified as the product of a particular factory.

65.7 If the design of an appliance contemplates cleaning or servicing (such as the replacement of pilot lamps or fuses) by the user, and if such cleaning or servicing would involve the exposure of a normally enclosed or protected live part to unintentional contact, the appliance shall be plainly marked to indicate that such servicing or cleaning be done with the appliance disconnected from the supply circuit.

Exception: The marking for a lampholder may be placed inside the lamp compartment.

65.8 If an appliance will not start and attain normal running speed when connected to a circuit protected by an ordinary (not a time-delay) fuse as described in 34.1.1, the appliance shall be plainly marked with the words "If connected to a circuit protected by fuses, use time-delay fuses with this appliance" or with an equivalent wording.

65.9 If any point within a terminal box or wiring compartment of a permanently connected appliance in which the power-supply conductors are intended to be connected (including such conductors themselves) attains a temperature rise of more than 35°C (63°F) during the normal-temperature test, the appliance shall be marked "For supply connection, use wires suitable for at least _____°C (____°F)," or with an equivalent statement, and the temperature value shall be in accordance with Table 65.1. This statement shall be located at or near the point where the supply connections are to be made, and shall be clearly visible both during and after installation of the appliance.

Table 65.1
Outlet-box marking

Temperature rise attained during test in terminal box or compartment	Temperature marking
36 – 50°C (64 – 90°F)	75°C (167°F)
51 – 65°C (91 – 117°F)	90°C (194°F)

65.10 An appliance shall not be marked with a double insulation symbol (a square within a square), the words "double insulation," or the equivalent unless it complies with the requirements for double-insulated appliances.

66 Cautionary

66.1 General

66.1.1 A marking shall be provided on an appliance to inform the user of a risk of injury to persons that is not obvious.

66.1.2 Other required markings in addition to the specific markings stated in 66.2 – 66.25 shall depend upon the construction, operation, or construction and operation of an appliance.

66.1.2 effective December 1, 2004

66.1.3 Caution markings intended to inform the user of a potential risk of injury to persons (see 66.2 – 66.20 and 66.23 under specific appliances) shall be prefixed by the signal word CAUTION. The signal word shall be more prominent than any other required marking on the appliance.

Exception: WARNING shall be used as the signal word for the marking stated in 66.18 and 66.25.

66.1.3 effective December 1, 2004

66.1.4 A marking intended to protect against potential injury to persons shall be:

- a) Permanent and legible;
- b) Located on a part that cannot be:
 - 1) Removed without impairing the operation of the appliance; or
 - 2) Left off the appliance without its being readily apparent; and
- c) In letters not less than:
 - 1) 3/32 inch (2.4 mm) high; or
 - 2) If the letters have a contrasting color to the background, 1/16 inch (1.6 mm).

66.1.5 Examples of permanent marking are those which are etched, molded, die-stamped, paint-stenciled, permanently secured stamped or etched metal, or indelibly stamped lettering on a pressure-sensitive label secured by adhesive. Intended usage, handling, storage, and the like of the appliance will be considered in determination of permanence of marking.

66.1.6 A caution marking intended to instruct the operator shall be legible and visible from the operator's position that provides maximum exposure to the risks.

66.1.7 A marking shall be provided on an appliance that is provided with a grasping function to open jars, which is not obvious to the user, that indicates the function to the user.

Exception: A marking is not required if there is no risk of a cut-type injury.

66.2 Food mixer markings

66.2.1 A food mixer shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) Portable – "Unplug before inserting or removing parts".
- b) Permanently Installed – "Turn off before inserting or removing parts".
- c) Hand supported – The marking required by (a) and (e) shall be located adjacent to the beater drives.
- d) For a stand-supported mixer, both detachable and nondetachable, the marking required by (a) shall be located on the base plate under the mixing bowl or where it is to be legible and visible from the operator's position.
- e) Hand supported – "Do not put in water"

66.3 Blending mixer markings

66.3.1 A blending mixer shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) "Do not operate without this cover in place" or the equivalent.
- b) The marking required by (a) shall be located on the main portion of the open-top blender cover.
- c) "Read instructions before using" or the equivalent.
- d) The marking required by (c) may be located on the bottom of the blender base.
- e) When it is possible to place a blade assembly itself on a blender base prior to its assembly to a container, the blender shall be marked "Never place blade assembly on base unless assembled to jar."

66.4 Liquid mixer markings

66.4.1 For liquid mixers, no appliance markings in addition to 66.1.1 – 66.1.7 are required.

66.5 Cord-connected knife markings

66.5.1 A cord-connected knife shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) "Do not put in water."
- b) "Unplug before handling blades" or the equivalent.
- c) In place of the marking required by (b), a positive lockout may be provided and the marking "Engage lockout before handling blades" or the equivalent shall be provided. The marking in (b) may be used as an alternate marking.
- d) The marking shall be on the exterior body of the knife.

66.6 Battery-operated knife markings

66.6.1 A battery-operated knife shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) "Engage lockout before handling blades" or the equivalent.
- b) The lockout shall be plainly marked OFF or the equivalent when engaged. This marking may be omitted if the lockout position is readily apparent.
- c) If the lockout is automatically reengaged in the OFF position, neither marking under (a) nor (b) is required.

66.7 Can openers and knife sharpener markings

66.7.1 For can openers and knife sharpeners, no appliance markings in addition to 66.1.1 – 66.1.7 are required.

66.8 Combination cleaver-meat tenderizer markings

66.8.1 A combination cleaver-meat tenderizer shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) Portable – “Unplug before handling blades” or the equivalent.
- b) Permanently Installed – “Turn off before handling blades” or the equivalent.
- c) In place of the marking required by (a) and (b), a positive interlock may be provided and the marking “Engage interlock before handling blades” or the equivalent shall be provided. The marking of (a) and (b) may be used as an alternate marking.
- d) The marking shall be on the exterior body of the product.
- e) If the interlock is automatically reengaged in the OFF position neither marking under (a), (b) or (c) is required.

66.9 Vegetable shredder (cone type) markings

66.9.1 A vegetable shredder (cone type) shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) Portable – “Unplug before inserting or removing parts”.
- b) Permanently Installed – “Turn off before inserting or removing parts”.
- c) The markings required by (a), (b) and (d) shall be located in accordance with 66.1.6.
- d) “Moving Parts – Keep fingers out of feed opening.”

66.10 Vegetable shredder (disc type) markings

66.10.1 A vegetable shredder (disc type) shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) “Sharp Blade – Always use food pusher.”
- b) “Moving Parts – Keep fingers out of feed and discharge openings.”

66.11 Food grinder, ice cream freezer, and juicer (reamer type) markings

66.11.1 For food grinders, ice cream freezers, and juicers (ream type), no appliance markings in addition to 66.1.1 – 66.1.7 are required.

66.12 Food processor and food chopper markings

66.12.1 A food processor and food chopper shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) "Do not open until blades stop" or equivalent.
- b) The marking required by (a) shall be located on the bowl cover.
- c) "Read instructions before using" or the equivalent.
- d) The marking required by (c) may be located on the bottom of the appliance base.

66.13 Baby-food chopper/grinder markings

66.13.1 A baby-food chopper/grinder shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) "Read instructions before using."
- b) "Unplug before inserting or removing parts."
- c) In place of the marking required by (b), a positive interlock may be provided with the marking "Engage interlock before handling blades". The marking of (b) may be used as an alternative marking.

66.14 Juicer or juice extractor (centrifugal type) markings

66.14.1 A juicer or juice extractor (centrifugal type) shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) Portable – "Unplug before cleaning and before assembling or removing parts".
- b) Permanently Installed – " Turn off before cleaning and before assembling or removing parts".
- c) The marking required by (a) and (b) shall be located in accordance with 66.1.6.
- d) "Read instructions before using" or the equivalent.
- e) The marking required by (d) may be located on the bottom of the appliance base.
- f) "Sharp Blade – Always use food pusher".

66.15 Slicer markings

66.15.1 A slicer shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) Portable – “Unplug before cleaning”.
- b) Permanently Installed – “Turn off before cleaning”.
- c) The marking required by (a) and (b) shall be located in accordance with 66.1.6.
- d) “Read instructions before using” or the equivalent.
- e) The marking required by (d) may be located on the bottom of the appliance base.
- f) “Sharp Blade – Never use slicer unless completely assembled.”
- g) The marking required by (f) shall be located in accordance with 66.1.6.

66.16 Ice crushing appliance and ice-crushing attachment markings

66.16.1 An ice crushing appliance and ice-crushing attachment shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) “Keep fingers out” located at feed and discharge openings. If discharge opening is inaccessible with ice container in place, the discharge opening marking need only be visible with container removed, or
- b) “Keep fingers out of feed and discharge openings.”
- c) “Read instructions before using jam-release mechanism” (when a jam-release mechanism is provided)

66.17 Appliance with a lamp markings

66.17.1 An appliance provided with a lampholder for an incandescent lamp shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) To indicate the maximum wattage rating of the lamp to be used in the lampholder and
- b) With cautionary marking indicating either “Unplug before relamping to avoid electric shock” or “To avoid electric shock unplug before relamping.”

66.18 Appliance (outdoor-use type) markings

66.18.1 An outdoor-use type appliance shall be marked with "Do not expose to rain— store indoors" (not required if appliance complies with requirements stated in the Resistance to Moisture Test, Section 45) in addition to any other markings required by the standard.

66.19 Coffee mill and butter churn markings

66.19.1 For a coffee mill and butter churn, no appliance markings in addition to 66.1.1 – 66.1.7 are needed.

66.20 Combination appliance markings

66.20.1 Combination appliances (including permanently installed appliances) shall include each applicable marking required by 66.2 – 66.19 and 66.21 – 66.24.1(b) under "Specific Appliance Markings" and shall be considered with respect to additional markings which may be required by such combination of functions.

66.21 Multi-speed appliance markings

66.21.1 If the operation of a multi-speed appliance, intended for use with various attachments, at speeds exceeding those recommended by the manufacturer results in a risk of injury to persons, each attachment or the appliance shall be marked with the recommended speeds of operation.

66.22 Appliance cart or stand markings

66.22.1 An appliance cart or stand shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) The markings required by (b) and (c) shall be located on the top of the cart or stand so as to be visible from the operator's position.
- b) A cart or stand that is recommended by the manufacturer for use with an appliance and that is packaged and marketed separately from the appliance shall be marked with the cart or stand manufacturer's name, a distinctive catalog designation and with the following or the equivalent: "CAUTION – This cart (or stand) designed for use only with (manufacturer's name) model number (or series) (appliance name). Use with other appliances may result in instability causing possible injury."
- c) If it is not feasible to include a specific appliance model number series designation in the cart or stand marking, the cart or stand may be marked, in place of the marking specified in (b), as follows: "CAUTION – This cart (or stand) for use only with specific (manufacturer's name) (appliance). See appliance instructions. Use with other models may result in instability causing possible injury." In conjunction with this marking an appliance intended for use with this cart or stand is to be marked as follows: "CAUTION– This (appliance name) may be used only with (cart or stand manufacturer's name and model number) cart (or stand). Use with other carts (or stands) may result in instability causing possible injury." This marking is to be located on a readily visible part of the appliance or on literature packed with it.
- d) Converse arrangement of the markings described in (c) may also be considered acceptable.

66.23 Wand-type mixer markings

66.23.1 A wand-type mixer shall be marked with "Sharp blades – handle carefully – unplug before inserting or removing parts – do not put motor end in water " in addition to any other markings required by the standard.

66.24 Product with separable battery/battery pack markings

66.24.1 A product with a separable battery/battery pack shall be marked with the following specific markings in addition to any other markings required by the standard:

- a) The product shall be marked: "For use only with _____ battery (battery pack)", or the equivalent. The blank is to be filled in with the catalog number, or the trade name, or the equivalent, of the battery (battery pack).
- b) The separable battery (battery pack) shall be marked: "For use only with _____ charger," or the equivalent. The blank is to be filled in with the catalog number, or the trade name, or the equivalent, of the charger.

66.25 Appliance with electronic controls with a stop position markings

66.25.1 Products employing exposed moving parts and electronic controls with a stop position while energized, and required to be provided with a red flashing light in accordance with 24.4

- a) "Flashing light indicates ready to operate. Avoid any contact with blades or moveable parts."
- b) The marking required by (a) shall be located next to the red flashing light.

66.25.1 effective December 1, 2004

67 Carton Marking

67.1 A carton (individual marketing container) for an appliance shall be marked to indicate that the product is intended for household type usage, such as, "Household Use Only", "Household Type", and the like. The marking shall:

- a) Be located on at least one outside surface; and
- b) Appear in lettering not less than the height specified in Table 67.1.

Exception: A carton for an appliance that has been evaluated for a household and commercial application shall be marked "Household and Commercial Use", if such use is intended.

Table 67.1
Lettering height

Smallest dimension of the carton panel to be marked in inches (mm)		Minimum height of lettering inches (mm)
More than	Less than or equal to	
0	6 (152)	1/8 (3.2)
6 (152)	10 (254)	3/16 (4.8)
10 (254)	–	1/4 (6.4)

INSTRUCTION MANUAL

68 General

68.1 An Instruction Manual or the equivalent shall be provided with the appliance. The manual shall specifically warn the user against each potential risk of fire, electric shock, and injury to persons; and state the precautions that should be taken to guard against that condition. The safety instructions shall be a permanent part of the manual but separated in format from the other instructions, and shall appear before the operating instructions in the manual.

68.2 The height of lettering in the text and illustrations of the safety instructions shall be as follows:

- a) Upper case letters shall not be less than 5/64 inch (2.0 mm) high;
- b) Lower case letters shall not be less than 1/16 inch (1.6 mm) high; and
- c) The phrases "IMPORTANT SAFEGUARDS" and "SAVE THESE INSTRUCTIONS" shall be in letters not less than 3/16 inch (4.8 mm) high.

68.3 The Instruction Manual shall include the important safeguards in 68.5 and the appropriate text from 69 – 70.

68.3 effective December 1, 2004

68.4 If the input when using any functional attachment is less than the minimum value in Table 35.1, including the allowable deviation, the Instruction Manual for a multipurpose appliance shall include information indicating that the maximum rating is based on the attachment that draws the greatest load (power or current) and that other recommended attachments may draw significantly less power or current.

68.5 Unless otherwise indicated, the text of the instructions shall be verbatim to, or in equally definitive terminology as, 69 – 70, except where specific conflict of the application to a product exists. The items may be numbered, and the phrases "Read all instructions" and "SAVE THESE INSTRUCTIONS" shall be first and last, respectively, in a list of items. Other important and additional safeguard items considered appropriate by the manufacturer may be inserted.

68.5 effective December 1, 2004

68.6 With reference to the requirements in 17.3, the international symbols specified are able to be used when the significance of these symbols is explained in the instructions provided with the appliance.

69 All Appliances

69.1 The following shall be included in the Instruction Manual for all appliances:

IMPORTANT SAFEGUARDS

When using electrical appliances, basic safety precautions should always be followed including the following:

- a) Read all instructions.
- b) Portable – To protect against risk of electrical shock do not put (state specific part or parts in question) in water or other liquid.
- c) Close supervision is necessary when any appliance is used by or near children.
- d) Portable – Unplug from outlet when not in use, before putting on or taking off parts, and before cleaning.

Permanently Installed – Make sure appliance is OFF when not in use, before putting on or taking off parts, and before cleaning.
- e) Avoid contacting moving parts.
- f) Portable – Do not operate any appliance with a damaged cord or plug or after the appliance malfunctions, or is dropped or damaged in any manner. Return appliance to the nearest authorized service facility for examination, repair or electrical or mechanical adjustment.
- g) The use of attachments not recommended or sold by the manufacturer may cause fire, electric shock or injury.
- h) Do not use outdoors (this may be omitted if it is specially designed for outdoor use).
- i) Portable – Do not let cord hang over edge of table or counter.
- j) Hand-held, other than cordless types – Do not let cord contact hot surface, including the stove.
- k) **SAVE THESE INSTRUCTIONS**

70 Specific Appliances

70.1 Food mixers

70.1.1 The following shall be included in the Instruction Manual for food mixers in addition to any other safety instructions required by the standard:

a) Add to 69.1(e):

"Keep hands, hair, clothing, as well as spatulas and other utensils away from beaters during operation to reduce the risk of injury to persons, and/or damage to the mixer."

b) "Remove beaters from mixer before washing."

70.2 Blending mixers

70.2.1 The following shall be included in the Instruction Manual for blending mixers in addition to any other safety instructions required by the standard:

a) "Keep hands and utensils out of container while blending to reduce the risk of severe injury to persons or damage to the blender (another trade name may be used). A scraper may be used but must be used only when the blender is not running (does not apply to an acceptable scraper integral with the appliance)."

b) "Blades are sharp. Handle carefully."

c) Blenders that have a removable cutting assembly that can be driven with the jar removed shall include the following additional safeguard instruction:

"To reduce the risk of injury, never place cutter-assembly blades on base without jar properly attached."

d) "Always operate blender with cover in place."

e) Replace 69.1(g) with the following:

"The use of attachments, including canning jars, not recommended by the manufacturer may cause a risk of injury to persons."

f) "When blending hot liquids, remove center piece of two-piece cover. (If a two-piece cover is provided.)"

g) For closed-top containers replace (f) with:

"Do not blend hot liquids."

h) For covers with more than one opening, replace (f) with: "When blending hot liquids, open or remove each non-pouring lid or cap, and close any edge cover openings intended for pouring."

70.2.1 effective April 6, 2006

70.3 Liquid mixers

70.3.1 The following shall be included in the Instruction Manual for liquid mixers in addition to any other safety instructions required by the standard:

- a) "Keep hands and utensils out of container to reduce the risk of injury to persons or damage to the mixer."
- b) "Never add to container while appliance is operating."
- c) "Container must be properly in place before operating appliance."

70.4 Cord-connected knives

70.4.1 The following shall be included in the Instruction Manual for cord-connected knives in addition to any other safety instructions required by the standard:

- a) Add to 69.1(b):

"Do not operate knife in water or under running water."
- b) Add to 69.1(d):

"Disconnect when changing blades." (This is also to be provided on the product).
- c) "Blades are sharp. Handle carefully. Always handle blades with hand away from cutting edge. Always store blades with cutting edge away from you."
- d) An illustration(s) showing the recommended procedures for handling blades of an electric knife shall be included in the Instruction Manual. The illustration(s) should depict the placement of the fingers and hand during such removal or insertion of the blades – that is, the palm is on the dull side of the blade and the fingers away from the sharp edge.

70.5 Battery-operated knives

70.5.1 The following shall be included in the Instruction Manual for battery-operated knives in addition to any other safety instructions required by the standard:

- a) Replace 69.1(d) with:

"Blades are sharp. Handle carefully. Always handle blades with hand away from cutting edge. Always store blades with cutting edge away from you."
- b) An illustration(s) showing the recommended procedures for handling blades of an electric knife shall be included in the Instruction Manual. The illustration(s) should depict the placement of the fingers and hand during such removal or insertion of the blades, that is, the palm is on the dull side of the blade and the fingers away from the sharp edge.
- c) "Engage lockout before handling blades."

Exception: The marking in (c) may be omitted if the lockout is automatically reengaged in the OFF position.

70.6 Can openers

70.6.1 The following shall be included in the Instruction Manual for can openers in addition to any other safety instructions required by the standard:

- a) "Do not open pressurized (aerosol-type) cans."
- b) "Do not open cans of flammable liquids such as lighter fluids."

70.7 Knife sharpeners

70.7.1 Other than those outlined in 69 for all appliances, additional Important Safeguard instructions may not be required for knife sharpeners.

70.8 Combination cleaver-meat tenderizers

70.8.1 The Instruction Manual for combination cleaver-meat tenderizers shall include "Blades are sharp. Handle carefully." in addition to any other safety instructions required by the standard.

70.9 Vegetable shredders (cone type)

70.9.1 The following shall be included in the Instruction Manual for vegetable shredders in addition to any other safety instructions required by the standard:

- a) Add to 69.1(e):
"Never feed food by hand. Always use food pusher."
- b) "Blades are sharp. Handle carefully."

70.10 Vegetable shredder/slicers (disc type)

70.10.1 The following shall be included in the Instruction Manual for vegetable shredder/slicers (disc type) in addition to any other safety instructions required by the standard:

- a) Add to 69.1(e):
"Moving Parts. Keep fingers out of discharge opening."
- b) "Never feed food by hand. Always use food pusher."
- c) "Blades are sharp. Handle carefully."

70.11 Meat grinders

70.11.1 The following shall be included in the Instruction Manual for meat grinders in addition to any other safety instructions required by the standard:

a) Add to 69.1(e):

"Never feed food by hand. Always use food pusher."

b) "Do not use fingers to scrape food away from discharge disc while appliance is operating. Cut type injury may result."

70.12 Baby-food chopper

70.12.1 The following shall be included in the Instruction Manual for baby-food choppers in addition to any other safety instructions required by the standard:

a) "Double-blade knife is sharp. Handle carefully. Use special tool when removing or replacing knife blade."

b) "Bowl must be in place before replacing knife blades."

c) "The appliance is intended for processing small quantities of food for immediate consumption, and is especially recommended for preparing baby food. The appliance is not intended to prepare large quantities of food at one time."

70.13 Baby-food grinders

70.13.1 The following shall be included in the Instruction Manual for baby-food grinders in addition to any other safety instructions required by the standard:

a) "Blades are sharp. Handle carefully."

b) "When planning food recipes, do not prepare more than 8 oz (227 g) of food at any time as the baby-food grinder is engineered to prepare only small quantities of food."

70.14 Ice cream freezers

70.14.1 Other than those outlined in 69 for all appliances, additional Important Safeguard instructions may not be required for ice cream freezers.

70.15 Ice crushers

70.15.1 The following shall be included in the Instruction Manual for ice crushers in addition to any other safety instructions required by the standard:

a) Add to 69.1(e):

“Never place fingers or other utensils into feed or discharge areas.”

b) “Check ice hopper for presence of foreign objects before using.”

70.16 Juicers (reamer type)

70.16.1 Other than those outlined in 69 for all appliances, additional important safeguard instructions may not be required for juicers (reamer type).

70.17 Juicers or juice extractors (centrifugal type)

70.17.1 The following shall be included in the Instruction Manual for juicers or juice extractors (centrifugal type) in addition to any other safety instructions required by the standard:

a) “Always make sure juicer cover is clamped securely in place before motor is turned on. Do not unfasten clamps while juicer is in operation.”

b) “Be sure to turn switch to OFF position after each use of your juicer. Make sure the motor stops completely before disassembling.”

c) “Do not put your fingers or other objects into the juicer opening while it is in operation. If food becomes lodged in opening, use food pusher or another piece of fruit or vegetable to push it down. When this method is not possible turn the motor off and disassemble juicer to remove the remaining food.”

d) “Do not use the appliance if the rotating sieve is damaged.”

70.17.1(d) effective April 6, 2006

70.18 Slicers

70.18.1 The following shall be included in the Instruction Manual for slicers in addition to any other safety instructions required by the standard:

a) Add to 69.1(e):

"Never feed food by hand. Always use completely assembled slicer with food platform and food grip."

b) "Blade is sharp. Handle carefully when cleaning."

70.19 Food processors

70.19.1 The following shall be included in the Instruction Manual for food processors in addition to any other safety instructions required by the standard:

a) "Keep hands and utensils away from moving blades or discs while processing food to reduce the risk of severe injury to persons or damage to the food processor. A scraper may be used but must be used only when the food processor is not running."

b) "Blades are sharp. Handle carefully."

c) "To reduce the risk of injury, never place cutting blade or discs on base without first putting bowl properly in place."

d) "Be certain cover is securely locked in place before operating appliance."

e) "Never feed food by hand. Always use food pusher."

f) "Do not attempt to defeat the cover interlock mechanism."

70.20 Food choppers

70.20.1 The following shall be included in the Instruction Manual for food choppers in addition to any other safety instructions required by the standard:

a) "Keep hands and utensils away from the cutting blade while chopping food to reduce the risk of severe injury to persons or damage to the food chopper. A scraper may be used but only when the food chopper is not running."

b) "Blade is sharp. Handle carefully."

c) "To reduce the risk of injury, never place cutting blade on base without first putting bowl properly in place."

d) "Be certain cover is securely locked in place before operating appliance."

e) "Do not attempt to defeat the cover interlock mechanism."

70.21 Coffee mills

70.21.1 The Instruction Manual for coffee mills shall include "Check hopper for presence of foreign objects before using." in addition to any other safety instructions required by the standard.

70.22 Outdoor-use appliances

70.22.1 The following shall be included in the Instruction Manual for outdoor-use appliances in addition to any other safety instructions required by the standard:

- a) "Do not use (name of appliance) in rain or wet conditions."
- b) "If an extension cord is used, the instructions concerning the proper cord as contained on page ___ should be followed."
- c) "Connect (name of appliance) to a grounded-type receptacle or use an acceptable adaptor. See page ____ "Grounding Instructions" for further directions."

70.23 Appliances intended for use with a cart or stand

70.23.1 The following shall be included in the Instruction Manual for appliances intended for use with a cart or stand in addition to any other safety instructions required by the standard:

Add to 69.1(f):

"Do not place this (appliance name) on an unstable cart, stand or table. The (appliance name) may fall, causing injury to a child or adult, and serious damage to the appliance. Use only with a cart or stand recommended by the manufacturer, or sold with the (appliance name)."

70.24 Appliance carts or stands

70.24.1 The following shall be included in the Instruction Manual for appliance carts or stands in addition to any other safety instructions required by the standard:

Instruction for the assembly of a cart or stand shall accompany a cart or stand if the assembly is to be made by the user.

70.25 Multi-speed appliances

70.25.1 The following shall be included in the Instruction Manual for multi-speed appliances in addition to any other safety instructions required by the standard:

If the operation of a multi-speed appliance, intended for use with various attachments, at speeds exceeding those recommended by the manufacturer results in a risk of injury to persons, the Instruction Manual provided with the appliance shall indicate the recommended speeds of operation.

70.26 Battery operated appliances (with separate chargers)

70.26.1 The following shall be included in the Instruction Manual for battery operated appliances (provided with separate chargers) in addition to any other safety instructions required by the standard:

- a) "Do not use an extension cord. Plug charger directly into an electric outlet."
- b) "Use only with the charger provided with the appliance. Do not attempt to use this charger with any other product. Likewise, do not attempt to charge this appliance with any other charger."

70.27 Battery operated appliances

70.27.1 The following shall be included in the Instruction Manual for battery operated appliances in addition to any other safety instructions required by the standard:

"Do not incinerate this appliance even if it is severely damaged. The batteries can explode in a fire."

70.28 Under-cabinet and wall-mounted products, and appliances provided with a hanging means

70.28.1 The following shall be included in the Instruction Manual for under-cabinet and wall-mounted products, and appliances provided with a hanging means in addition to any other safety instructions required by the standard:

- a) "To reduce the risk of fire or electric shock, do not operate any heating appliance beneath the mounted unit."
- b) "Do not mount the storage bracket/unit over or near any portion of a heating or cooking appliance or a sink or basin."

70.29 Pasta mixers-extruders

70.29.1 The following shall be included in the Instruction Manual for pasta mixers-extruders in addition to any other safety instructions required by the standard:

"Do not attempt to defeat the cover interlock mechanism."

70.30 Pasta extruding attachments

70.30.1 The following shall be included in the Instruction Manual for pasta extruding attachments in addition to any other safety instructions required by the standard:

Add to 69.1(e):

"Never feed dough by hand. Always use food pusher."

70.31 Wand-type mixers

70.31.1 The following shall be included in the Instruction Manual for wand-type mixers in addition to any other safety instructions required by the standard:

a) Replace 69.1(c) with the following:

"This appliance should not be used by children and care should be taken when used near children."

b) "When mixing liquids, especially hot liquids, use a tall container or make small quantities at a time to reduce spillage."

c) "Keeps hands and utensils out of the container while blending to prevent the possibility of severe injury to persons or damage to the unit. A scraper may be used but must be used only when the unit is not running."

d) "Blades are sharp. Handle carefully."

70.32 Appliances with electronic controls with a stop position

70.32.1 Appliances employing exposed moving parts and electronic controls with a stop position while energized, and required to be provided with a red flashing light in accordance with 24.4

a) Replace 69.1(e) with the following:

"Flashing light indicates ready to operate. Avoid any contact with blades or moveable parts."

70.32.1 effective December 1, 2004

71 User Maintenance

71.1 The Instruction Manual shall include instructions and caution statements for cleaning, user-maintenance (such as lubrication or nonlubrication) operations recommended by the manufacturer, and shall warn a user that any other servicing should be performed by an authorized service representative. The manual or other literature packaged with the product shall also indicate that the product is for household use.

71.2 For a battery operated appliance the Instruction Manual shall indicate that the appliance should only be used with the battery charger/base model packaged with the appliance and/or those battery charger/base models recommended by the manufacturer and evaluated for use with the product.

Exception: A battery operated appliance may be marked for use with a specific battery charger/base model, which, in turn, is marked for use with the battery operated appliance.

71.3 For a Battery Operated Appliance (provided with a separate charger) the Instruction Manual shall indicate the battery charger/base that is for use with the battery operated appliance, and conversely, the battery operated appliance that is for use with the battery charger/base.

72 Mounting Instructions

72.1 Under-Cabinet and Wall-Mounted Products— The marking mentioned in 36.21.1 shall consist of "Do not install closer than ___ inches (or ___ millimeters) to a (vertical, horizontal, and the like) surface", or an equivalent wording. A diagram indicating the spacings is also acceptable.

72.2 Under-Cabinet and Wall-Mounted Products and Appliances Provided with a Hanging Means – Instruction for installation, including the recommended hardware and mounting surfaces, shall be provided. 70.28.1(b) shall also be included at the beginning of the installation instructions.

73 Appliance-Outdoor Use

73.1 The following shall be included in the Instruction Manual:

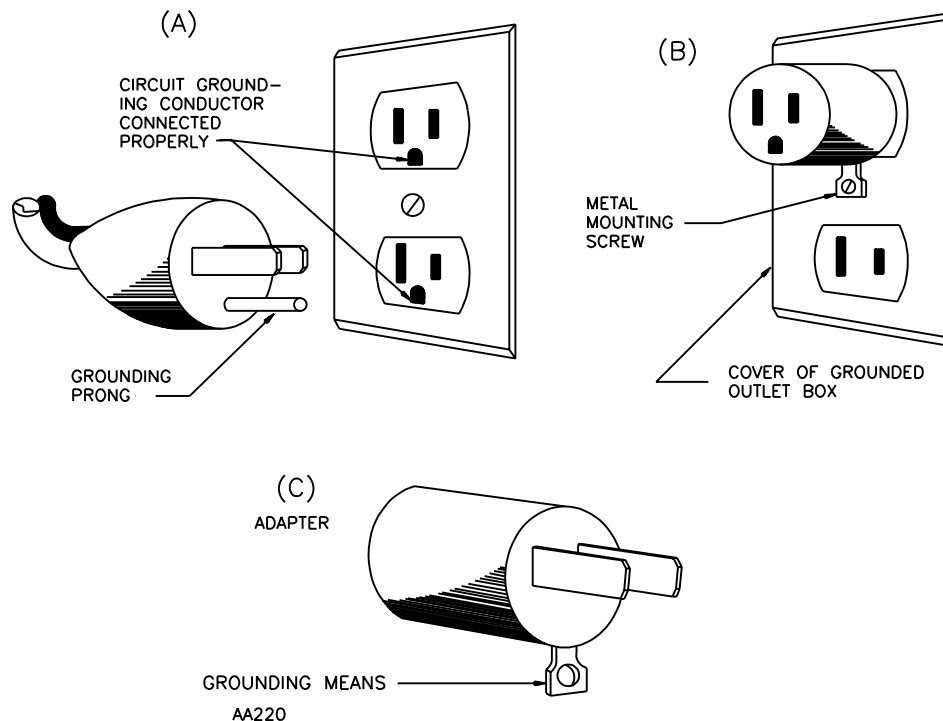
GROUNDING INSTRUCTIONS

This appliance must be grounded while in use to protect the operator from electrical shock. The appliance is equipped with a 3-conductor cord and a 3-prong grounding-type plug to fit the proper grounding-type receptacle. The appliance has a plug that looks like sketch A in Figure 73.1. An adaptor, sketch B, should be used for connecting sketch-A plugs to two-prong receptacles. The grounding tab which extends from the adaptor must be connected to a permanent ground such as a properly grounded outlet box as shown in sketch C using a metal screw.

EXTENSION CORDS

Use only 3-wire extension cords which have 3-prong grounding-type plugs and 3-pole cord connectors that accept the plug from the appliance. Use only extension cords which are intended for outdoor use. These extension cords are identified by a marking "Suitable for use with outdoor appliances; store indoors while not in use". Use only extension cords having an electrical rating not less than the rating of the appliance. Do not use damaged extension cords. Examine extension cord before using and replace if damaged. Do not abuse extension cord and do not yank on any cord to disconnect. Keep cord away from heat and sharp edges.

Figure 73.1
Grounding methods



74 Polarization

74.1 Each appliance provided with a 2-wire polarized attachment plug shall be provided with the following instructions or the equivalent: "This appliance has a polarized plug (one blade is wider than the other). To reduce the risk of electric shock, this plug will fit in a polarized outlet only one way. If the plug does not fit fully in the outlet, reverse the plug. If it still does not fit, contact a qualified electrician. Do not modify the plug in any way."

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APPENDIX A

Standards for Components

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard – UL Standard Designation

Title of Standard – UL Standard Designation

Clocks, Household Electric – UL 826
Cord Sets and Power-Supply Cords – UL 817
Flexible Cord and Fixture Wire – UL 62
Fuseholders – UL 512
Lampholders, Edison-Base – UL 496
Motors, Electric – UL 1004
Motors, Overheating Protection for – UL 2111
Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of – UL 94
Plugs and Receptacles, Attachment – UL 498
Polymeric Materials – Short Term Property Evaluations – UL 746A
Polymeric Materials – Long Term Property Evaluations – UL 746B
Polymeric Materials – Use in Electrical Equipment Evaluations – UL 746C
Printed-Wiring Boards – UL 796
Sharpness of Edges on Equipment, Tests for – UL 1439
Sheathed Heating Elements – UL 1030
Sleeving, Coated Electrical – UL 1441
Switches, Clock-Operated – UL 917
Switches, General-Use Snap – UL 20
Switches, Special-Use – UL 1054
Tape, Polyvinyl Chloride, Polyethylene, & Rubber Insulating – UL 510
Temperature-Indicating and -Regulating Equipment – UL 873
Terminal Blocks – UL 1059
Thermal Cutoffs for Use in Electrical Appliances and Components – UL 1020
Transformers, Class 2 and Class 3 – UL 1585
Transformers, Specialty – UL 506
Tubing, Extruded Insulating – UL 224
Wire Connectors – UL 486A-486B
Wire Connectors, Splicing – UL 486C
Wires and Cables, Thermoset-Insulated – UL 44
Wires and Cables, Thermoplastic-Insulated – UL 83

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**Superseded requirements for
the Standard for
Motor-Operated Household Food Preparing Machines**

UL 982, Fifth Edition

The requirements shown are the current requirements that have been superseded by requirements in this edition. The numbers in parentheses refer to the new requirements with future effective dates that have superseded these requirements. To retain the current requirements, do not discard the following requirements until the future effective dates are reached.

1.3 (1.3) These requirements cover cord-connected and permanently wired motor-operated appliances rated at a nominal 120 V including appliances supplied by low-voltage power supplies, and battery-operated appliances provided with battery chargers.

7.6 (7.6) The construction of an enclosure of a knife-sharpener (or a combination appliance having a knife-sharpening function) shall preclude the drawing in of filings developed during the sharpening function if such would result in a risk of fire or electric shock. See 30.3 – 30.5

15.2.6 (16.2.6) The functioning of a motor-protective device provided as part of an appliance (whether such device is required or not) shall not result in a risk of fire or injury to persons.

16.6 (17.8) A manually operated, line-connected, single pole switch, or other control device, intended for appliance on-off operation shall be connected to the ungrounded conductor of the power-supply cord. Table 11.1 specifies the polarity identification of the power-supply cord conductors.

18.3 (5.15) LINE-VOLTAGE CIRCUIT – A circuit classified as line voltage for the purpose of this Standard is one involving a potential of not more than 125 V and having circuit characteristics in excess of those of a low-voltage circuit.

**Table 18.1 (19.1)
Spacings at other than wiring terminals**

Parts involved ^b	Minimum spacings in inches (mm)
	Over surface or through air
Commutator of a motor	1/16 (1.6)
Elsewhere in the appliance	3/32 ^a (2.4 ^a)

^a For a motor rated at 1/3 hp or less, these spacings may not be less than 1/16 inch (1.6 mm).
^b Magnet wire is considered to be an uninsulated live part.

19.1.1 (20.1.1) A cord-connected appliance intended for outdoor use and a permanently connected appliance shall have provision for grounding.

20.1 (21.1) The design of a counter-top appliance shall preclude the drawing of liquids into the appliance if such would result in risk of fire or electric shock.

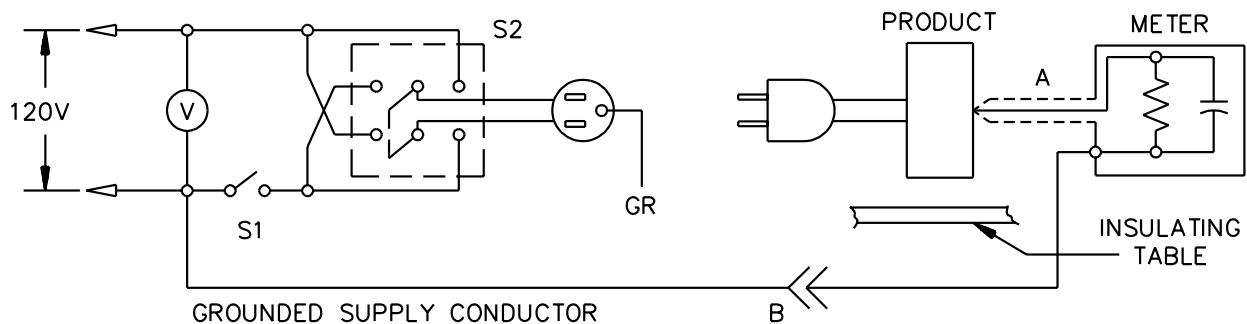
21.1.4 (22.4) If a malfunction or breakdown of an electronic component - such as a loss of "off" control or unexpected operation, located in any circuit of the product - results in increased risk of injury to persons, that circuitry shall comply with the requirements for safety-related controls employing solid-state devices, UL 991. A single malfunction is to be considered at a time.

22.3 (31.3) All operational tests shall be conducted with the appliance connected to a supply circuit of the maximum rated frequency and voltage but not less than 120 V, except as specified in 22.4, 23.6, 27.1.1.

23.1 (32.1) The leakage current of a cord-connected appliance rated for a nominal 120 V supply when tested in accordance with 23.3 – 23.7 shall not be more than:

- a) 0.5 mA for an ungrounded (two-wire) portable, stationary, or fixed appliance,
- b) 0.5 mA for a grounded (three-wire) portable appliance, and
- c) 0.75 mA for a grounded (three-wire) stationary or fixed appliance employing a standard attachment plug rated 20 A or less.

Figure 23.1 (32.1)
Leakage-current measurement circuit



LC100

NOTES:

A – Probe with shielded lead.

B – Separated and used as clip when measuring currents from one part of the appliance to another.

23.6 (32.6) A sample of the appliance is to be tested for leakage current starting with the as-received condition but with its grounding conductor, if any, open at the attachment plug. The as-received condition is without prior energization except as may occur as part of the production-line testing. The supply voltage is to be adjusted to 120 V. The test sequence, with reference to the measuring circuit (Figure 23.1) is to be as follows:

- a) With switch S1 open, the appliance is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2 and with the appliance switching devices in all their normal operating positions.
- b) Switch S1 is then to be closed energizing the appliance, and within a period of 5 seconds, the leakage current is to be measured using both positions of switch S2, and with the appliance switching device in all their normal operating positions.

c) The leakage current is to be monitored until thermal stabilization. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operation as in the Normal Temperature Test, Section 27.

27.1.1 (36.1.1) An appliance, when tested under the conditions of "Maximum Normal Load" as described in 27.2.1.1– 27.2.25.2, shall not attain a temperature at any point high enough to constitute a risk of fire or to damage any materials employed in the appliance, nor shall the appliance show greater temperature rises at certain specified points than those indicated in Table 27.1 when operated at 120 V, and in Table 27.2 when operated also at 127 V.

Table 27.1 (36.1)
Maximum acceptable temperature rises at 120 V

Materials and component parts		Degrees C	Degrees F
1.	Varnished-cloth insulation	60	108
2.	Fuses	65	117
3.	Fiber employed as electrical insulation	65	117
4.	Wood and other combustible material	65	117
5.	Class A insulation systems on coil windings of motors ^a :		
	Thermocouple method or Resistance method	85	153
6.	Transformers with Class 105 insulation systems:		
	Thermocouple method	65 ^a	117 ^a
	Resistance method	75 ^a	135 ^a
7.	Transformers with Class 130 insulation systems:		
	Thermocouple method	85 ^a	153 ^a
	Resistance method	95 ^a	171 ^a
8.	Class B insulation systems except as indicated in item 14:		
	Thermocouple method	85	153
9.	Phenolic composition employed as electrical insulation or as a part depended upon to reduce the risk of fire, electric shock, or injury to persons	125 ^b	225 ^b
10.	Rubber- or thermoplastic-insulated wires and cords	35 ^{b,c}	63 ^{b,c}
11.	Capacitors:		
	Electrolytic	40 ^d	72 ^d
	Other types	65 ^e	117 ^e
12.	Class 105 insulation systems on windings of relays, solenoids, and the like:		
	Thermocouple method	65	117
	Resistance method	85	153
13.	Class B insulation systems on coil windings of motors ^a :		
	Thermocouple method or resistance method	105	189
14.	a) Copper, tinned or bare strands:		
	1) less than 0.015 inch diameter	125	225
	2) 0.015 inch diameter and larger	175	315

Table 27.1 (36.1) Continued on Next Page

Table 27.1 (36.1) Continued

Materials and component parts	Degrees C	Degrees F
b) Nickel, gold, or silver platings or combinations of those platings, over copper conductors	225	405
<p>^a See 27.1.6 and 27.1.9.</p> <p>^b The limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to compounds which have been investigated and found to have special heat-resistant properties.</p> <p>^c Rubber-insulated conductors within a Class-A-insulated motor, rubber-insulated motor leads, may be subjected to a temperature rise of more than 35°C (63°F), provided that a braid is employed on the conductor. However, this does not apply to thermoplastic-insulated wires.</p> <p>^d For an electrolytic capacitor which is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure may be more than 65°C (117°F).</p> <p>^e A capacitor which operates at a temperature rise of more than 65°C (117°F) may be investigated on the basis of the marked temperature limit.</p>		

Table 27.2 (36.2)
Maximum acceptable temperature rises at 127 V

Materials and component parts	Degrees C	Degrees F
1. Class A insulation systems on coil windings of motors: Thermocouple or resistance method	100	180
2. Class B insulation systems on coil windings of motors: Thermocouple or resistance method	120	216

27.2.5.3 (36.5.3) The input to a centrifugal fruit juice extractor is to be measured extracting the juice from celery and spinach. For the temperature test, a centrifugal type juicer for fruits and vegetables is to be operated juicing two bunches of celery, (1-3/4 lb or 0.8 kg per bunch minimum) after which it is to be cleaned and then immediately followed with the juicing of 4 lbs (1.8 kg) of spinach. If, during the operation of the unit, the juicer becomes so clogged that it begins to vibrate excessively, the appliance is to be turned off and cleaned. Then it is to be turned on and the juicing operation is to be continued until the celery and spinach are consumed.

27.2.7.1 (36.7.1) The input test on a baby-food grinder is to be conducted while the appliance is processing small pieces of cooked roast beef. Starting with the appliance at room temperature the food tube is to be filled with the cooked roast beef and with the food pusher, pressure is to be applied to maintain the food in contact with the cutter. During the temperature test on the baby-food grinder, the appliance is to be operated grinding 8 oz (227 g) of cooked roast beef. Small pieces of cooked roast beef are to be placed into the food tube. Pressure is to be maintained on the pusher to maintain the grinding action. When this quantity is ground, the food tube is to be refilled while the appliance is continuously operating. The test is continued until 8 oz (227 g) are consumed.

27.2.11.1 (36.11.1) The input and temperature tests on a knife sharpener (or a combination appliance having a knife-sharpening function) are to be performed with the appliance operating continuously, sharpening an 8 inch (200 mm) length of the dull back edge of a 12 inch (300 mm) long, general-purpose, all-hard, standard-steel (carbon-steel) hand hacksaw blade approximately 0.025 inch (0.64 mm) thick, mounted in the fixture shown in Figure 27.1. If the pressure exerted by this assembly prevents the abrasive wheel from turning, the blade is to be removed from the fixture and applied with pressure to

27.2.19.1 (36.19.1) The input test on a food processor is to be conducted in the following manner:

- a) Metal cutting-mixing blade (S-blade) – The appliance is to be operated with the metal cutting-mixing blade installed as described in the manufacturer’s instruction manual while processing the various foods such as meats, hard cheese, and the like, in the quantities recommended in the instruction manual. The average input under load of each food tested is to be noted. Recipes suggested in the instruction manual which can be prepared in the food processor, such as for bread dough, are not to be considered for this test.
- b) Slicing and/or shredding discs – The disc is to be installed in the food processor as intended. The food processor is to be operated as described in the instruction manual, slicing or shredding various foods such as cucumbers, potatoes, carrots, hard cheese, hard meats, sausage, and the like. The food is to be placed in the food chute and pressure is to be applied on the food pusher to maintain the cutting action without forcing the process. The average input under load of each food tested is to be noted.

Exception: The input test on a food processor provided with a discharge opening is to be conducted using the various attachments provided, with the food processor slicing or shredding the various foods intended as indicated in the instruction manual provided with the appliance.

27.2.19.2(36.19.2) The temperature test is to be performed in the following manner:

- a) Metal cutting-mixing blade (S-blade)– The cutting-mixing blade is to be installed in the appliance as intended. The appliance is to be operated for 4 cycles of operation. Each cycle of operation is to consist of 3 minutes on followed by a 1 minute off period. The bowl is to be filled with dry 50 – 80 core sand, which is to be changed and replaced with fresh sand after each cycle to a level which causes an input (wattage) to the appliance equal to the average input noted in the input test when processing the food which resulted in the highest input. The amount of sand employed is not to exceed the maximum capacity of (total amount containable by) the bowl.
- b) Slicing and/or shredding disc – The disc to be tested is to be installed in the food processor bowl as intended. The appliance is then to be operated for 4 cycles of operation, slicing or shredding the food that caused the highest input to the appliance as noted during the input test. During each cycle of operation the bowl is to be filled to its maximum capacity or to a maximum-fill indicator, if provided, with the food being processed, followed by a 1 minute off period.

Exception: The temperature test on a food processor provided with a discharge opening is to be conducted as follows:

- a) *The appliance is to be operated while slicing or shredding cabbage for 4 cycles, each cycle having a 3 minute shredding period followed by a 1 minute idling period. During the idling period, the motor is to be on without a load on the shredding mechanism. The cutting mechanism (cutter blade, cone, or the like) is not to be removed during the idling period.*
- b) *The appliance is to be operated while slicing or shredding 5 lbs (2.3 kg) of cheese or other foods recommended by the manufacturer using the same cycling rate as in (a) of this Exception.*

28.4 (37.4) If the appliance involves an isolating transformer or an autotransformer, the test potential for the secondary circuit is to be:

- a) 1000 V if the secondary operates at 51 – 125 V;
- b) 500 V if the secondary operates at 50 V or less, except that this test does not apply if the secondary circuit is supplied from a Class 2 transformer.

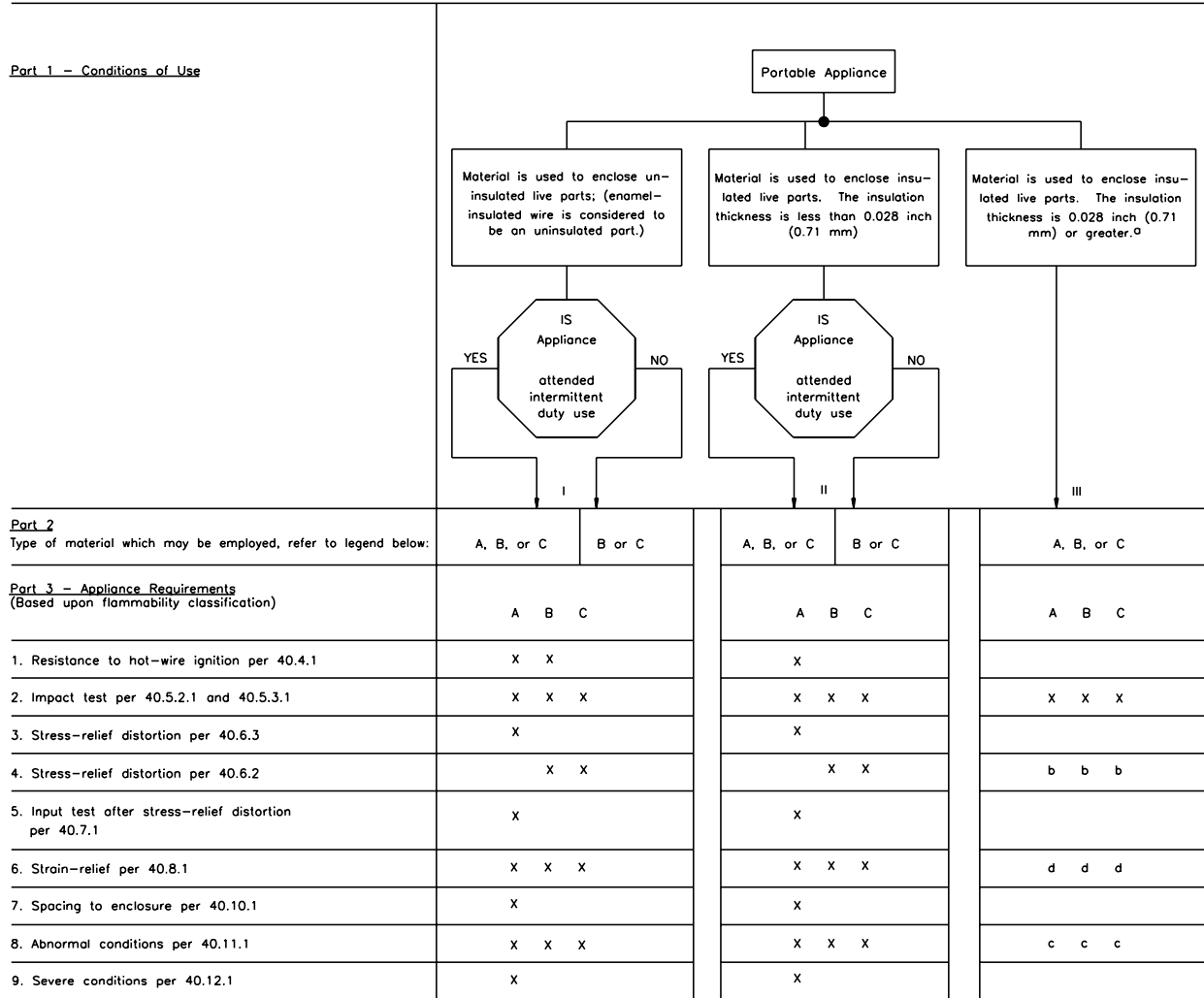
21.9.4.3 (30.4.3) An open-top container of a blender or a blender-type drink mixer shall be provided with a one or two-piece cover, with a center opening. For a one-piece cover or the largest cover of a two-piece cover, the center opening shall not have a dimension larger than 2-5/8 inches (66.7 mm) or less than 1 inch (25.4 mm).

30.3 (39.3) A knife sharpener (or a combination appliance having a knife-sharpening function):

- a) Shall comply with the leakage current requirements as stated in 23.1 after being conditioned as described in 30.4 and 30.5, and
- b) Shall comply with the dielectric voltage-withstand requirements in 28.1 after being conditioned as described in 30.4 and 30.5.

34.2 (48.2) The appliance of 34.1 is to be tested on a 120 V, 60 Hz supply circuit in series with a 20 A, time-delay plug fuse. The appliance is to be placed on a white tissue paper covered softwood surface.

Figure 40.1 (58.1)
Test related to use of polymeric material for enclosures of portable appliances



SM498A

(Continued)

Figure 40.1 (58.1) (Cont)**Test related to use of polymeric material for enclosures of portable appliances****Legend**

A – A material classed as HB by means of the Horizontal Burning test described in the requirements for tests for flammability of plastic materials for parts in devices and appliances, UL 94.

B – A material classed as V-0, V-1, or V-2 as defined in the Vertical Burning Test described in the requirements for tests for flammability of plastic materials for parts in devices and appliances, UL 94.

C – A material which when flame tested as used in the appliance, complies with the requirements of 40.3.1. The use of flame retardant coating applied to the inside of a polymeric enclosure when flame tested as used in the appliance is not acceptable unless the coating/material interface has been found to be acceptable by separate investigation.

Notes

^a The insulation thickness of the body material of component parts is considered equivalent to 0.028 inch (0.71 mm) insulation if the component has been judged on the basis of requirements covering the component in question.

^b Only required if failure of the material will cause a stress on the junction between a lead and a terminal of a component. If the strain relief test is acceptably performed for components with integral leads either as a separate test or as a part of the regular test procedure for the component, it shall be considered that failure of the material will not cause a stress on the junction between the lead and a terminal of the component.

^c Only required if material is employed in the unattended mode.

^d This test is required only if the strain-relief means are mounted on the polymeric enclosure.

42.4.1 (60.4.1) A thermoplastic coil form or thermoplastic insulating material employed in a motor with a stalled-rotor current greater than twice the normal operating current shall comply with all of the following after the running-burnout conditioning described in 42.4.2:

- a) The 3-ampere fuse described in 42.4.2 shall remain intact during the test.
- b) The thermoplastic insulating material shall show no appreciable softening or melting to affect spacing.
- c) Any molten metal or flaming shall be confined within the enclosure of electrical equipment within which the motor is used.

Exception: This test is not required to be conducted if burnout of the motor does not occur as described in 42.3.2(a) during the abnormal conditioning (stalled-rotor test) described in Section 42.3.

44.1.3 (68.3) The instruction manual shall include the important safeguards in 44.1.5 and the appropriate text from 44.2.1– 44.3.31.

44.1.5 (68.5) Unless otherwise indicated, the text of the instructions shall be verbatim to, or in equally definitive terminology as, 44.2.1 – 44.3.31, except where specific conflict of the application to a product exists. The items may be numbered, and the phrases "Read all instructions" and "SAVE THESE INSTRUCTIONS" shall be first and last, respectively, in a list of items. Other important and additional safeguard items considered appropriate by the manufacturer may be inserted.

44.3.2 (70.2.1) Blending mixers

a) "Keep hands and utensils out of container while blending to reduce the risk of severe injury to persons or damage to the blender (another trade name may be used). A scraper may be used but must be used only when the blender is not running (does not apply to an acceptable scraper integral with the appliance)."

b) "Blades are sharp. Handle carefully."

c) Blenders that have a removable cutting assembly that can be driven with the jar removed shall include the following additional safeguard instruction:

"To reduce the risk of injury, never place cutter-assembly blades on base without jar properly attached."

d) "Always operate blender with cover in place."

e) Replace 44.2.1(g) with the following:

"The use of attachments, including canning jars, not recommended by the manufacturer may cause a risk of injury to persons."

f) "When blending hot liquids, remove center piece of two-piece cover. (If a two-piece cover is provided.)"

g) For closed-top containers replace (f) with:

"Do not blend hot liquids."

46.1.2 (66.1.2) Other markings in addition to the specific markings stated in 46.2.1 – 46.2.23.2 may be required depending upon the construction and/or operation of an appliance.

46.1.3 (66.1.3) Caution markings intended to inform the user of a potential risk of injury to persons (see 46.2.1 – 46.2.19 and 46.2.22 under specific appliances) shall be prefixed by the signal word CAUTION. The signal word shall be more prominent than any other required marking on the appliance.

Exception: WARNING shall be used as the signal word for the marking stated in 46.2.17.