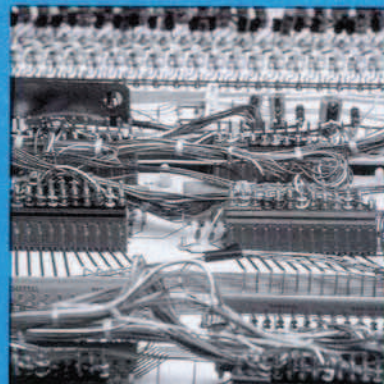




UL 1082

Underwriters Laboratories Inc. Standard for Safety

Household Electric Coffee Makers and Brewing-Type Appliances



Documents

Document Sharing Hub

UL COPYRIGHTED MATERIAL –  **Documents**
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR Document Sharing Hub
DISTRIBUTION WITHOUT PERMISSION FROM UL

UL Standard for Safety for Household Electric Coffee Makers and Brewing-Type Appliances, UL 1082

Sixth Edition, Dated March 17, 2009

SUMMARY OF TOPICS

This revision to ANSI/UL 1082 includes the following changes in requirements:

Addition of Supplement SB, Hospitality-Use Drip-Type Coffee Makers

Text that has been changed in any manner or impacted by UL's electronic publishing system 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 new requirements are substantially in accordance with Proposal(s) on this subject dated December 18, 2009.

A reference to UL 60730-1 and/or a Part 2 standard from that series has been added to this standard. The addition of this reference provides an alternate standard for investigating components currently covered by UL 873 until October 19, 2016. This added reference will facilitate the use of components that have been investigated to the UL 60730 series. Such components have been determined to fulfill the requirements of the legacy standards.

UL 60730-1 (4th Edition) becomes effective on October 19, 2016. All components that were previously investigated to the requirements in UL 873 will have to comply with the requirements in either UL 60730-1 and/or a Part 2 standard from that series in order to maintain UL Listing or Recognition, as appropriate. UL 873 legacy control standard will be withdrawn on October 19, 2016.

This is intended to provide end product manufacturers with sufficient time to a) address the impact of the standards changes during normal design changes over the intervening years, b) submit any modified products for investigation, and c) implement any necessary changes in production.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of UL.

UL provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

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.

MARCH 17, 2009
(Title Page Reprinted: April 23, 2010)



ANSI/UL 1082-2010

1

UL 1082

Standard for Household Electric Coffee Makers and Brewing-Type

Appliances

First Edition – December, 1972
Second Edition – July, 1979
Third Edition – August, 1985
Fourth Edition – October, 1991
Fifth Edition – November, 1996

Sixth Edition

March 17, 2009

This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through April 23, 2010.

The most recent designation of ANSI/UL 1082 as an American National Standard (ANSI) occurred on April 21, 2010. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

The Department of Defense (DoD) has adopted UL 1082 on February 6, 1976. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

UL's Standards for Safety are copyrighted by UL. Neither a printed nor electronic copy of a Standard should be altered in any way. All of UL's Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

COPYRIGHT © 2010 UNDERWRITERS LABORATORIES INC.

No Text on This Page

*UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL*



Documents

Document Sharing Hub

CONTENTS

INTRODUCTION

1 Scope	7
2 Components	7
3 Undated References	8
4 Units of Measurement	8
5 Glossary	8

CONSTRUCTION

6 General	9
7 Frame and Enclosure	9
8 Assembly	17
9 Handles	17
10 Corrosion Protection	19
11 Supply Connections	19
11.1 General	19
11.2 Strain relief	22
11.3 Pin terminals	22
11.4 Bushings	24
12 Current-Carrying Parts	24
13 Internal Wiring	25
13.1 General	25
13.2 Protection of wiring	25
13.3 Splices	26
14 Secondary Circuits	26
14.1 General	26
14.2 Limited-energy secondary circuits	27
15 Heating Elements	28
16 Electrical Insulation	28
17 Thermal Insulation	29
18 Thermal Cutoffs	29
19 Lampholders	30
20 Switches	30
21 Dual Voltage Appliance	30
22 Limit Controls	31
23 Overheating Protection	31
24 Spacings	32
24.1 General	32
24.2 Barriers	32
25 Grounding	32
26 Protection Against Injury to Persons	33
27 Pressure Vessels and Parts Subject to Pressure	34

PERFORMANCE

28 General	36
29 Resistance of Grounding Test	36
30 Power Input	36
31 Leakage Current Test	37

32	Operational Tests	39
33	Normal Temperature Tests	39
33.1	General	39
33.2	Specific test conditions	46
34	Leakage Current as a Result of Moisture Tests	47
35	Dielectric Voltage-Withstand Test	49
36	Broken Element Test	50
37	Strain Relief Test	50
38	Push-Back Relief Test	50
39	Metal Enclosure Impact Tests	51
40	Thermal Degradation	54
41	Handle Securement Tests	54
41.1	General	54
41.2	Oven conditioning	54
41.3	Dishwashing	55
41.4	Flexing test	55
41.5	Static load	55
41.6	Static force	55
42	Under-Cabinet and Wall Mounted Appliances-Impact Test	60
43	Loading Test	60
44	Stability Test	61
45	Tip Over Test	61
46	Dynamic Stability Test	61
47	Abnormal Operation Tests	65
47.1	General	65
47.2	Specific test conditions	66
47.3	Dual voltage appliances	70
48	Secondary Circuit Component Failure Test	70
49	Automatic Controls Test	71
49.1	General	71
49.2	Endurance	71
50	Permanence of Marking Tests	72

MANUFACTURING AND PRODUCTION-LINE TESTS

51	Dielectric Voltage-Withstand Test	72
52	Polarization and Grounding Continuity Tests	74
52.1	Polarization test	74
52.2	Continuity of grounding connection	74
52.3	Electrical indicating device	75

RATINGS

53	Details	75
----	---------------	----

MARKINGS

54	Details	75
55	Carton Marking	78

INSTRUCTION MANUAL

56 General	78
57 All Appliances	79
58 Specific Appliances	80
59 User Maintenance	81

SUPPLEMENT SA - HOUSEHOLD ELECTRIC DRIP-TYPE COFFEE MAKERS AND SIMILAR DRIP-TYPE BREWING APPLIANCES

SA1 Scope	SA1
SA2 Glossary	SA1
SA3 Assembly	SA1
SA4 Corrosion Protection	SA2
SA5 Supply Connections	SA2
SA6 Gaskets and Seals	SA2
SA7 Water Connections	SA2
SA8 Thermal Conductivity	SA3
SA9 Grounding	SA4
SA10 Operating Controls	SA4
SA11 Power-On Indicator	SA5
SA12 Temperature Controls	SA5
SA12.1 General	SA5
SA12.2 Temperature regulating	SA5
SA12.3 Limiting-type devices	SA6
SA13 Operation Degradation	SA7
SA14 Leakage Current	SA8
SA15 Normal Temperature	SA8
SA16 Leakage Current as a Result of Moisture	SA9
SA17 Stability	SA10
SA18 Loading Test	SA10
SA19 Impact Test	SA11
SA20 Abnormal Operation	SA11
SA20.1 General	SA11
SA20.2 Specific test conditions	SA12
SA20.3 Dry operation	SA12
SA20.4 Overfill	SA12
SA20.5 Restricted water inlet	SA14
SA21 Tests by Manufacturer	SA14
SA21.1 Polarization verification	SA14
SA21.2 Continuity of grounding connection	SA15
SA21.3 Indicator	SA15
SA22 Markings	SA15
SA23 Graphical Symbols and Supplemental Markings	SA15
SA23.1 No user-serviceable parts compartment warning	SA15
SA23.2 Graphical symbol size and color	SA17
SA23.3 Supplemental marking size and color	SA17
SA23.4 Size of outlines and symbols	SA18
SA23.5 Explanation of graphical symbols in the operating instructions	SA18
SA24 Important Safeguards	SA20
SA25 User Maintenance	SA22

SUPPLEMENT SB - HOSPITALITY-USE DRIP-TYPE COFFEE MAKERS

SB1	Scope	SB1
SB2	Glossary	SB1
SB3	Assembly	SB2
SB4	Corrosion Protection	SB2
SB5	Supply Connections	SB3
SB6	Gaskets and Seals	SB3
SB7	Water Connections	SB3
SB8	Thermal Conductivity	SB4
SB9	Grounding	SB5
SB10	Operating Controls	SB5
SB11	Power-On Indicator	SB6
SB12	Temperature Controls	SB6
	SB12.1 General	SB6
	SB12.2 Temperature regulating	SB7
	SB12.3 Limiting-type devices	SB7
SB13	Operation Degradation	SB8
SB14	Operation Tests	SB9
SB15	Leakage Current	SB9
SB16	Normal Temperature	SB10
SB17	Leakage Current as a Result of Moisture	SB11
SB18	Stability	SB12
SB19	Loading Test	SB13
SB20	Impact Test	SB13
SB21	Abnormal Operation	SB14
	SB21.1 General	SB14
	SB21.2 Specific test conditions	SB14
	SB21.3 Dry operation	SB15
	SB21.4 Overfill	SB15
	SB21.5 Fusible devices	SB16
	SB21.6 Water valve failure	SB16
	SB21.7 Restricted water inlet	SB17
	SB21.8 Overvoltage	SB18
SB22	Test for Permanence of Cord Tag	SB18
SB23	Tests by Manufacturer – Continuity of Grounding Connection	SB19
SB24	Markings	SB19
SB25	Graphical Symbols and Supplemental Markings	SB20
SB26	Important Safeguards	SB22
SB27	User Maintenance	SB23

Appendix A

Standards for Components.....	A1
-------------------------------	----

INTRODUCTION

1 Scope

1.1 These requirements cover portable electric coffee makers, percolators, coffee urns, and other brewing-type appliances rated 120 V or less, for use in ordinary locations in accordance with the National Electrical Code, NFPA 70.

1.2 In addition to coffee makers, this Standard covers tea pots, water kettles, carafes, soup warmers, and other similar appliances in which liquid is heated to greater than 115°F (46°C), and are lifted and tilted to dispense the liquid in normal service.

1.3 These requirements do not cover coffee-making-type appliances with capacities of more than 250 ounces (7.4 L), appliances intended for outdoor use, or appliances that are covered in individual requirements that are separate from this Standard.

1.4 For the purposes of this Standard, a requirement that applies to one type of equipment is identified by a specific reference to the type of equipment involved (for example, percolator or other specific appliance). 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 types of equipment covered by the Standard.

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 Undated References

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

4 Units of Measurement

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

4.2 Unless indicated otherwise all voltages and current values mentioned in this Standard are root-mean-square (rms).

5 Glossary

5.1 For the purposes of this Standard the following definitions apply.

5.2 **LINE-VOLTAGE CIRCUIT** – A circuit involving a potential of not more than 120 volts, and having circuit characteristics in excess of those of a low-voltage or an isolated-limited secondary circuit.

5.3 **LOW-VOLTAGE (SECONDARY) CIRCUIT** – A circuit involving a potential of not more than 30 volts alternating-current, (42.4 volt peak or direct-current), and supplied by an isolating transformer. A circuit derived from a source of supply classified as a line voltage circuit, using impedance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low voltage nor an isolated limited-energy secondary circuit. See 14.2.1.

5.4 **TEMPERATURE-LIMITING THERMOSTAT** – A thermostat which functions only under conditions which produce abnormal temperatures. The malfunction of such a thermostat might or might not result in a risk of fire.

5.5 **TEMPERATURE-REGULATING THERMOSTAT** – A thermostat which functions only to regulate the temperature of the appliance under normal conditions of use, and whose malfunction does not result in a risk of fire.

5.6 **TEMPERATURE-REGULATING AND -LIMITING THERMOSTAT** – A thermostat which functions to regulate the temperature of the heating appliance under normal conditions of use, and also serves to prevent a risk of fire which might result from conditions of abnormal operation of the appliance.

CONSTRUCTION

6 General

6.1 Only materials that are acceptable for the particular use shall be used in an appliance. An appliance 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 degree of resistance inherent in the appliance shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other serious defects that alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

7.2 An appliance shall be provided with an enclosure of material acceptable for the particular application. The enclosure shall house all electrical parts, except a supply cord, that may present a risk of fire, electric shock, or injury to persons under any conditions of use.

7.3 Among the factors that shall be considered 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 under conditions of normal or abnormal use.

For a nonmetallic enclosure, see the enclosure requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. A metal enclosure or enclosure part shall be tested in accordance with Metal Enclosure Impact Tests, Section 39, for resistance to impact.

Exception No. 1: When considering the abnormal and severe conditions tests of UL 746C, the appliance enclosure is to be subjected to the Abnormal Operation Tests of Section 47.

Exception No. 2: Thermoset materials need not be subjected to the relative thermal capability requirements of UL 746C. For a thermoset material operating at a temperature above its temperature rating, the 1000 hour aging test specified in 40.1 shall be conducted.

Exception No. 3: An appliance employing a thermoplastic enclosure with a HB flammability rating is not required to comply with the flammability requirements of UL 746C if it complies with the requirements in Table 7.1.

Table 7.1
Flammability requirements for enclosures

Flammability rating of enclosure material	Flammability requirements, additional testing, or both
V-0 V-1 V-2	None
HB	1. 3/4 inch (19 mm) Flame Test (UL 746C) or 1. Minimum 1/2 inch (12.7 mm) spacing from enclosure material (including ribs, grills, and the like) to any uninsulated live parts, 2. HWI – Minimum 7 seconds (PLC-0,1,2,3,4), and 3. HAI – Minimum 60 arcs (PLC-0,1)

7.4 Cast- and sheet-metal portions of the enclosure shall be no thinner than indicated in Table 7.2 unless the enclosure is found to be acceptable when judged under considerations such as mentioned in 7.3.

Table 7.2
Minimum acceptable thicknesses of enclosure metal

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 equivalent physical strength		At relatively large unreinforced flat surfaces	
	Inches	(mm)	Inches	(mm)
Die-cast	3/64	(1.2)	5/64	(2.0)
Cast malleable iron	1/16	(1.6)	3/32	(2.4)
Other cast metal	3/32	(2.4)	1/8	(3.2)
Uncoated sheet steel	0.026 ^a	(0.66) ^a	0.026	(0.66)
Galvanized sheet steel	0.029 ^a	(0.74) ^a	0.029	(0.74)
Nonferrous sheet metal	0.036 ^a	(0.91) ^a	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.

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

7.6 For an appliance as mentioned in 47.2.6.4, the enclosure mentioned in 7.5 shall be provided with drainholes located below the lowest live part.

7.7 The enclosure shall be constructed so that molten metal, burning insulation, flaming particles, or the like does not fall on the supporting surface.

7.8 The requirement in 7.7 necessitates that an enclosure bottom with an opening be provided with a barrier above or below the opening if the opening is:

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.

3) The motor is provided with a thermal motor protector (a protective device that is sensitive to both temperature and current) that prevents the temperature of the motorwindings from becoming more than 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle, and from becoming more than 150°C (302°F) with the rotor of the motor locked; or

4) The motor complies with the requirements for impedance-protected motors.

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

c) Under an unenclosed switch, transformer, relay solenoid, and the like, unless it can be shown that malfunction of the component is not likely to result in a fire.

d) Under field- and factory-made splices and overload and overcurrent protective devices.

Exception: A barrier need not be provided if the opening is not within the area under the component requiring a barrier as illustrated by Line D in Figure 7.1.

7.9 The barrier mentioned in 7.8 shall be:

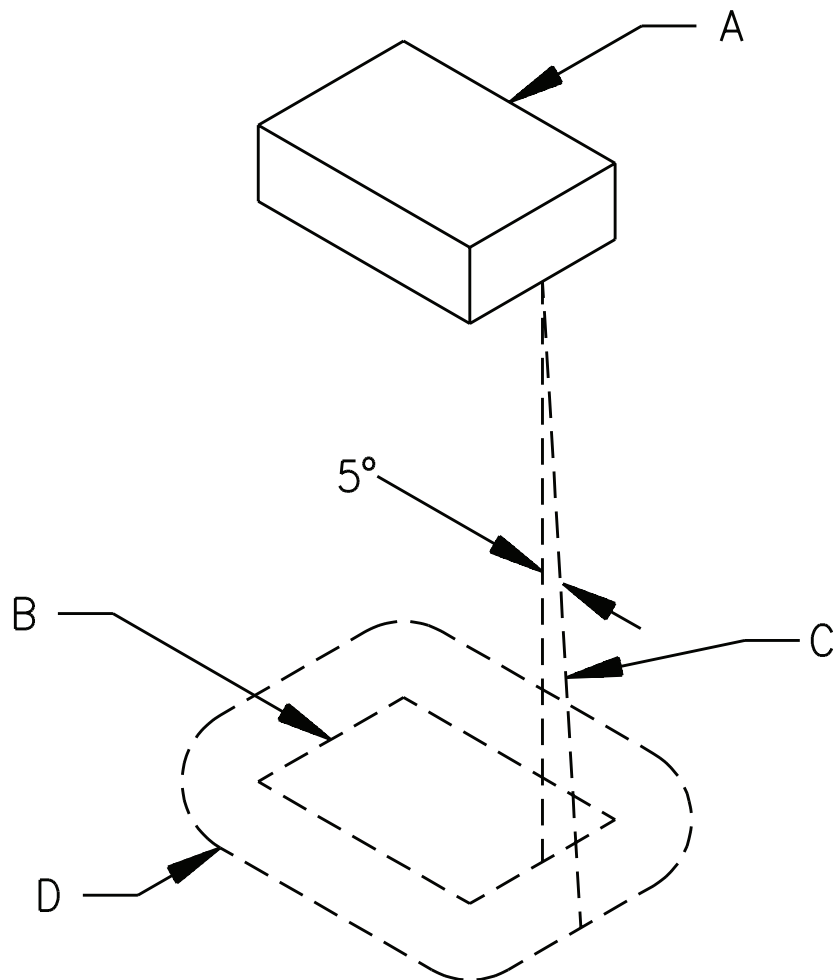
a) Of metal, ceramic, or a material that would be acceptable as an enclosure in accordance with 7.3;

b) Horizontal; and

c) Located as indicated in Figure 7.1, and shall not have an area less than that described in Figure 7.1.

7.10 An opening in the enclosure that has a minor dimension of less than 1 inch (25.4 mm) is acceptable if a probe as illustrated in Figure 7.2, inserted through the opening, cannot be made to touch any uninsulated live part of film-coated wire that involves the risk of electric shock. The probe shall be applied in all possible articulated positions before, during, and after insertion.

Figure 7.1
Location and extent of barrier



SA0604-1

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

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. The line is always:

- 1) Tangent to the component;
- 2) 5 degrees from the vertical; and
- 3) So oriented that the area traced out on a horizontal plane is maximum.

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

Technical drawing of a mechanical part, PA100A, showing front, side, and cross-sectional views with dimensions in millimeters.

Front View (Left):

- Top feature: 3.5 RADIUS.
- Section A-A: Circular cross-section with hatching.
- Dimensions: .05, .05, .05, .05, .05, 78, 97, 16, 25.4, .05, 50.

Side View (Right):

- Top feature: APPROX. 30°, 5.8, 5.0.
- Dimensions: 30, 60, 90, 96, 100, 136, 154, 234, 15, 19, 21.5, 25.4.

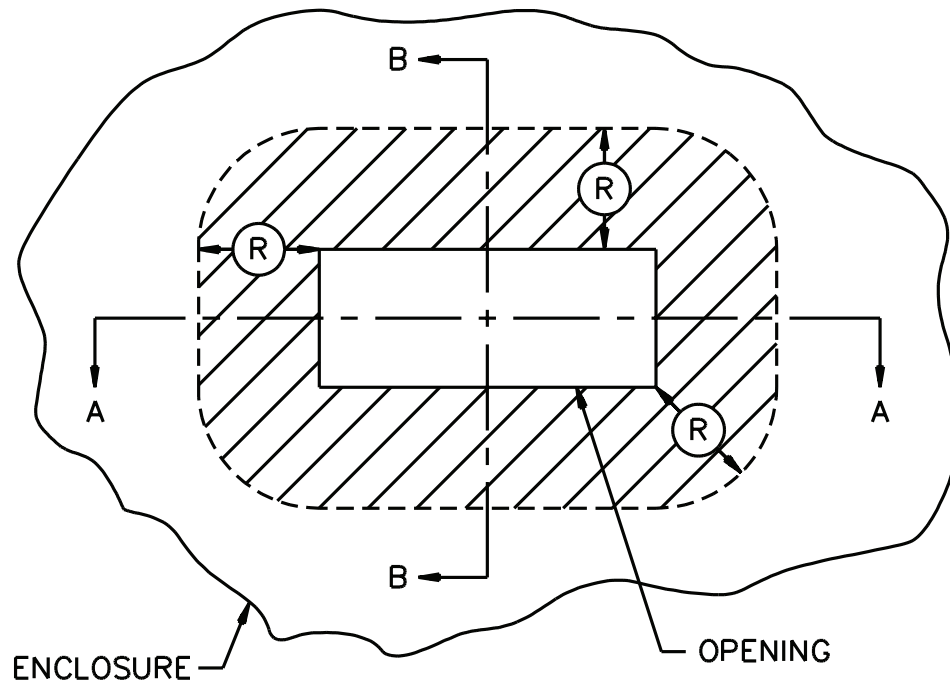
Bottom View (Bottom):

- Dimensions: 78, 25 RADIUS, 25 RADIUS.

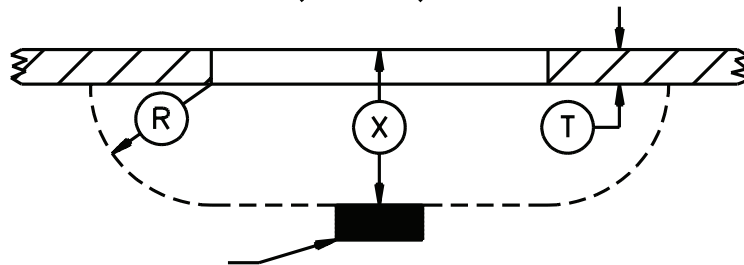
ALL DIMENSIONS IN MILLIMETERS

PA100A

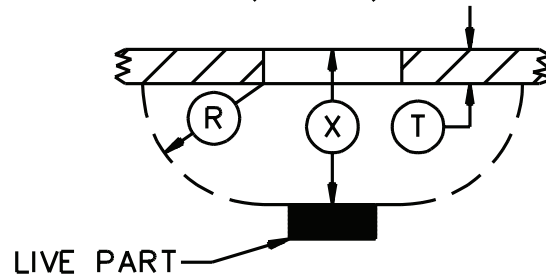
Figure 7.3
Opening in enclosure



SECTION A-A
($X=R+T$)



SECTION B-B
($X=R+T$)



SB0610-1

7.11 An opening that has a minor dimension of 1 inch (25.4 mm) or more, in an enclosure, as illustrated in Figure 7.3, is acceptable if, within the enclosure, there is no uninsulated live part or film-coated wire less than:

- a) R distance from the inside edge of the perimeter of the opening; and
- b) X distance from the plane of the opening.

T equals the enclosure thickness, R equals X minus T, and X equals 5 times the diameter of the largest round rod that can be inserted through the opening but not less than 6-1/16 inches (154 mm). In evaluating an opening, any barrier located within the volume is to be ignored unless it intersects the boundaries of the volume in a continuous, closed line.

7.12 If a marking draws attention of the user to a hole of any size in the enclosure for the adjustment of a thermostat or for a similar activity, it shall not be possible to damage insulation or contact uninsulated live parts through the hole with a 1/16-inch-diameter rod (1.6 mm).

7.13 During the examination of an appliance in connection with the requirements in 8.2 – 8.4, 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 54.6.

7.14 A component of an appliance that is likely to need inspection, replacement, cleaning, or other servicing shall be as accessible as possible. The component shall be readily accessible without the use of special tools (tools not available to other than service personnel) if it is intended to be manually operated or adjusted or periodically serviced.

7.15 The bulb and capillary tube of a thermostat shall be protected from mechanical damage if damage of the tube or bulb increases the risk of fire.

8 Assembly

8.1 A switch, lampholder, or plug-type connector provided as a part of an appliance shall be mounted securely and prevented from turning by means other than friction between surfaces.

8.2 A lock washer properly applied is acceptable as a means to prevent turning of a stem-mounted switch.

8.3 Uninsulated live parts shall be secured to the base or surface so that they are prevented from turning or shifting in position as the result of stresses if such motion may result in a reduction of spacings below the minimum required in 24.1.1 and 24.1.2.

8.4 Friction between surfaces is not acceptable as a means to prevent shifting or turning of live parts, but a lock washer properly applied is acceptable.

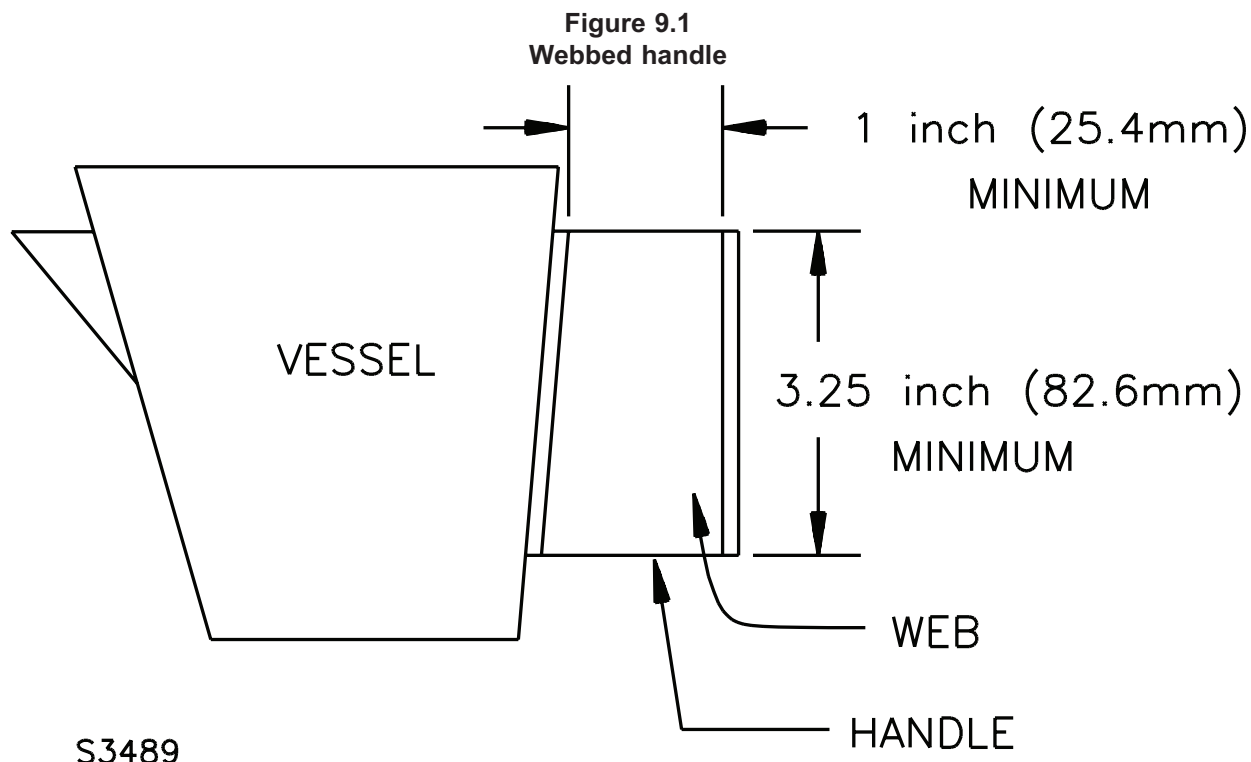
9 Handles

9.1 Unless determined to be acceptable for the purpose, fastening of the vessel handle assembly of an appliance shall not rely on cement or equivalent materials alone. Mechanical means, such as pressure clamping, bosses and lances, and the like, shall be provided.

9.2 A handle assembly that is utilized to lift and tilt a vessel, which is either integral to the appliance or a separate unit, to dispense a heated liquid shall comply with the requirements in 9.3 – 9.7, and Normal Temperature Tests, Section 33, and Handle Securement Tests, Section 41. The handle assembly of an integrally heated vessel shall also comply with 47.2.3.6.

Exception: This requirement does not apply to a carafe type vessel having a capacity of less than 17.5 ounces and provided with a product not employing a "keep warm" feature for the vessel.

9.3 For an appliance or separate vessel that is provided with a webbed handle – that is a solid handle that cannot be grasped by wrapping the fingers around it – the web shall be a minimum of 1 inch in width and 3.25 inches in length. See Figure 9.1.



9.4 No portion of a nonmetallic handle whose failure could result in the loss of handle strength or integrity is to be subjected to a temperature in excess of the mechanical temperature index (without impact) of the material when tested as indicated in Normal Temperature Tests, Section 33.

9.5 On a vessel where handle securement is accomplished by a band around the body of the vessel, the diameter of the vessel above and below the band securement area shall be larger than the diameter at the area of securement. A handle shall be fastened so that a positive stop, interference screw, rivet, or other arrangement is provided so that with minor loosening, disengagement of the handle from the vessel does not result.

Exception: The diameter of the vessel above and below the band securement need not be larger than the diameter at the area of securement if an equivalent means of preventing movement of the handle assembly is provided.

9.6 Iron and steel parts of a handle assembly shall be provided with corrosion protection in accordance with 10.1 or shall be constructed of stainless steel or other noncorrosive metal acceptable for the application.

9.7 A handle secured by a single fastening means shall be prevented from rotating by means other than friction. A lockwasher alone shall not be sufficient.

10 Corrosion Protection

10.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, if the deterioration of such unprotected parts increases the risk of fire or electric shock.

Exception: Where the oxidation of steel is not likely to be accelerated due to the exposure of metal to air and moisture or other oxidizing influence – thickness of metal and temperature also being factors – surfaces of sheet steel within an enclosure may not be required to be protected against corrosion. Cast-iron parts are not required to be protected against corrosion. A sheath employed on a heating element operating in air and terminal parts attached directly to the heating element need not be protected against corrosion.

10.2 The aging characteristics of plating or other finish used in an appliance shall be such that deterioration of the finish does not result in unacceptable performance of the appliance.

11 Supply Connections

11.1 General

11.1.1 An appliance shall be provided with a length of attached flexible cord and an attachment plug for connection to the supply circuit, or shall have male pin terminals that accommodate a detachable power-supply cord. The length of flexible cord shall be within the limits indicated in Table 11.1.

Table 11.1
Lengths of cord connection

Means of dispensing liquid	Kind of cord connection	Minimum acceptable length ^a		Maximum acceptable length ^{a,c}	
		Feet	(Meters)	Feet	(Meters)
Lifting and tilting appliance	Attached cord or detachable power-supply cord	2.0	(0.6)	3.0	(0.9)
	Coiled (retractile) detachable power-supply cord	–	–	3.0 ^b	(0.9) ^b
Separable vessel, spigot or the like	Attached cord or detachable power-supply cord	2.0	(0.6)	7.0	(2.1)
^a Measured external to the appliance and including the fittings but excluding the blades on the attachment plug. ^b Measured with the cord relaxed on a horizontal surface. Measured with the cord fully extended, the length is not to exceed 7.0 ft (2.1 m) and is not to be less than 6.0 ft (1.8 m). ^c An appliance shall be provided with instructions in accordance with 54.7 or 54.8, whichever is applicable.					

11.1.2 The rating (both current and voltage) of the cord and the fittings of a nondetachable and a detachable power supply cord, shall not be less than that of the appliance.

11.1.3 A 3- to 2-wire grounding-type adapter shall not be provided with an appliance.

11.1.4 An attached flexible cord and the cord in a detachable power-supply cord that is provided with an appliance shall be of a Type HPD, HPN, HSJ, HSJO, SP-2, SPE-2, SPT-2, SV, SVE, SVO, SVT, SVTO, SJ, SJE, SJO, SJT, or SJTO cord, or shall have such properties that are at least equally as serviceable for the particular application.

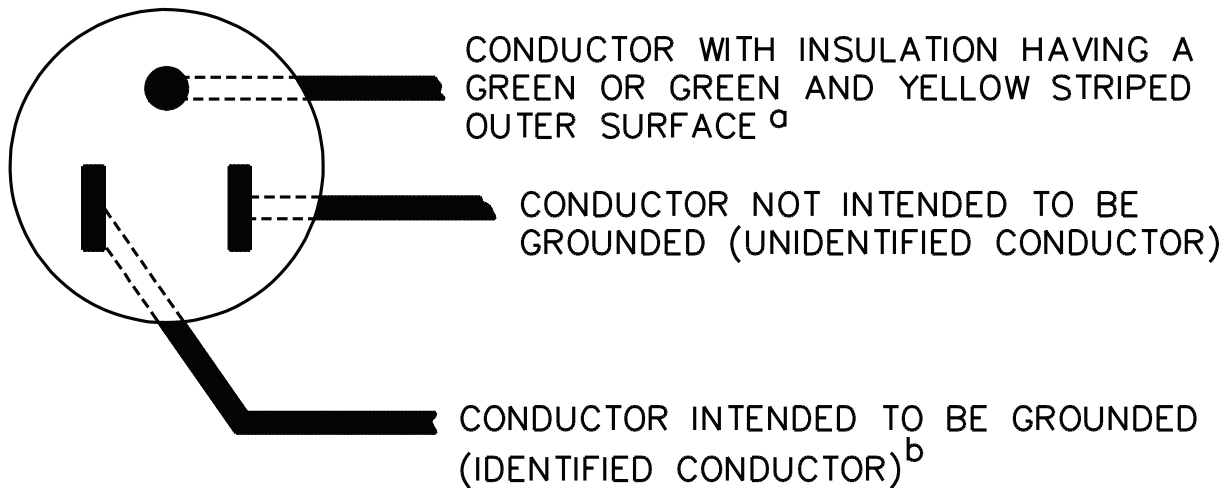
11.1.5 Supplementary insulation, if employed, shall not extend more than 1/2 inch (13 mm) outside the appliance (unless provided with additional mechanical protection), shall be prevented from fraying or unraveling, and shall not affect adversely the means for providing strain relief.

11.1.6 The attachment plug of the power supply cord of an appliance 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 polarized or grounding type.

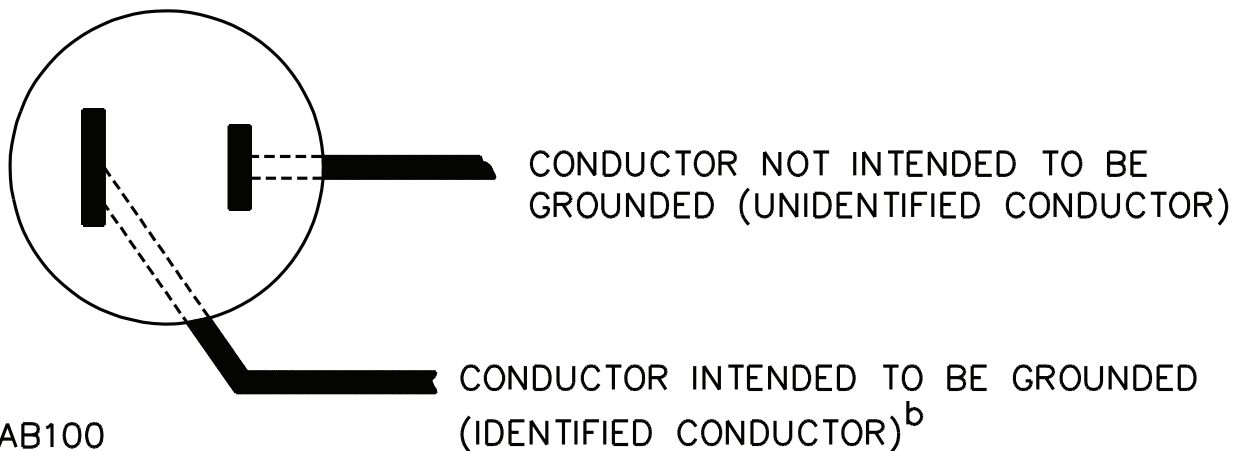
11.1.7 If a 3-wire grounding-type attachment plug or a 2-wire polarized attachment plug is provided, the attachment plug connection shall comply with Figure 11.1 and the polarity identification of the flexible cord shall comply with Table 11.3.

Figure 11.1
Connections to attachment plug

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 In the above illustration, 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.

11.1.8 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.

11.2 Strain relief

11.2.1 Strain relief shall be provided to reduce the risk of a mechanical stress on an attached flexible supply cord from being transmitted to terminals, splices, or interior wiring.

11.2.2 If wood, pressed board, or other fibrous material is used to secure the strain relief assembly, the fibrous material shall be secured to the appliance by a pin, setscrew, or other positive means.

11.2.3 Means shall be provided to reduce the likelihood of an attached supply cord or lead from being pushed into the enclosure of an appliance through the cord entry hole. To determine compliance with this requirement, the supply cord or lead shall be tested in accordance with Push-Back Relief Test, Section 38.

11.2.4 If a knot serves as strain relief in an attached flexible cord, any 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 on the conductors.

11.3 Pin terminals

11.3.1 If an appliance is provided with pin terminals, the design of the appliance shall be such that no live parts are exposed to unintentional contact both during and after the placement of the plug on the pins, in the intended manner.

11.3.2 A pin guard is required, such that:

- a) A straight edge placed in any position, across and in contact with edges of the plug opening without the plug in place, cannot be made to contact any current-carrying pin.
- b) With the plug aligned with the pins and the face of the plug in a plane located perpendicular to the end or ends of the farthest projecting current-carrying pin, the probe illustrated in Figure 7.2 shall not touch any current-carrying pin while the probe is inserted through any opening with the appliance in any position.

11.3.3 The plug used in 11.3.2(b) shall be the plug intended for use with the appliance.

11.3.4 If an appliance employs three or more pin terminals designed for use with a plug that covers all the pins, the terminals shall be spaced so that they do not accommodate a flatiron or appliance plug or cord-connector body. The plug which these pins accommodate shall be acceptable for the particular application.

11.3.5 An appliance provided with three pin terminals, one of which is for grounding, shall not be provided with or capable of being used with a two-conductor detachable power-supply cord.

11.3.6 An appliance provided with two pin terminals shall not be provided with or capable of being used with a three-conductor detachable power-supply cord employing a grounding conductor.

11.3.7 A pin terminal shall be securely and rigidly mounted and shall be prevented from shifting in position by means other than friction between surfaces.

11.3.8 The requirement in 11.3.7 is intended primarily to provide for the maintenance of spacings as given in 24.1.1 and to provide for the maintenance of proper spacings between pin terminals. Under this requirement, consideration is also to be given to the means for locking terminals in position to maintain tightness.

11.3.9 The dimensions of pins and their center-to-center spacings (including the corresponding spacings of the female contacts of general-use plugs which these arrangements of pins will accommodate) are as indicated in Table 11.2.

Table 11.2
Pins

Type and rating of plug that accommodates the pins	Configuration of pins			Dimensions of pins	
	Number	Agreement	Spacing between centers, inch (mm)	Diameter, inch (mm)	Length, inch (mm)
Appliance plug rated 10 A at 125 V	2	In line	1/2 (12.7)	0.156 ±0.005 (3.97 ±0.13)	9/16 – 5/8 (14.3 – 15.9)
Flatiron plug rated 10 A at 125 V	2	In line	11/16 (17.5)	0.188 ±0.005 (4.76 ±0.13)	3/4 – 7/8 (19.1 – 22.2)

Table 11.3
Polarity identification of flexible cords

Method of identification	Acceptable combinations		
	Wire intended to be grounded ^d		All other wires ^d
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 bold	Solid color other than white or gray – without tracer
Color of insulation on individual conductors	C ^a	Solid white or gray	Solid color other than white or gray
	C1 ^e	Light blue	Solid color other than light blue, white, or gray
Color of separators	D ^b	White or gray	Color other than white or gray
Other means	E ^c	Tin or other white metal on all strands of the conductor	No tin or other white metal on the strands of the conductor
	F ^b	A stripe, ridge, or groove on the exterior surface of the cord	

^a Only for cords – other than Type SP-1, and SPT-1 – having no braid on any individual conductor.

UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

Table 11.3 Continued on Next Page

Table 11.3 Continued

Method of identification	Acceptable combinations	
	Wire intended to be grounded ^d	All other wires ^d
^b Only for Types SP-1, SP-2, and SPT-2 cords. ^c Only for Type SPT-1 and SPT-2 cords. ^d A wire 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. See 25.1 and Figure 11.1. ^e For jacketed cord.		

11.4 Bushings

11.4.1 At a point where a flexible cord passes through an opening in a wall, barrier, or enclosing case, there shall be a bushing or the equivalent which shall be substantial, reliably secured in place, and shall have a smooth, well-rounded surface against which the cord may bear. If Type SP-2, SPT-2, or other cord lighter than Type HSJ 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. The heat- and moisture-resistant properties of the bushing material shall be such that the bushing is acceptable for the particular application.

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

11.4.3 Ceramic materials and some molded compositions are acceptable generally for insulating bushings, but a separate bushing of wood, hot-molded shellac and tar composition, or rubber material (other than in a motor) is not acceptable. Vulcanized fiber may be employed if the bushing is not less than 3/64 inch (1.2 mm) thick and if it is so formed and secured in place that it will not be affected adversely by conditions of ordinary moisture.

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

12 Current-Carrying Parts

12.1 Each current-carrying part shall be made of metal that is acceptable for the particular application.

12.2 Current-carrying parts made of corrosion-resistant alloys (for example, stainless steel) are acceptable regardless of temperature. Current-carrying parts made of ordinary iron and steel are not acceptable unless they are rendered corrosion-resistant by an appropriate coating and, even then, they are acceptable only as follows:

- a) Pin terminals.
- b) Parts whose normal operating temperature is higher than 100°C (212°F).
- c) Parts of a component that the requirements referred to in 2.1 indicate as being acceptable with coated iron and steel parts.

12.3 If a reservoir is part of an appliance, all live parts shall be so located or protected that they will not be subject to dripping if the reservoir develops leaks, unless:

- a) The reservoir is adequately resistant to corrosion from the liquid intended for use in it; and
- b) The reservoir does not develop cracks as a result of aging.

13 Internal Wiring

13.1 General

13.1.1 The internal wiring of an appliance shall consist of wire of a size and type or types which are acceptable for the particular application, when considered with respect to the temperature and voltage to which the wiring is likely to be subjected.

13.1.2 There is no temperature limit applicable to glass fiber, beads of inorganic material, or the equivalent employed as conductor insulation.

13.1.3 Thermoplastic-insulated wire employed for the internal wiring of an appliance shall be fixture wire, or appliance-wiring material acceptable for the particular application.

13.2 Protection of wiring

13.2.1 If the wiring of an appliance is located so that it may be in proximity to combustible material or may be subjected to mechanical injury, it shall be protected.

13.2.2 Wires within an enclosure or the like shall be disposed or protected so that no damage to conductor insulation results from contact with any rough, sharp, or moving part.

13.2.3 A hole by means of which insulated wires pass through a sheet-metal wall within the over-all enclosure of an appliance shall be provided with a smooth, well-rounded bushing or shall have smooth, well-rounded surfaces upon which the wires may bear, to prevent abrasion of the insulation.

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

13.3 Splices

13.3.1 All splices and connections shall be mechanically secure and shall provide adequate and reliable electrical contact. A soldered connection shall be made mechanically secure before being soldered if breaking or loosening of the connection results in any risk of fire or electric shock.

13.3.2 A splice shall be provided with insulation equivalent to that of the wires involved if permanence of spacing between the splice and other metal parts of the appliance is not reliably maintained.

13.3.3 Insulation consisting of two layers of friction tape, two layers of thermoplastic tape, or of one layer of friction tape on top of one layer of rubber tape, is acceptable on a splice. In determining whether splice insulation consisting of coated fabric, thermoplastic, or other type of tubing is acceptable, consideration is to be given to such factors as its dielectric properties, heat resistant and moisture-resistant characteristics. Thermoplastic tape wrapped over a sharp edge is not acceptable.

13.3.4 Where stranded internal wiring is connected to a wire-binding screw, loose strands of wire shall be positively prevented from contacting any other uninsulated live part that is not always of the same polarity as the wire, and from contacting any dead metal part. This may be accomplished by the use of pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or other equivalent means.

14 Secondary Circuits

14.1 General

14.1.1 Each secondary circuit shall be judged under the requirements for line-voltage circuits.

Exception: A secondary circuit need not be investigated if:

- a) It is not a circuit that is intended to reduce the risk of injury to persons; and*
- b) It complies with the requirements for a limited-energy secondary circuit as specified in 14.2.*

14.1.2 Secondary circuits may be connected to the frame of the appliance. Except as noted in 14.1.3 and 14.2.6, the connection shall be made at only one point in the appliance or system.

14.1.3 A grounding bus of adequate ampacity that is used as the return for a secondary circuit other than as covered by 14.2.6 may be connected to the frame at more than one point.

14.1.4 If any secondary circuit having an open-circuit potential of more than 42.4 volts peak is connected to the frame of an appliance, all exposed dead metal parts that may become energized, and all dead metal parts within the enclosure that can be contacted during servicing and that may become energized, shall be reliably connected together.

14.2 Limited-energy secondary circuits

14.2.1 A limited-energy secondary circuit shall be supplied from:

- a) A Class 2 transformer; or
- b) An isolating transformer having an open-circuit sinusoidal potential of 30 volts, rms (42.4 volts, peak) or less, and that includes at least one of the following means, that limits the power available to the levels specified for a Class 2 transformer.
 - 1) A reliable fixed impedance;
 - 2) A noninterchangeable fuse – the largest fuse that fits in the fuseholder provided;
 - 3) A nonadjustable manually reset circuit protector; or
 - 4) A reliable regulating network.

14.2.2 The impedance, the fuse, the protector, or the regulating network and the wiring between them and the isolating transformer described in 14.2.1 shall be judged as if they were part of a line-voltage circuit.

14.2.3 A fuse or a circuit protector used to limit the power as specified in 14.2.1 shall be rated or set at not more than 3.2 amperes for a circuit operating between 15 and 30 volts and at not more than 5.0 amperes for a 0 – 15 volt circuit.

14.2.4 An impedance or a regulating network that is used to limit the current shall be of such value or design as to limit the current under short-circuit conditions to not more than 8.0 amperes measured after 1 minute.

14.2.5 The performance of a regulating network used to limit the power in accordance with 14.2.1 shall not be adversely affected by either a short circuit or an open circuit between any two terminals of any single rectifier, capacitor, transistor, or similar component in the network.

14.2.6 The frame may be used as the return for a limited-energy secondary circuit.

14.2.7 The wiring in a limited-energy secondary circuit shall be routed away from the wiring of other circuits or shall be provided with insulation that is for use at the highest of the voltages in the other circuits.

14.2.8 The wiring in a limited-energy secondary circuit shall be routed away from the uninsulated live components of other circuits.

14.2.9 Wires and cables that are part of a limited-energy secondary circuit shall be provided with strain relief in accordance with 37.1 and 37.2 if stress on the wire or cable could cause the internal wiring of the circuits to contact uninsulated live parts of other circuits.

15 Heating Elements

15.1 A heating element shall be supported in a sturdy and reliable manner. It shall be protected against mechanical damage and contact with outside objects.

15.2 In determining that a heating element is adequately supported, consideration shall be given to sagging, loosening, and other adverse conditions of the element resulting from continuous heating. For an open-wire (uninsulated resistance wire) heating element, consideration shall also be given to breakage at any point.

15.3 An open-wire element, that is, uninsulated resistance wire, may be used in an appliance provided it complies with the following:

- a) It is enclosed or protected by barriers or covers that require tools for removal;
- b) It complies with the accessibility of live parts requirements specified in 7.5 – 7.13; and
- c) It complies with the Broken Element Test, Section 36.

15.4 A sheathed heating element, rope heater, or the like shall be judged under the applicable requirements of this Standard.

16 Electrical Insulation

16.1 Insulating washers, bushings, and the like that are integral parts of an appliance and bases or supports for the mounting of current-carrying parts shall be of a moisture-resistant material that is not damaged by the temperatures to which they are subjected under conditions of actual use. Molded parts shall be constructed so that they have the mechanical strength and rigidity necessary to withstand the stresses of actual service.

16.2 Insulating material employed in an appliance shall be judged with respect to its acceptability for the particular application. Materials such as mica, some molded compounds, and certain refractory materials are usually acceptable for use as the direct support of live parts. Other materials which are not acceptable for general use, such as magnesium oxide, may be acceptable if used in conjunction with other more appropriate insulating materials or if located and protected against mechanical damage and the absorption of moisture is minimized. When it is necessary to investigate a material to determine whether it is acceptable, consideration is to be given to its mechanical strength, dielectric properties, insulation resistance, heat-resistant qualities, the degree to which it is enclosed or protected, and any other features having a bearing on the risk of fire, electric shock, or injury to persons involved, in conjunction with conditions of actual service. All of these factors are considered with respect to thermal aging. The appropriate tests in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C (see Temperature Considerations – General, Functional-Use Temperature Indices, and Generic Thermal Indices) are to be used to evaluate a material for the above-mentioned properties.

Exception: Thermoset materials need not be subject to the relative thermal capability requirements of UL 746C. For a thermoset material operating at a temperature above its temperature rating, the 1000 Hour Aging Test as specified in 40.1 shall be conducted.

16.3 In the mounting or supporting of small fragile insulating parts, screws or other fastenings should not be tight enough to cause cracking or breaking of these parts with expansion and contraction. Generally, such parts should be slightly loose.

16.4 Sleeving or tubing used as an insulator for uninsulated live parts (such as glass fiber in rope heaters) shall be so disposed or protected that no damage to the sleeving or tubing can result from contact with any rough, sharp, or moving part. The sleeving or tubing shall not be installed under a compression that renders it incapable of complying with the dielectric voltage-withstand requirements in 35.1.

17 Thermal Insulation

17.1 Thermal insulation, if employed, shall be of such a nature and so located and mounted or supported that it is not adversely affected by any normal operation of the appliance.

17.2 Combustible or electrically conductive thermal insulation shall not make contact with uninsulated live parts of an appliance.

17.3 Some types of mineral-wool thermal insulation contain conductive impurities in the form of slag, which make its use unacceptable if in contact with uninsulated live parts. See 34.1.

18 Thermal Cutoffs

18.1 If an appliance is provided with a thermal cutoff, it shall be secured in place and be located so that it is accessible for replacement without damaging connections or internal wiring. See 54.6.

18.2 If an appliance is provided with a thermal cutoff, it shall be capable of opening the circuit in the intended manner without causing the short-circuiting of live parts and without causing live parts to become grounded to the enclosure when the appliance is connected to a circuit of voltage in accordance with 33.1.11, and operated in a normal position to cause abnormal heating.

18.3 To determine whether or not a thermal cutoff complies with the requirement in 18.2, the appliance is to be operated with separate cutoffs five times as described in 18.2 while any other thermally operated control devices in the appliance are short-circuited. Each cutoff is required to perform acceptably. During the test, the enclosure is to be connected through a 3-A fuse to a supply conductor not containing the thermal cutoff.

19 Lampholders

19.1 If an appliance is equipped with a polarized attachment plug, a lampholder supplied as a part of the appliance shall be wired so that the screw shell is connected to the grounded conductor.

19.2 A lampholder shall be constructed and installed so that uninsulated live parts other than the screw shell are not exposed to contact by persons removing or replacing lamps in normal service.

Exception: This requirement does not apply if, in order to remove or replace a lamp, it is necessary to dismantle the appliance by means of tools.

20 Switches

20.1 A switch or other control device provided as a part of an appliance shall be of a type intended for the particular application and shall have a current and voltage rating not less than that of the circuit (load) which it controls.

20.2 A switch employed on an appliance shall be located or protected so that it is not subjected to mechanical damage during use.

20.3 A manually operated, line-connected, single pole switch for appliance on-off operation shall not be connected to the conductor of the power supply cord intended to be grounded. Table 11.3 specifies the identification of the power-supply cord conductor intended to be grounded.

21 Dual Voltage Appliance

21.1 The construction of the circuit voltage selector shall be such that the circuit voltage setting cannot be changed inadvertently.

21.2 If the appliance is so constructed that the supply circuit voltage selector can be changed, the action of changing the voltage selector setting shall also change the supply circuit voltage indication.

21.3 An appliance that can be set to different rated supply circuit voltages shall be provided with the statement required by 58.5.

22 Limit Controls

22.1 A safety or temperature-limiting control constructed to reduce the risk of fire or electric shock shall be operative whenever the appliance is connected to its power supply.

22.2 A control device shall not be constructed to deliberately overload the branch-circuit protective device as a means of disconnecting the appliance from the supply.

22.3 The terminals of a safety device within the enclosure of an appliance shall be so located or further enclosed that they will be protected against unintentional short-circuiting and damage.

23 Overheating Protection

23.1 The requirements in this section are applicable to all products. These requirements are in addition to or modify the applicable requirements in the Automatic Controls Test, Section 49.

23.2 An appliance shall be provided with a separate and distinct temperature-limiting device to limit temperatures within the appliance. A single combination regulating-limiting control is unacceptable for this purpose.

Exception No. 1: A temperature-limiting device is not required if, with all thermally responsive devices short-circuited, the results of all appropriate abnormal tests are in compliance with the Abnormal Operation Test, Section 47.

Exception No. 2: A temperature limiting device, as specified in 23.3, is not required if an appliance is provided with:

a) A manually reset operating control that operates during each cycle of normal operation to terminate the heating process; and

b) A minimum of two independent temperature limiting thermostats, as specified in Table 49.1.

23.3 A limiting-type device shall be a thermal cutoff, a single-operation thermostat or a manual-reset thermostat that is inaccessible to the user without the use of tools.

23.4 A single-operation thermostat or a manual-reset thermostat that is provided as the thermal limiting device shall comply with the applicable requirements in the Standard for Temperature-Indicating and Regulating Equipment, UL 873 for limiting controls. Compliance with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

23.4 revised April 23, 2010. UL 873 will be withdrawn on October 19, 2016.

23.5 A thermal cutoff shall comply with the applicable requirements in the Standard for Thermal-Links – Requirements and Application Guide, UL 60691.

23.6 If a grounding-type attachment plug is provided or the enclosure of the appliance has metal parts that are likely to become grounded, such as a metal bottom with bumped-out metal feet, the limiting-type device shall be located in one supply conductor and the temperature-regulating control shall be located in the other supply conductor. If identifiable, the ungrounded supply conductor shall contain the limiting-type device.

24 Spacings

24.1 General

24.1.1 The spacings in an appliance shall be 1/16 inch (1.6 mm) between uninsulated live parts of opposite polarity; and between a rigidly mounted uninsulated live part and a dead metal part that either is exposed for persons to contact or may be grounded.

Exception No. 1: If exact centering of the cold pin of a sheathed-type heating element is required to maintain the 1/16-inch (1.6-mm) spacing, a spacing of 3/64 inch (1.2 mm) in one location is acceptable.

Exception No. 2: As indicated in 24.1.2.

24.1.2 At closed-in points only, such as the screw-and-washer construction of an insulated terminal mounted in metal, a spacing of 3/64 inch (1.2 mm) is acceptable. Within a thermostat, except at contacts, the spacings between uninsulated live parts on opposite sides of the contacts are to be not less than 1/32 inch (0.8 mm) through air and 3/64 inch (1.2 mm) over the surface of insulating material, and the construction is to be such that the spacings are maintained permanently.

24.2 Barriers

24.2.1 An insulating liner or barrier of fiber or similar material 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 cannot be adversely affected by arcing, except that 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.

Exception: Insulating material having a thickness less than specified may be used if it is equivalent in appropriate properties for the application.

24.2.2 Unless protected from mechanical abuse during assembly and functioning of an appliance, a barrier of mica shall be 0.010 inch (0.25 mm) or thicker.

25 Grounding

25.1 On an appliance where grounding is provided, the flexible cord shall include a grounding conductor that shall be:

- a) Green, with or without one or more yellow stripes;
- b) Connected to the grounding blade of an attachment plug of a grounding type; and
- c) Connected to the enclosure of the appliance by means of a screw not likely to be removed during ordinary servicing, or by other reliable means. Solder alone is not acceptable for making this connection.

25.2 All exposed dead metal parts of a cord-connected appliance that is equipped with a grounding conductor, and all dead metal parts within the enclosure that are exposed to contact during any user servicing and are likely to become energized, shall be conductively connected to the grounding conductor of the power-supply cord. The grounding means shall comply with the requirements in Resistance of Grounding Test, Section 29.

25.3 A separable connecting device provided with a grounding connection shall be such that the appliance grounding connection is made before connection to, and broken after disconnection from the supply circuit.

Exception: This requirement does not apply to an interlocked plug, receptacle, and connector that is not energized when the appliance grounding connection is made.

26 Protection Against Injury to Persons

26.1 Materials employed in the construction of the appliance depended upon for protection against personal injury shall be appropriate for the particular use. See 7.1 and 7.3.

26.2 An enclosure, a frame, a guard, a handle, or the like shall not be sharp enough 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 7.2 need not comply with this requirement.

26.3 Compliance with the requirement of 26.2 shall be determined by applying the test procedures, equipment, and acceptance criteria specified in the Standard for Tests for Sharpness of Edges on Equipment, UL 1439.

26.4 The stability of an appliance shall be such that it will not be overturned readily in normal use. The appliance shall be subjected to the Stability Test, Section 44.

26.5 If any part of an appliance requires proper assembly, for example fully inserting a lid or engagement of a twist-lock part, in order to reduce a risk of injury to persons, then improper assembly that may result in a risk of injury to persons shall be clearly visible to the user.

26.6 A coffee urn or similar water-heating appliance that is not lifted or tilted to dispense the liquid and that has a capacity of more than 17.5 oz (520 mL) shall be:

- a) Provided with such a lid as described in 26.5; and
- b) Subjected to the Tip Over Test, Section 45, wherein the lid does not become dislodged.

26.7 The construction of an appliance shall be such as to minimize the possibility of physical injury when pouring under conditions simulating intended normal use. The pouring spout shall be constructed so that the direction and rate of liquid flowing from the spout will be as anticipated. Liquid shall not be emitted from other than the spout in the intended use.

26.8 An appliance, or that part of an appliance (such as a carafe), that requires lifting and tilting to dispense the liquid and that has a capacity of more than 17.5 fluid oz (520 mL) shall be subjected to the Tip Over Test, Section 45.

Exception No. 1: The Tip Over Test is not required if the critical angle of balance is 45 degrees or greater. The critical angle of balance is determined as the angle at which a sample will tip over due only to the force of gravity, in any orientation throughout its vertical axis.

Exception No. 2: The Tip Over Test is not required if it complies with the Dynamic Stability Test, Section 46.

26.9 The release mechanism for detachable handles shall be:

- a) Located and/or guarded so that inadvertent detachment of the handle does not occur during normal use of the appliance; and
- b) Constructed so that complete and proper engagement of the handle is obvious to the user during the operation of attaching the handle.

27 Pressure Vessels and Parts Subject to Pressure

27.1 Espresso coffee makers shall be constructed so that the coffee filter cannot be removed by a simple or unintentional operation when the vessel is pressurized. A coffee filter that can only be removed after having been rotated through an angle of at least 30 degrees is considered to comply with this requirement. A coffee filter holder provided with two separate and distinct means for securement onto the machine, accomplished either manually or by an automatic process, is also acceptable.

27.2 An espresso maker shall include a distinctive marking, such as an arrow, vertical bar, dot, or other equivalent marking, or the word "lock", which clearly indicates the proper position to secure the coffee filter holder during the brewing cycle. This marking shall be located directly above the position of the filter holder handle when the filter holder is properly secured.

27.3 Except as noted in 27.4, a pressure vessel having an inside diameter of more than 6 inches (152 mm) and subject to a gauge pressure of more than 15 lbf/in² (103 kN/cm² or 10.5 gf/mm²) shall be certified by the National Board of Boiler and Pressure-Vessel Inspectors and marked in accordance with the appropriate boiler and pressure vessel code symbol of the American Society of Mechanical Engineers (ASME) ("H", "M", "S", or "U") for a working pressure not less than the pressure determined by applying 27.5.

27.4 If a pressure vessel, because of its application, is not covered under the inspection procedures of the ASME code, it shall be so designed and constructed that it complies with the requirements in 27.4 – 27.8.

27.5 The espresso-coffee maker is to be operated until maximum pressure is attained, by any combination of functional controls, at rated voltage or at the upper limit of a rated voltage range, with the coffee-filter both un-blocked and blocked and the steam valve, if provided, closed, except that, during the period that steam is produced, the supply voltage shall be such that the input is equal to the maximum rated input. If the steam valve is linked to the switch used for starting the production of steam, this link must not be disturbed during determination of maximum pressure. The maximum pressures are to be noted.

27.6 The espresso-coffee maker is then to be subjected for five minutes, to a pressure equal to twice the maximum pressure noted with the coffee-filter blocked. The over pressure may be supplied from an external source, care being taken to ensure that the espresso-coffee maker is at its intended operating temperature for starting the brewing period.

27.7 The steam system of an espresso-coffee maker, which is normally open to ambient pressures, shall be subjected for five minutes, to a pressure equal to twice the maximum pressure noted with the coffee-filter not blocked. During the test, the system under test (pressure system) is not to be altered or modified, the steam outlet tube is to be blocked, and the steam valve is to be opened. The over pressure may be supplied from an external source, care being taken to ensure that the espresso-coffee maker is at its intended operating temperature for starting the steaming period.

27.8 During the tests described in 27.6 and 27.7, the espresso maker shall not rupture and there shall be no leakage other than at places intended for that purpose. Leakage is only acceptable through a self-resetting overpressure relief. At the conclusion of the tests described in 27.6 and 27.7 the coffee-maker shall perform in its intended manner.

27.9 Following the test specified in 27.6, the coffee-maker is to be subjected to the same pressure as described in 27.6 except with any means for limiting the pressure during determination of the maximum pressure made inoperative. During this test the steam outlet is blocked, as it is regarded as the limiting device during determining the maximum pressure. The coffee-maker shall withstand this test without exploding or emitting hazardous jets of fluid.

27.10 If an intentionally weak part ruptures during the test in 27.9, a second sample is to be tested with identical results. Rupture of an intentionally weak part shall render the coffee-maker unfit for further use and not pose a risk of personal injury, electrical shock, or fire hazard.

27.11 A means for relieving pressure shall be provided for all parts in which pressure might be generated in the event of fire.

27.12 Pressure-relief devices (see 27.18), fusible plugs, soldered joints, nonmetallic tubing, or other pressure-relief means or the equivalent may be employed to comply with the requirements in 27.11.

27.13 There shall be no shut-off valve between the pressure-relief means and the parts that it is intended to protect.

27.14 A vessel having an inside diameter of more than 3.0 inches (76.2 mm) and subject to air or steam pressure generated or stored within the appliance shall be protected by a pressure-relief device.

27.15 The start-to-discharge pressure setting of the pressure-relief device shall not be higher than the working pressure marked on the vessel. The discharge rate of the device shall acceptably relieve the pressure.

27.16 A pressure-relief device shall comply with all four of the following:

- a) Shall be connected as close as possible to the pressure vessel or parts of the system that it is intended to protect;
- b) Shall be installed so that it is readily accessible for inspection and repair and cannot be readily rendered inoperative;
- c) Shall have its discharge opening located and directed so that the risk of scalding is reduced to a minimum; and
- d) Shall have its discharge opening located and directed so that operation of the device does not deposit moisture on bare live parts or on insulation or components affected detrimentally by moisture.

27.17 A pressure-relief device having an adjustable setting is judged on the basis of its maximum setting unless the adjusting means is sealed at a lower setting.

27.18 A pressure-relief device is considered to be a pressure-actuated valve or rupture member intended to relieve excessive pressures automatically.

27.19 Where a pressure-relief device is required, the control responsible for limiting the pressure in the vessel shall be capable of performing under rated load for 100,000 cycles of operation and shall prevent the pressure from exceeding 90 percent of the relief device setting under any condition of normal operation.

PERFORMANCE

28 General

28.1 The performance of an appliance shall be investigated by subjecting the required number of appliances to all the applicable tests as described in Sections 29 – 49. Appliances employed for leakage-current tests shall be first tested for leakage prior to employing them for other tests.

29 Resistance of Grounding Test

29.1 The resistance between the point of connection of the equipment-grounding means at or within the appliance and any other point in the grounding circuit of the appliance shall not exceed 0.1 ohms.

29.2 Compliance with the requirement in 29.1 is to be determined by:

- a) A resistance-measuring instrument; or
- b) Passing an alternating current of at least 30 amperes from a power supply of not more than 12 volts from the grounding pin of the attachment plug cap to a point in the grounding circuit, and then measuring the resulting drop in potential between the two points. The resistance in ohms is to be determined by dividing the drop in potential in volts by the current in amperes passing between the two points.

30 Power Input

30.1 The power input to an appliance shall not be more than 105 or less than 90 percent of its marked rating.

30.2 To determine if an appliance complies with the requirement in 30.1, the power input is to be measured with the appliance at normal operating temperature under full-load conditions and while connected to a supply circuit adjusted to the highest voltage of the following:

- a) The marked voltage rating; or
- b) 120 V, whichever is appropriate for the appliance.

31 Leakage Current Test

31.1 The leakage current of a cord-connected appliance rated for a nominal 120-V or 240-V supply when tested in accordance with 31.1 – 31.7 shall not be more than:

- a) 0.5 mA for an ungrounded (2-wire) appliance;
- b) 0.5 mA for a grounded (3-wire) appliance that is easily carried or conveyed by hand; and
- c) 0.75 mA for a grounded (3-wire) permanently connected appliance, or a cord connected appliance that is intended to be fastened in place or located in a dedicated space and employing a standard attachment plug rated 20 A or less.

Exception: The leakage current of an appliance incorporating a sheath type heating element, when measured in accordance with 31.3 – 31.7, shall not exceed 2.5 mA during the first 5 minutes after reaching the leakage current limit of 0.5 mA or 0.75 mA, as applicable, and at the end of this time, the leakage current shall be not more than the 0.5 mA or 0.75 mA limit as applicable— the leakage current is to be monitored during heat-up and cool-down.

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

31.3 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 acceptable for protection against electric shock as defined in 7.1 – 7.13. 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 electric shock.

31.4 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.

31.5 The measurement circuit for leakage current is to be as shown in Figure 31.1. The ideal measurement 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 ideal instrument. The meter used need not have all the attributes of the ideal 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) that is equal to the ratio of the impedance of a 1500 ohm resistor shunted by a 0.15 microfarad capacitor to 1500 ohms. At an indication of 0.5 mA, the measurement is to have an error of not more than 5 percent at 60 Hz.