UL 858

STANDARD FOR SAFETY

Household Electric Ranges

UL Standard for Safety for Household Electric Ranges, UL 858

Sixteenth Edition, Dated November 7, 2014

Summary of Topics

This revision of ANSI/UL 858 dated August 2, 2023 is issued to incorporate the following:

> ***– Improvements to Abnormal Operation – Induction Surface Unit Cooking Oil Ignition Test; 47A.1, 60A.1 – 60A.3, 60A.5, Table 60A.1, 60A.8.1 – 60A.8.4, 60A.10, 60A.11, 60A.13 and Figure 60A.3***

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated April 21, 2023.

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UL 858

Standard for Household Electric Ranges

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The most recent designation of ANSI/UL 858 as an American National Standard (ANSI) occurred on August 2, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface.

The Department of Defense (DoD) has adopted UL 858 on November 9, 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 ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

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INTRODUCTION

1 Scope

1.1 These requirements cover household cooking equipment that is floor or cabinet supported, wall-mounted, counter mounted, or combinations thereof, rated 600 V or less, for installation in accordance with the National Electrical Code.

1.2 These requirements also cover ventilating hoods that are provided as an integral part of the cooking equipment, or that are separately supported on the building structure but arranged for factory-provided electrical connection to the cooking equipment with which they are intended to be used.

1.3 These requirements do not cover commercial cooking appliances.

1.4 These requirements do not cover special types of household cooking appliances. However, if such appliances are used as a part of a range, oven, surface assembly, or combination thereof, they will be judged on the basis of compliance with the requirements in this standard, insofar as they apply, and further appropriate examination and tests in accordance with the applicable requirements for electric heating appliances. These requirements do not cover all tests required on household cooking appliances having microwave ovens.

1.5 For the purpose of these requirements, cooking equipment includes ranges, ovens, surface assemblies, or combinations thereof. A range is considered to be a combination of a surface assembly with one or more ovens. Wall-mounted cooking equipment is considered to be those appliances intended for mounting in or on a wall or other vertical surface of a building or cabinet. Counter-mounted cooking equipment is considered to be those appliances intended for mounting in or on a counter or other horizontal surface of a building or cabinet.

1.6 In the following text, a requirement that applies only to one, two, or three of the classes of equipment coming within its scope – ventilating hoods, ranges, wall-mounted ovens, counter-mounted cooking units, or combinations thereof – are so identified. 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 these classes of equipment.

2 Glossary

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

2.1.0 CLOSED LOOP COOKING – A cooking process whereby a feedback device, either wired or wireless, provides a parameter to the appliance control designed to automatically regulate the power of one or more surface units to achieve and maintain a target value.

Note 1: The feedback device of the closed loop cooking system may be integral to the appliance or be a peripheral device designed to work with the appliance control.

Note 2: The feedback parameter can be a sensing value, typically but not restricted to temperature, but also a target value, typically but not restricted to temperature or power level, that is processed by the appliance control(s) integral to the appliance.

2.1.1 COIL SURFACE UNIT – A sheathed heating cooktop element that is intended to directly support and heat a cooking utensil.

2.2 COMPONENT – A device or fabricated part of the appliance covered by the scope of a safety standard dedicated to the purpose. When incorporated in an appliance, equipment otherwise typically field

installed (e.g. luminaire) is considered to be a component. Unless otherwise specified, materials that compose a device or fabricated part, such as thermoplastic or copper, are not considered components.

2.3 CONTINUOUS-CLEANING OVEN – An oven that utilizes treated surfaces on the interior of the oven and on insert panels of the oven to gradually reduce oven soil during normal baking or roasting operations.

2.3.1 COOKTOP – A combination of multiple cooktop elements and which may include controls on the top surface of an appliance.

2.4 COOKTOP ELEMENT – Any grill, griddle, deep-fat fryer, surface unit, or the like, on the top surface of an appliance, that is used as a source of heat.

2.4.1 ELECTRICAL CONNECTION – The physical interface between two points in a circuit such as spade terminals, pin terminals, micro switch contacts, relay contacts, timer contacts, crimped connections, and connections that are welded or soldered.

2.4.2 FLAME CYLINDER – A projection of a vertical cylinder having a diameter of 20 mm and a height of 50 mm.

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

2.5.1 INDUCTION COOKTOP APPLIANCES – Appliances having single or multiple induction cooktop surface units that can heat at least one metallic vessel by means of eddy currents. The eddy currents are induced to the cooking vessel by the electromagnetic field of a coil.

2.5.2 INDUCTION WOK – Cooktop surface unit with concaved shaped surface unit to accept and heat a wok container.

2.6 LOW-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 30 V and supplied by a primary battery, by a standard Class 2 transformer, or by a combination of a transformer and a fixed impedance that, as a unit, complies with all of the performance requirements for a Class 2 transformer. A circuit derived from a high-voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low-voltage circuit.

2.7 OVEN-DOOR INTERLOCK – An automatically-operated device that prohibits access to the interior of the oven during the high-temperature portion of the self-cleaning cycle.

2.7A REMOTE CLOSED LOOP COOKING – A closed loop cooking process whereby the target setting can be adjusted by an external device, such as a smart phone or computer.

2.8 SELF-CLEANING OVEN – An oven that utilizes elevated temperatures during a separate high-heat cycle to reduce oven soil to light ash.

2.9 SURFACE UNIT – A cooktop element intended to support and heat a cooking utensil.

2.10 TEMPERATURE-LIMITING CONTROL – A control that functions only under conditions that produce abnormal temperatures.

2.11 TEMPERATURE-REGULATING CONTROL – A control that functions to regulate the temperature of the appliance under normal conditions of use.

2.12 THERMAL CUTOFF – A temperature or temperature and current sensitive device incorporating a thermal element for protecting a circuit by opening the protected circuit when the device reaches a predetermined temperature. It is intended to:

a) Reduce the risk of fire due to overheating of a product during abnormal operation; and

b) Operate only once, that is it can not be reset or reconditioned for reuse.

2.13 WARMING ELEMENT – A surface element intended for keeping previously cooked foods warm but not intended to continue the cooking process. Typically, a warming element is low wattage with a wattage rating of approximately 10 percent of a surface cooking element.

3 Units of Measurement

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

4 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.

CONSTRUCTION

5 General

5.1 An appliance shall employ materials and components throughout that are acceptable for the use, and shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

5.2 A material of asbestos composition shall not be used.

5.3 For an appliance provided with casters, the casters shall be adjustable so that when they are in the locked position, the appliance rests on feet or the equivalent on the floor.

5.4 A component of a product covered by this Standard shall:

a) Comply with the requirements for that component as indicated in the individual section covering that component;

b) Be used in accordance with its rating established for the intended conditions of use;

c) Be used within its established use limitations or conditions of acceptability; and

d) Additionally comply with the applicable requirements of this end product Standard.

Exception No. 1: A component of a product covered by this Standard is not required to comply with a specific component requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product;

b) Is superseded by a requirement in this Standard; or

c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.

Exception No. 2: A component complying with a component standard other than those cited in this Standard is acceptable if:

a) The component also complies with the applicable component standard indicated in this Standard; or

b) The component standard:

1) Is compatible with the ampacity and overcurrent protection requirements in the National Electrical Code, NFPA 70, where appropriate;

2) Considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and

3) Any use limitations of the other component standard is identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.

5.5 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable UL standard that cover devices that provide those functions.

Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional component standard need not be applied.

5.6 A component not anticipated by the requirements of this end product Standard, not specifically covered by the component standards noted in this Standard, and that involves a risk of fire, electric shock, or injury to persons, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with 5.4 (b) – (e).

5.7 With regard to a component being additionally investigated, reference to construction and performance requirements in another UL end product standard is suitable where that standard anticipates normal and abnormal use conditions consistent with the application of this end product Standard.

6 Frame and Enclosure

6.1 General

6.1.1 An appliance shall have an enclosure of moisture resistant material that encloses all live parts excluding power supply cords.

6.1.2 An enclosure shall be formed and assembled so that it:

a) Has the strength and rigidity necessary to resist the normal abuses to which it is likely to be subjected, without resulting in a risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects;

b) Reduces the likelihood of unintentional user contact with uninsulated live parts; and

c) Reduces the likelihood of electrical components and internal wiring being subjected to excessive moisture, grease, and the like as determined by the requirements in Protection Against Spillage and Cooking Vapors, 6.4.

6.1.3 Polymeric materials shall comply with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.1.4 An enclosure shall be investigated with respect to size, shape, thickness of material, and acceptability for the particular application. An enclosure material shall be of such thickness or shape, or shall be reinforced to provide stiffness and protection not less than that provided by flat sheet steel with a minimum thickness of 0.020 in (0.51 mm).

Exception: A mesh barrier, when used below a live heater element inside an oven cavity, such as a broil element, shall be formed to provide stiffness and protection so that when a 2 lb (9N) force is applied at any point using the probe described in Figure 6.1 the mesh will not touch live parts or result in a reduction of spacing below the minimum acceptable values specified in Spacings, Section 26.

6.1.5 Aluminum not less than 0.034 in (0.86 mm) thick is acceptable in lieu of steel. Aluminum with a thickness less than 0.034 in shall be investigated on the basis of the stiffness and protection required by the application.

6.1.6 Sheet metal to which a wiring system is to be connected in the field shall have a thickness or shall be formed or reinforced to provide a stiffness and rigidity not less than that of steel sheet with a minimum thickness of 0.053 in (1.35 mm).

6.1.7 Cast metal to which a wiring system is to be connected in the field shall not be less than 1/8 in (3.2 mm) thick.

6.1.8 Glass, other than a cooking surface, constituting a part of the electrical enclosure:

a) Shall be reliably secured so that it cannot be readily displaced during normal use, and

b) Shall not be utilized for the support of any component.

6.1.9 With reference to 6.1.8, glass, other than a cooking surface, having a dimension, including a diagonal, more than 12 in (305 mm) shall:

a) Be a nonshattering or tempered type that complies with the requirements in the Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings, ANSI Z97.1 Class A, or

b) Withstand the impact described in 76.1, without cracking or breaking to the extent that pieces are released or dropped from their normal position.

6.1.10 With reference to 6.1.8, glass of a cooking surface and constituting a part of the electrical enclosure shall comply with the impact test requirements described in 76.2 – 76.6.

6.1.11 A part relied upon for compliance with this Standard, when fabricated from polymeric materials, shall have clear traceability as to composition, ingredients, and processing for the fabricated part to the extent that the composition, ingredients, or process impacts the compliance of the product. Fabricated parts complying with the Standard for Polymeric Materials – Fabricated Parts, UL 746D, meets this requirement.

6.2 Accessibility of uninsulated live parts, film-coated wire, and moving parts

6.2.1 General

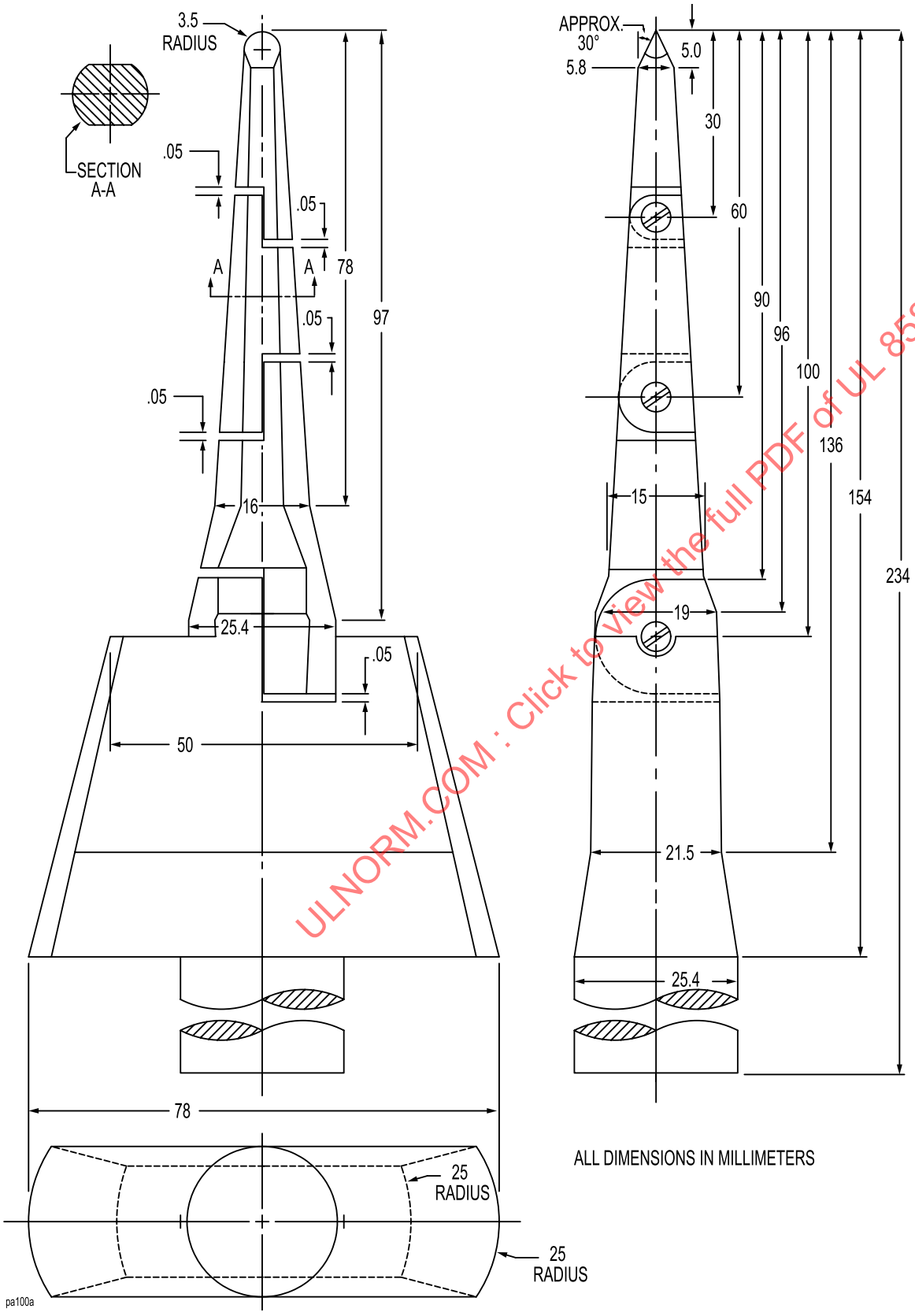
6.2.1.1 An opening in the enclosure shall comply with Accessibility of Uninsulated Live Parts and Film-Coated Wire, Section 6.2.2, and Accessibility of Moving Parts, Section 6.2.3.

6.2.1.2 A component such as a lampholder, fuseholder, circuit breaker, or the like that is intended to be user serviceable shall be located so that persons replacing or resetting the component cannot unintentionally touch an uninsulated live part as determined using the probe illustrated in Figure 6.1.

Exception: The requirement does not apply to the screwshell or center contact of a screwshell lampholder or to the clips of a fuseholder that is associated with the component being replaced.

Figure 6.1

Articulate probe with web stop



6.2.1.3 During the examination of a product to determine compliance with 6.2.1.1, a part of the enclosure that may be opened or removed by a user without the use of a tool (for example, during use or normal cleaning, to attach an accessory, during insertion or removal of a plug-in module, to make an operating adjustment, or the like) is to be opened or removed. The normal cleaning operation is considered to involve any space available after removal of drip trays, drawers, filters, grease traps, covers, and similar parts.

6.2.1.4 A filter unit that is intended to be removed by the user for cleaning or replacement is to be removed when determining compliance with 6.2.1.1.

6.2.1.5 For examinations involving a probe, the probe is to be articulated into any configuration and may be rotated or angled to any position before, during, or after insertion into the opening; and the penetration may be to any depth allowed by the size of the opening, including minimal depth combined with maximum articulations. The probe shall not be used to determine the strength of a material. The probe is to be applied with the minimum force necessary to determine accessibility and shall not distort the enclosure material surrounding the opening in any way.

6.2.2 Accessibility of uninsulated live parts and film coated wire

6.2.2.1 An uninsulated live part or film coated wire shall not be exposed to unintentional contact during normal operation, normal cleaning, and insertion or removal of a plug-in module.

6.2.2.2 An opening in an enclosure shall comply with either (a), (b), or (c):

a) An opening that has a minor dimension less than 1 in (25.4 mm) shall be located so that an uninsulated live part or film-coated wire cannot be contacted by the probe illustrated in Figure 6.1. The minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening to any depth.

Exception: For film-coated wire, an opening less than 1 in is acceptable if the probe illustrated in Figure 6.2 cannot contact the wire.

b) An opening that has a minor dimension greater than or equal to 1 in but no more than 6 in (152 mm) shall be located so that a part or wire is spaced from the opening as specified in Table 6.1.

c) An opening, when used as a protective cover for a downward facing open-wire / ribbon heating element such as a broil element, shall have a minor dimension of less than 0.10 in (2.54 mm).

Figure 6.2

Probe for film-coated wire

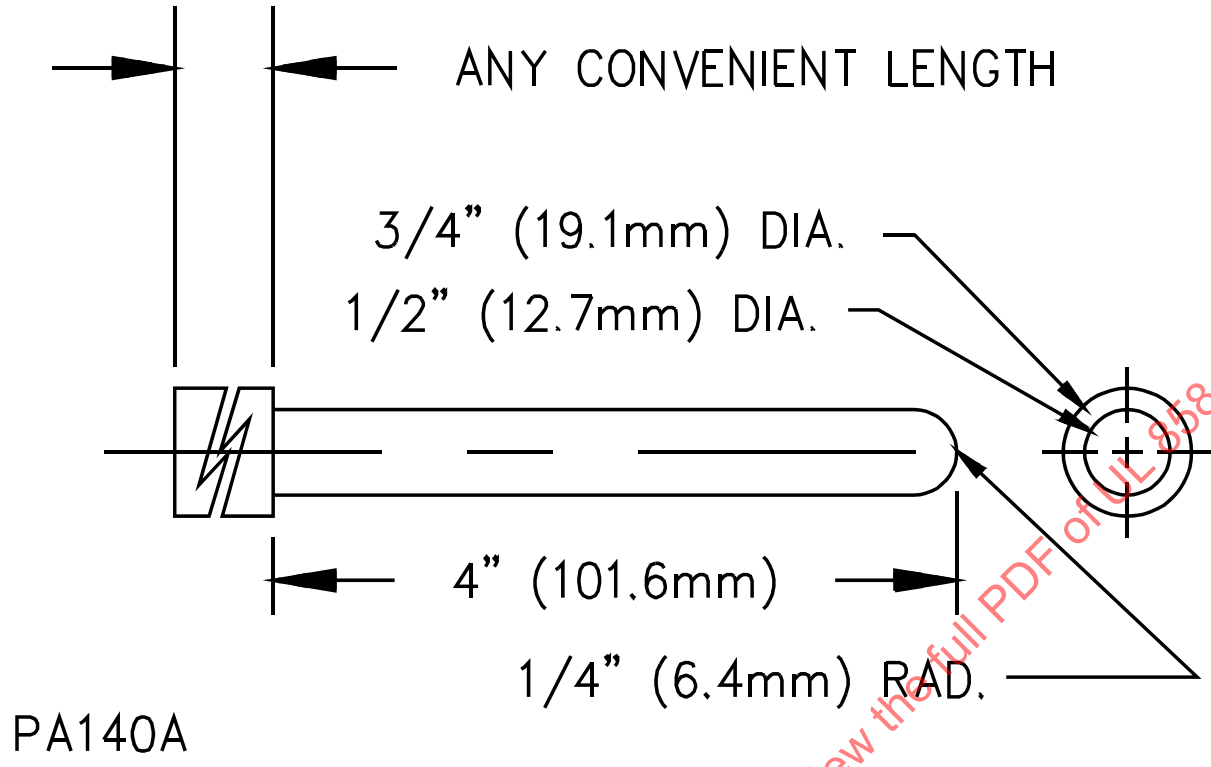


Table 6.1
Minimum acceptable distance from an opening to a moving part or a part that may involve a risk of electric shock

Minor dimension of opening[a]		Minimum distance from opening to part	
in[b]	(mm)	in[b]	(mm)
1	(25.4)	6-1/2	(165.0)
1-1/4	(31.8)	7-1/2	(190.0)
1-1/2	(38.1)	12-1/2	(318.0)
1-7/8	(47.6)	15-1/2	(394.0)
2-1/8	(54.0)	17-1/2	(444.0)
c		30	(762.0)

[a] The minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening to any depth.

[b] Between 1 in and 2-1/8 in, interpolation is to be used to determine a value between values specified in the table.

[c] More than 2-1/8 in, but not more than 6 in (152.4 mm).

6.2.2.3 Terminals of heating elements, receptacles, and similar uninsulated live parts are to be considered live parts during normal cleaning – after removal of drip bowls, raising of top surfaces, or the like – unless such parts are disconnected by means of an air-gap switch with a marked off position or interlocking function. See 25.1.6.

6.2.2.4 Terminals of a heating-element or module may be exposed during insertion and removal provided the ungrounded circuit lead or leads are disconnected by means of an air-gap switch with a marked off position or interlocking function.

6.2.2.5 Uninsulated live parts shall be secured to the base or mounting surface so that they will be prevented from turning or shifting in position, if such motion may result in a reduction of spacings below the minimum acceptable values specified in 26.1 – 26.3.

6.2.3 Accessibility of moving parts

6.2.3.1 Moving parts of an appliance shall, as far as practical considering the intended use of the appliance, be positioned or enclosed to reduce the likelihood of personal injury during normal use.

6.2.3.2 An opening in an enclosure shall comply with either (a) or (b):

a) An opening that has a minor dimension less than 1 in (25.4 mm) shall be located so that a moving part cannot be contacted by the probe illustrated in Figure 6.1. The minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening to any depth. The examination with the probe is to be conducted with the moving parts adjusted to the most unfavorable position within their range of adjustment. If necessary, belts are to be removed.

b) An opening that has a minor dimension greater than or equal to 1 in but no more than 6 in (152 mm) shall be located so that a moving part is spaced from the opening as specified in Table 6.1.

6.3 Expulsion of molten metal and burning insulation

6.3.1 General

6.3.1.1 Openings in the enclosure of an appliance shall be located and constructed so that burning insulation, molten metal, flaming particles, or the like are not expelled from the enclosure.

6.3.1.2 Openings in an enclosure, unless constructed as specified in Openings in Vertical Surfaces, Section 6.3.2, or Openings in Horizontal Surfaces, Section 6.3.3, shall not be located below live parts or internal wiring.

Exception No. 1: Openings in the enclosure of a component fan or blower assembly may be judged in accordance with the applicable requirements in the Standard for Electric Fans, UL 507, provided that the fan or blower circuit is protected by a branch circuit-type fuse or circuit breaker rated no more than 20 A.

Exception No. 2: Opening in horizontal surfaces below live parts, opening into an oven cavity, are acceptable with a maximum minor dimensions as defined in 6.2.2.2(c).

6.3.1.3 An internal barrier, provided to comply with 6.3.2.1 or 6.3.3.1, shall be constructed of materials that are acceptable for use as an enclosure as specified in 6.1.2 or shall comply with the applicable requirements for internal barriers in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.3.2 Openings in vertical surfaces

6.3.2.1 An opening in a surface that is 45 degrees or less from vertical shall be provided with a louver, baffle, barrier, or the like, that is shaped or located to prevent the expulsion of burning insulation, molten metal, and the like from the enclosure. See Figure 6.3 for examples of constructions that comply with this

requirement. An opening in the surface of an enclosure that is located above the highest plane that contains one or more live parts or internal wiring is considered to comply with this requirement.

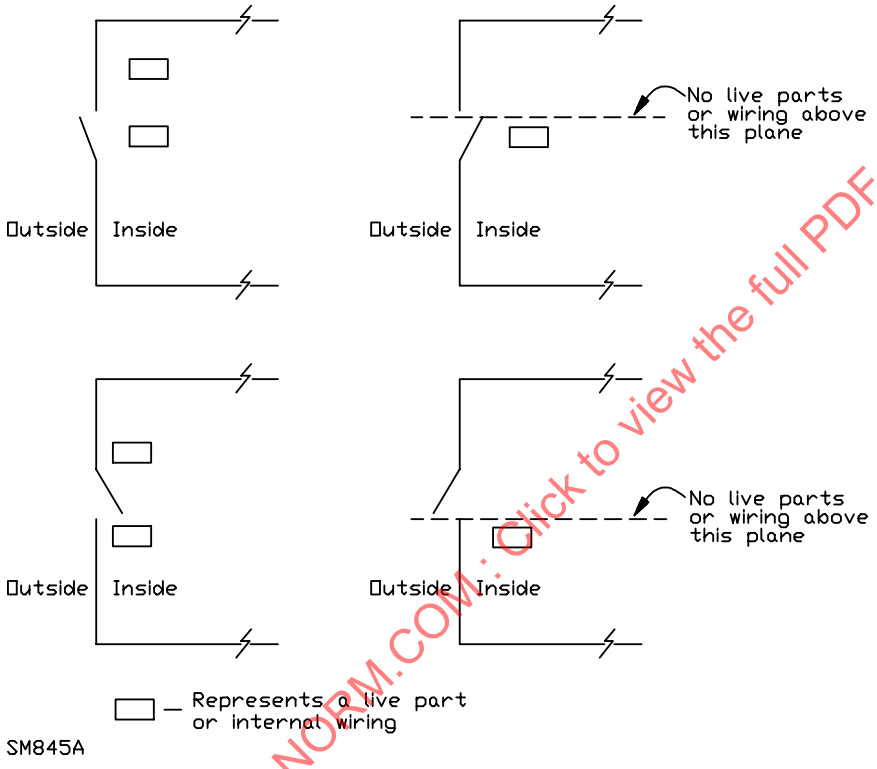
Exception: Openings required for a manufacturing operation such as drainage of paint, production-line adjustment, or calibration of components may be provided in a vertical surface without a louver, baffle, or barrier if:

a) No single opening has a dimension more than 5/16 in (7.9 mm), and

b) The total area of all such openings in any 1-ft^2 area does not exceed 1 in^2 (645 mm^2).

Figure 6.3

Examples of openings in vertical surfaces that comply with 6.3.2.1



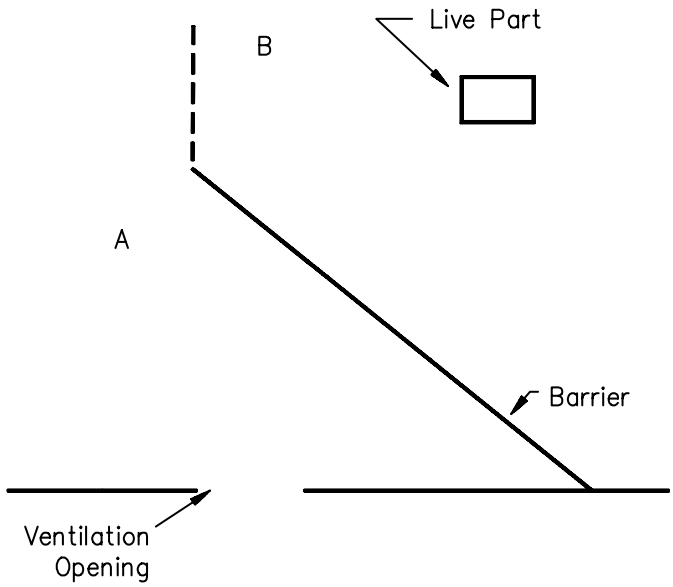
6.3.3 Openings in horizontal surfaces

6.3.3.1 An opening in a surface that is more than 45 degrees from vertical, and that is located at or below any horizontal plane that contains internal wiring or live parts, shall comply with 6.3.3.2 – 6.3.3.3.

6.3.3.2 An opening as described in 6.3.3.1 shall be provided with one or more baffles, barriers or other obstructions of such dimensions and locations that any path from live parts or internal wiring through the opening requires at least one change in direction from a straight line. If the minor dimension of such an opening is larger than 1/4 in (6.4 mm), the opening shall be provided with a perforated sheet or screen with openings having a minor dimension no larger than 1/4 in. See Figure 6.4.

Figure 6.4

Example of an acceptable opening



A – No live parts permitted in this area.
B – Live parts acceptable this side of barrier.

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6.3.3.3 A perforated sheet or screen provided in accordance with 6.3.3.2 shall be constructed of a material having a thickness not less than the thickness required for an enclosure of live parts.

6.4 Protection against spillage and cooking vapors

6.4.1 A live part of an appliance shall be located or enclosed so that it will not be exposed to vapors from an oven cavity of the appliance. The part shall also be located or enclosed so that it is protected against spillage and accumulations of spillage.

Exception: An open-wire / ribbon heating element used in a downward facing application such as a broil element is acceptable where exposed to oil-laden air and vapors when:

a) The element complies with Heating Elements, Section 18.

b) The element employs a mesh that complies with Frame and Enclosures, Section 6; with an exception to 6.1.4.

c) The element complies with all applicable tests in Tests for Elements Exposed to Oil-laden Air and Oven Vapors, Moisture and Grease, Section 72.6.

6.4.2 A control that is mounted in a surface that is more than 45 degrees from vertical, and that is mounted in or adjacent to a cooking surface and therefore subject to spillage shall comply with Spillage on Horizontally Mounted Controls, Section 75.1.

6.4.3 An appliance provided with a collecting surface beneath the cooking surface that is sealed or that does not otherwise allow for user access for cleaning of spillage, shall comply with Spillage on Sealed Cooktops, Section 75.3.

6.4.4 An appliance cooktop employing a seal or gasket to prevent live parts or internal wiring from being exposed to spillage or the accumulations of spillage shall comply with Aging of Cooktop Seals and Gaskets, Section 75.4.

6.4.5 An appliance cooktop having any vents, slots, or openings on or near the horizontal cooking surface and therefore subject to spillage shall comply with the Spillage on vents, slots, or openings, Section 75.5.

6.4.6 An appliance intended for under counter installation, such as a built-in oven, that may be subject to spillage of liquids from the above countertop or cooking surface shall comply with the Spillage on under counter appliances, Section 75.6.

7 Assembly

7.1 A switch, a lampholder, an attachment-plug receptacle, or similar component shall be mounted securely and shall be prevented from turning. See 7.2.

Exception No. 1: A switch if all four of the following conditions are met:

a) The switch is 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 of mounting the switch makes it unlikely that operation of the switch will loosen it.

c) The spacings are not reduced below the minimum acceptable values if the switch rotates.

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

Exception No. 2: 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 by a nonrenewable jewel if rotation cannot reduce spacings below the minimum acceptable values.

7.2 The means by which the turning mentioned in 7.1 is prevented is to include more than friction between surfaces – for example, a properly applied lock washer is acceptable as a means to prevent turning of a device having a single-hole mounting means.

7.3 In an appliance provided with a panel or assembly that is moved in making or inspecting power-supply connections or is moved in packaging for shipment, a concentrated stress shall not be transmitted to the internal wiring connections when the panel or assembly is not secured in its intended position, and the internal wiring and the capillary tube of a thermostat shall not be crushed or kinked with the panel or assembly in any position.

7.4 The construction and intended method of installation of a counter-mounted cooking unit shall be such that, if the rough-in box and parts attached thereto become partially detached from the remainder of the assembly, a stress will not be transmitted to internal wiring connections.

7.5 An oven door of a range or wall-mounted oven that can be removed and replaced with or without the use of simple hand tools may be shipped separately provided:

a) The door is self-aligning during replacement, or the construction is such that alignment of the door is not necessary, and

b) Instructions for removing and replacing the door are provided.

7.6 A top surface of a counter-mounted cooking unit and the remainder of the unit may be shipped separately provided:

a) The units are marked in accordance with 83.7,

b) No electrical components are mounted on the top surface except:

1) Heating elements,

2) Leads factory connected to the heating elements, and

3) Receptacles provided for plug-in heating elements,

c) No insulated or uninsulated live parts or internal wiring are exposed on the remainder of the unit, and

d) The separate parts may be assembled without the necessity of flexing the heating element leads to an extent greater than that encountered in normal use and cleaning.

8 Protection Against Corrosion

8.1 All surfaces of sheet steel used for casing, backing, or support of electrical components shall be protected against corrosion by enameling, painting, galvanizing, anodizing, plating, or equivalent means.

Exception: Sheet steel with porcelain enamel applied only on the outside is acceptable.

9 Power-Supply Connections

9.1 General

9.1.1 With reference to Power-Supply Connections, Section 9, an appliance that incorporates a factory-installed feature or provision for a field-installed feature that is intended to be attached to the building structure is to be judged as an appliance that is attached to the building structure and shall have provisions for permanent attachment to the power supply. A slide-in type of range provided with trim strips to cover the opening between the range and the counter is not considered to be attached to the building structure.

Exception: An appliance intended to be built-in, by attachment to cabinetry, and rated 120 V, 1.75 kW (14.6 A) or less, may employ a flexible cord and attachment plug for connection to the power supply. Such an appliance shall not connect to external exhaust / ventilation connections.

9.1.2 An appliance that is intended for both permanent wiring and cord connection shall comply with the enclosure requirements in Frame and Enclosure, Section 6, under conditions of each intended supply connection configuration.

9.1.3 The requirements in 9.2.1.1 – 9.2.3.29 apply to all appliances, except those appliances that are intended to be connected to the power supply only through a factory-installed power supply cord.

9.1.4 An appliance provided with casters shall only be cord-connected and comply with Cord-Connected Appliances, Section 9.3.

9.2 Permanently connected appliances

9.2.1 General

9.2.1.1 An appliance intended for permanent connection to the power supply shall have provision for connection of a wiring system.

Exception: Leads provided for power-supply connection of an appliance may be brought out through factory-attached flexible conduit 3 – 6 ft (0.91 – 1.80 m) long. An outlet box or conduit fitting shall be provided at the free end of the conduit, or the conductor insulation at the free end of the conduit shall be protected from the sharp edges of the conduit during shipping by means of a tape wrap, a fiber bushing secured in place, or the equivalent.

9.2.2 Outlet or terminal boxes

9.2.2.1 An outlet or terminal box shall have sufficient volume to accommodate the intended wiring. A trial installation is to be made using wires of the size indicated in 9.2.3.2 and 9.2.3.3 and conduit and fittings sized for the wire in accordance with the National Electrical Code, ANSI/NFPA 70.

9.2.2.2 A terminal block intended for field connection of power-supply conductors shall be rated for connection to both copper and aluminum conductors.

9.2.2.3 Other than as noted in 9.2.2.4, an outlet or terminal box mounted integrally with a permanently connected cabinet-supported, wall-mounted, or counter-mounted appliance shall be located so that the power-supply connections can be inspected without moving the appliance to the extent that it will not be supported by the building structure only.

9.2.2.4 An outlet or terminal box mounted integrally with a counter-mounted cooking unit of the insert type shall be located so that the power-supply connections can be inspected without moving the assembly after it has been installed as intended.

9.2.2.5 An outlet or terminal box intended for power-supply connection and mounted integrally with the appliance shall be prevented from turning with respect to the appliance.

9.2.3 Wiring terminals and leads

9.2.3.1 A wiring terminal or lead is that terminal or lead to which a power-supply or equipment-grounding connection will be made in the field when the appliance is installed.

9.2.3.2 Wiring terminals intended for permanent connection to the power supply shall be rated for connection of conductors having an ampacity in accordance with the National Electrical Code, ANSI/NFPA 70, and the rating of the appliance, except that the National Electrical Code demand load is able to be applied only to a range.

9.2.3.3 Leads provided for permanent connection to the power supply shall be equal to or one standard size smaller – see Table 310-16 of the National Electrical Code, ANSI/NFPA 70 for standard sizes – than the required copper conductor size as determined in accordance with the National Electrical Code. See Table 9.1 for the minimum acceptable size of leads for an appliance rated 120/240 V, 3-wire; and Table 9.2 for the minimum acceptable size of leads for an appliance rated 120/208 V, 3-wire.

Table 9.1
Size of conductors for 120 / 240 V, 3-wire appliances

Appliance rating, W	Minimum conductor size, AWG		
	Ungrounded conductor L1 and L2	Neutral conductor	Grounding conductor
Wall-mounted and counter-mounted cooking units			
0 – 3,600	16	16	16
3,601 – 4,800	16	16	16
4,801 – 5,150	14	16	14
5,151 – 6,850	12	16	12
6,851 – 7,200	12	14	12
7,201 – 9,600	10	12	10
9,601 – 10,300	8	12	10
10,301 – 13,200	8	10	10
13,201 – 13,700	6	10	10
13,701 – 14,400	6	8	10
14,401 – 16,800	6	8	8
16,801 – 18,850	4	8	8
18,851 – 19,200	4	6	8
19,201 – 22,800	3	6	8
22,801 – 24,000	2	6	8
24,001 – 26,400	2	4	6
Ranges			
0 – 3,600	16	16	14
3,601 – 4,500	16	16	12
4,501 – 4,800	14	16	12
4,801 – 6,000	14	16	10
6,001 – 6,425	12	16	10
6,426 – 8,749	12	12	10
8,750 – 14,500	10	12	10
14,501 – 16,500	10	10	10
16,501 – 24,000	8	10	8
24,001 – 25,500	8	10	6
25,501 – 26,500	6	10	6
26,501 – 27,000	6	8	6

Table 9.2
Size of conductors for 120 / 208 V, 3-wire appliances

Appliance rating, W	Minimum conductor size, AWG		
	Ungrounded conductor L1 and L2	Neutral conductor	Grounding conductor
Wall-mounted and counter-mounted cooking units			
0 – 3,120	16	16	16
3,121 – 4,160	16	16	16
4,161 – 4,450	14	16	14
4,451 – 5,940	12	16	12
5,941 – 6,240	12	14	12
6,241 – 8,320	10	12	10
8,321 – 8,900	8	12	10
8,901 – 11,440	8	10	10
11,441 – 11,900	6	10	10
11,901 – 12,500	6	8	10
12,501 – 14,560	6	8	8
14,561 – 16,350	4	8	8
16,351 – 16,640	4	6	8
16,641 – 19,760	3	6	8
19,761 – 20,800	2	6	8
20,801 – 22,880	2	4	6
22,881 – 23,800	1	4	6
23,801 – 26,000	1	3	6
Ranges			
0 – 3,120	16	16	14
3,121 – 3,900	16	16	12
3,901 – 4,160	14	16	12
4,161 – 5,200	14	16	10
5,201 – 5,570	12	16	10
5,571 – 7,430	12	14	10
7,431 – 7,800	12	12	10
7,801 – 12,500	10	12	10
12,501 – 14,500	8	12	10
14,501 – 20,500	8	10	8
20,501 – 20,800	6	10	8
20,801 – 21,500	6	10	6
21,501 – 27,000	6	8	6

9.2.3.4 A wiring terminal shall be provided with a soldering lug or pressure terminal connector, firmly bolted or held by a screw.

Exception: A wire-binding screw or stud may be employed at a wiring terminal intended to accommodate a 10 AWG or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in position. See 9.2.3.5.

9.2.3.5 The provision of a wire-binding screw or stud for one terminal and pressure wire connectors for the remaining terminals is not acceptable.

9.2.3.6 A wire-binding screw or stud employed at a wiring terminal shall be 10 or larger.

Exception: A 8 screw or stud may be used at a terminal intended for connection of a 14 AWG conductor only. The screw or stud shall not have more than 32 threads per inch (25.4 mm). See 9.2.3.7.

9.2.3.7 It should be noted that 14 AWG is the smallest conductor that is acceptable for branch-circuit wiring, and thus is the smallest conductor anticipated at a terminal for connection of a power-supply wire.

9.2.3.8 A wire-binding screw employed at a wiring terminal shall thread into a metal terminal plate not less than 0.050 in (1.27 mm) thick, and there shall not be fewer than two full threads in the metal.

9.2.3.9 A terminal plate formed from stock having the minimum acceptable thickness specified in 9.2.3.8 may have the metal extruded at the tapped hole to provide the two full threads for the binding screw.

9.2.3.10 A wire-binding screw or stud shall employ upturned lugs or a cupped washer that will retain a conductor of the size mentioned in 9.2.3.4 – but not smaller than 14 AWG – under the head of the screw, nut, or washer.

9.2.3.11 The free length of a lead inside an outlet box or wiring compartment, or extending beyond the end of the flexible conduit provided in accordance with the Exception to 9.2.1.1 shall be 6 in (152 mm) or more.

9.2.3.12 A wiring terminal shall be securely and rigidly mounted, and shall be prevented from turning or shifting in position by means other than friction between surfaces.

9.2.3.13 The requirement in 9.2.3.12 is intended primarily to provide for the maintenance of spacings, as specified in Spacings, Section 26. Consideration is also to be given to the means for locking terminals in position to maintain tightness.

9.2.3.14 A pressure wire connector provided at a wiring terminal shall be prevented from turning so as to reduce spacings to values less than the minimum acceptable specified in Spacings, Section 26, except that, if such minimum or larger spacings are maintained with connectors turned 30 degrees toward each other or toward other metal parts, no means to prevent turning need be provided.

9.2.3.15 A permanently connected appliance rated 125 V or less, 125/250 V or less, 3-wire, 120/208 V, and employing a screw-shell lampholder or a single-pole switch other than an automatic control without a marked off position shall have one field-wiring terminal or lead identified for the connection of the grounded conductor of the supply circuit.

9.2.3.16 A terminal intended for the connection of a grounded power-supply conductor shall be of or plated with a metal 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.

9.2.3.17 A lead intended to be connected to a grounded power-supply conductor shall be finished to show a white or gray color, and shall be readily distinguishable from the other leads.

9.2.3.18 A lead provided for field connection to accomplish equipment grounding shall be bare, or shall be finished to show a green color with or without one or more yellow stripes. No other lead intended for field connection shall be so identified.

9.2.3.19 A wire-binding screw intended for the connection of an equipment-grounding conductor shall have a green-colored head that is hexagonal, slotted, or cross-recessed; and upturned lugs or the

equivalent shall be employed to retain the conductor. A pressure wire connector intended for the connection shall be marked in accordance with 82.7. The wire-binding screw or pressure wire connector shall be located so that it does not require removal during normal servicing of the appliance. A sheet-metal screw shall not be used for connection of an equipment-grounding conductor.

9.2.3.20 The wiring-terminal compartment of a wall-mounted oven or a counter-mounted cooking unit may include supplementary terminals for parallel connection of associated units, provided the terminal compartment is constructed so that the field-connected wiring system from the associated units and from the source of supply may be connected thereto. Connections to the source of supply may be provided in accordance with the Exception to 9.2.1.1.

9.2.3.21 The supplementary terminals mentioned in 9.2.3.20 are considered to be field-wiring terminals and, as such, all requirements regarding size, spacing, and the like for wiring terminals shall apply thereto.

9.2.3.22 The main wiring terminals mentioned in 9.2.3.20 shall be capable of securing conductors of sizes having ampacities that, according to the rating of the main and each associated unit and the National Electrical Code, ANSI/NFPA 70 demand load, are rated for supplying both the main and each associated unit as well as for supplying the main unit only. See 80.5, 82.2, and 82.21.

9.2.3.23 An opening in a wiring compartment for the connection to the power supply in the field, whether in the form of a knockout or an open hole, shall:

a) Have the minimum width of flat surface surrounding the opening as specified in Table 9.5 or

b) Be acceptable when the Test Gauge for Flat Surfaces Surrounding Knockout is applied as specified in the Standard for Metallic Outlet Boxes, UL 514A.

9.2.3.24 For an appliance that is intended to be connected to the power supply only by means of permanent wiring brought into the appliance, the knockout or opening in the wiring compartment for connection in the field shall be sized in accordance with the "Permanent Wiring Connection" column in Table 9.3 or Table 9.4, as applicable. See 82.10.

Table 9.3
Range connection opening sizes

Range rating, W		Diameter of connection opening, in (mm)											
		Permanent wiring connection						Cord set, cord-kit connection					
120/240 V 3-wire	120/208 V 3-wire	Minimum		Nominal		Maximum		Minimum		Nominal		Maximum	
0 – 8,749	0 – 7,800	0.860	(21.84)	7/8	(22.23)	0.906	(23.01)	1.094	(27.79)	1-1/8	(28.58)	1.140	(28.96)
8,750 – 16,500	7,801 – 12,500	1.094	(27.79)	1-1/8	(28.58)	1.140	(28.96)	1.360	(34.54)	1-3/8	(34.93)	1.406	(35.71)
16,501 – 22,500	12,501– 18,500	1.360	(34.54)	1-3/8	(34.93)	1.406	(35.71)	1.719	(43.66)	1-3/4	(44.45)[a]	1.765	(44.83)
22,501 – 25,500	18,501 – 20,500	1.360	(34.54)	1-3/8	(34.93)	1.406	(35.71)	–		–		–	
25,501 – 27,000	20,501 – 27,000	1.719	(43.66)	1-3/4	(44.45)	1.765	(44.83)	–		–		–	

[a] The connection opening may be reduced to a nominal 1-3/8 in diameter if the installation instructions provided with the appliance indicate that the appliance is to be connected using a power-supply-cord kit marked for use with a 1-3/8 in diameter opening.

Table 9.4
Wall- or counter-mounted cooking unit connection opening sizes

Range rating, W		Diameter of connection opening, in (mm)											
		Permanent wiring connection						Cord set, cord-kit connection					
120/240 V 3-wire	120/208 V 3-wire	Minimum		Nominal		Maximum		Minimum		Nominal		Maximum	
0 – 7,200	0 – 6,240	0.860	(21.84)	7/8	(22.23)	0.906	(23.01)	1.094	(27.79)	1-1/8	(28.58)	1.140	(28.96)
7,201 – 9,600	6,241 – 8,320	1.094	(27.79)	1-1/8	(28.58)	1.140	(28.96)	1.360	(34.54)	1-3/8	(34.93)	1.406	(35.71)
9,601 – 12,000	8,321 – 10,400	1.360	(34.54)	1-3/8	(34.93)	1.406	(35.71)	1.719	(43.66)	1-3/4	(44.45)[a]	1.765	(44.83)
12,001 – 13,200	10,401 – 11,440	1.360	(34.54)	1-3/8	(34.93)	1.406	(35.71)	–		–		–	
13,201 – 19,200	11,441 – 16,640	1.719	(43.66)	1-3/4	(44.45)	1.765	(44.83)	–		–		–	
19,201 – 22,800	16,641 – 19,760	1.958	(49.73)	2	(50.8)	2.015	(51.18)	–		–		–	
22,801 – 26,400	19,761 – 26,000	2.433	(61.72)	2-1/2	(63.5)	2.500	(63.5)	–		–		–	

[a] The connection opening may be reduced to a nominal 1-3/8 in diameter if the installation instructions provided with the appliance indicate that the appliance is to be connected using a power-supply-cord kit marked for use with a 1-3/8 in diameter opening.

Table 9.5
Sizes of flat surfaces surrounding connection openings

Nominal diameter of opening,		Corresponding trade size of conduit,	Minimum width of flat surface surrounding opening,	
in	(mm)	in	in	(mm)
0.875	(22.23)	1/2	0.133	(3.38)
1.109	(28.17)	3/4	0.156	(3.96)
1-3/8	(34.93)	1	0.198	(5.03)
1-3/4	(44.04)	1-1/4	0.274	(6.96)
2	(50.39)	1-1/2	0.315	(8.00)
2-1/2	(62.71)	2	0.353	(8.97)

9.2.3.25 An appliance that is intended to be connected to the power supply by means of either permanent wiring brought into the appliance or a power-supply cord kit shall be provided with:

a) Two knockouts (concentric or eccentric);

b) An opening inside a knockout; or

c) A reducing fitting in an opening.

The smaller knockout or opening, or the opening in the reducing fitting, shall be sized in accordance with the "Permanent wiring connection" column in Table 9.3 or Table 9.4, as applicable. The larger knockout, or the opening in which the reducing fitting is mounted, shall be sized in accordance with the "Cord-kit connection" column in Table 9.3 or Table 9.4, as applicable.

9.2.3.26 A knockout shall comply with the requirements in the Knockout Test, Section 65.

9.2.3.27 Concentric and eccentric knockouts shall be constructed so that any size knockout may be removed without disturbing the next larger size provided.

9.2.3.28 A compartment shall be provided to enclose field supply-wiring connections. The minimum free space for each conductor, other than an equipment grounding conductor, in the compartment shall not be less than specified in Table 9.6. Each conductor that originates outside the compartment and terminates inside the compartment is to be counted as one conductor. When determining the available free space within a compartment, the volume of any equipment grounding conductor, clamp, connector, or the like is to be deducted.

Table 9.6
Size of field-wiring compartment

Size of conductor		Minimum free space within compartment for each conductor	
AWG	(mm^2)	in^3	(cm^3)
18	(0.82)	1.5	(24.6)
16	(1.3)	1.75	(28.7)
14	(2.1)	2	(32.8)
12	(3.3)	2.25	(36.9)

Table 9.6 Continued on Next Page

Table 9.6 Continued

Size of conductor		Minimum free space within compartment for each conductor	
AWG	(mm^2)	in^3	(cm^3)
10	(5.3)	2.5	(41.0)
8	(8.4)	3	(49.2)
6	(13.3)	5	(81.9)

9.2.3.29 The distance between a pressure terminal connector intended for field wiring and the wall of an enclosure toward which the conductor is directed or through which the conductor may normally pass shall be as specified in Table 9.7.

Exception: Spacings may be less where a wall or obstruction lies outside the area occupied by a conductor that is bent or deflected to a radius not less than the distance specified in Table 9.7.

Table 9.7
Wire-bending space

Size of wire			Minimum bending space, terminal to wall			
			1 wire per pole		2 wires per pole[a]	
AWG or kcmil (mm^2)			in	(mm)	in	(mm)
14 – 10	AWG	(2.1 – 5.3)	Not specified		–	–
8 – 6	AWG	(8.4 – 13.3)	1-1/2	(38.1)	–	–
4 – 3	AWG	(21.2 – 26.7)	2	(50.8)	–	–
2	AWG	(33.6)	2-1/2	(63.5)	–	–
1	AWG	(42.4)	3	(76.2)	–	–
1/0 – 2/0	AWG	(53.5 – 67.4)	3-1/2	(88.9)	5	(127)
3/0 – 4/0	AWG	(85.0 – 107.2)	4	(102)	6	(152)
250	kcmil	(127)	4-1/2	(114)	6	(152)

[a] Applies to two conductors that are only able to approach a terminal from the same direction.

9.3 Cord-connected appliances

9.3.1 General

9.3.1.1 The requirements in 9.3.1.2 – 9.3.2.2 apply only to those appliances on which a factory-connected flexible cord is provided.

9.3.1.2 A range, a wall-mounted oven, a counter-mounted cooking unit, or a combination thereof that is not intended to be attached to the building structure – see 9.1.1 – may be provided with a power-supply cord for external connections.

9.3.1.3 A flexible cord shall be Type SRD, SRDT, S, SO, or ST.

Exception: A flexible cord provided with a wall-mounted oven or counter-mounted cooking unit or an appliance intended to be built-in as noted in the exception to 9.1.1, may be Type SJ, SJO, or SJT.

9.3.1.4 A cord set or power supply cord shall comply with the Standard for Cord Sets and Power-Supply Cords, UL 817.

9.3.1.5 A flexible cord provided with a wall-mounted oven or counter-mounted cooking unit shall have a temperature rating not less than the temperature of any surface that it is likely to contact. See 59.5.1.2 and 59.5.1.4.

9.3.1.6 A grounding lead of a flexible cord shall have a green color, with or without one or more yellow stripes, and no other lead shall be so identified.

9.3.1.7 A flexible cord and an attachment plug shall have a voltage rating not less than the rated voltage of the appliance, and shall have an ampacity in accordance with the rating of the appliance, except that the National Electrical Code, ANSI/NFPA 70 demand load is able to be applied only to a range. See 9.2.3.29.

9.3.1.8 Attachment plugs, receptacles, appliance couplers, appliance inlets (motor attachment plugs), and appliance (flatiron) plugs, shall comply with the Standard for Attachment Plugs and Receptacles, UL 498.

Exception: Attachment plugs and appliance couplers integral to cord sets or power supply cords that are investigated in accordance with the Standard for Cord Sets and Power-Supply Cords, UL 817, are not required to comply with UL 498.

9.3.1.9 Female devices (such as receptacles, appliance couplers, and connectors) that are intended, or that may be used, to interrupt current in the end product, shall be suitably rated for current interruption of the specific type of load, when evaluated with its mating plug or connector. For example, an appliance coupler that can be used to interrupt the current of a motor load shall have a suitable horsepower rating when tested with its mating plug.

9.3.1.10 For an appliance rated 120 V, 1.75 kW (14.6 A) or less, the size of the conductors of the flexible cord shall be based on the current rating of the appliance, and shall be in accordance with Table 9.8.

Table 9.8
Cord conductor size for appliances rated 120 V, 1.75 kW or less

Cord conductor size, AWG	Maximum current rating of appliance, A	
	Attachment plug connection crimped only	Attachment plug connection soldered, brazed, or welded[a]
18	8	10
16	10.4	13
14	14.4	14.6

NOTE – This table limits the appliance current on the basis of cord conductor size and type of connection between the cord conductors and blades of the attachment plug. For current limitation based on the attachment plug rating, see 9.3.1.11. For appliances rated in watts rather than amperes, the limitation shall be based on the equivalent current rating calculated using the supply voltage specified in 56.4.

[a] A soldered connection shall be mechanically secured before being soldered. A soldered connection that is crimped before being soldered is considered to be mechanically secured before soldering. A brazed or welded connection may additionally be mechanically secured before brazing or welding.

9.3.1.11 For an appliance rated 120 V, 1.75 kW (14.6 A) or less, the current rating of the attachment plug shall not be less than 125 percent of the current rating of the appliance.

9.3.1.12 The length of a flexible cord and attachment-plug assembly provided on an appliance shall not be less than 3 ft (0.91 m) nor more than 6 ft (1.83 m) measured from the face of the attachment plug to the point of entry into the appliance.

Exception: The length of external flexible cord and attachment-plug assembly provided on an appliance intended to be built-in, attached to the cabinetry and rated 120 V, 1.75 kW (14.6 A) or less, shall not be less than 3.0 (0. 91 m) nor more than 6 ft (1.82 m) in length.

9.3.1.13 The edges of the opening in the enclosure in which the power-supply cord strain relief is mounted, and the edges of an opening in a strain relief, bushing, fitting, or the like through which the power-supply cord passes, shall be smooth and free from burrs, fins, projections, sharp edges, and the like that may damage the insulation of the cord. The opening in which the power-supply cord strain relief is mounted shall be sized in accordance with the "Cord-kit connection" column in Table 9.3 or Table 9.4, as applicable.

Exception: The requirements regarding the opening size do not apply if the appliance is:

a) Provided with the instructions described in 86.12, or

b) Constructed in accordance with the Exception to 16.1.1.

9.3.2 Strain relief

9.3.2.1 Strain relief shall be provided at the enclosure so that mechanical stress on a flexible cord is not transmitted to terminals, splices, or internal wiring. See Section 64.

9.3.2.2 Means shall be provided to prevent the flexible cord from being pushed into the enclosure through the cord-entry hole if:

a) Such displacement is likely to subject the cord to mechanical damage or to expose the cord to a temperature higher than that for which it is acceptable, or

b) It is likely to reduce spacings, such as to a metal strain-relief clamp, below the minimum acceptable values.

9.3.2.3 Insulating bushings serving as strain relief shall comply with the Standard for Insulating Bushings, UL 635. Tests specified in this Standard (e.g. Strain Relief Test) may still need to be performed to confirm the combination of the insulating bushing and the supporting parts are suitable.

10 Internal Wiring

10.1 The wiring and connections between parts of an appliance shall be protected or enclosed, except that a power-supply cord may be employed on a range, a wall-mounted oven, a counter-mounted cooking unit, or a combination thereof for external connections.

10.2 The protection mentioned in 10.1 shall include a complete enclosure for all ungrounded internal supply leads directly connected to the branch-circuit supply leads, and for other unswitched internal wiring that would otherwise be exposed during normal cleaning after removal of drip pans, raising of top surfaces, or the like.

10.3 A length of jacketed flexible cord specified in the Exception to 9.3.1.3 may be employed for external connections between parts of an appliance if flexibility is essential.

10.4 With regard to enclosure of internal wiring, the protection of wiring specified in 10.2 is considered to exist if, when considered as if it were film-coated wire, the construction complies with 6.2.2.1.

10.5 Wires within an enclosure, compartment, raceway, or the like shall be disposed or protected so that no damage to conductor insulation can result from contact with any rough, sharp, or moving part such as a drawer, drip tray, door, etc., or from any utensil placed in a drawer or storage compartment.

10.6 Internal wiring shall not be located directly above a filter opening, although well-routed internal wiring may be visible through the opening when the filter units are removed.

Exception: This requirement does not apply to the leads to a blower motor.

10.7 The insulation on a conductor shall be acceptable for the voltage and temperature to which it is subjected during normal operation.

10.8 Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758 and shall have a flame rating of VW1.

Exception No. 1: Insulated conductors need not comply with UL 758 if they comply with one of the following:

a) The Standard for Thermoset-Insulated Wires and Cables, UL 44;

b) The Standard for Thermoplastic-Insulated Wires and Cables, UL 83; or

c) The applicable UL standard for other insulated conductor types specified in Wiring Methods and Materials, of the National Electrical Code, NFPA 70.

Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit not involving the risk of fire, electric shock, or injury to persons need not comply with UL 758.

Exception No. 3: Wiring in the appliance does not need to be VW-1 if all of the following criteria are met:

a) Wire insulation consists of silicone or inorganic materials with glass or aramid braid fiberous covering. [For reference, examples UL Style 3251, 3257, 5420]

b) Conductors shall be stranded copper wire having a 600 Vac minimum insulation rating for high voltage circuits and having a 300 Vac insulation rating for low voltage circuits. Maximum current rating would be based on Table 10.1.

c) The product is compliant to 77A for all electrical connections that involve internal wire not rated VW-1.

Table 10.1
Maximum Current Based on Wire Size

Wire size		Maximum Ampacity
mm^2	AWG	
0.41	22	3
0.66	20	5
0.82	18	10
1.3	16	15
2.1	14	20
3.3	12	25
5.3	10	30
8.4	8	40
The ampacities shown apply to appliances wire materials. For types of wires other than appliance wiring materials, the ampacity shall be determined from 310.15(B)(16) and 310.15(B)(17) in the National Electrical Code, ANSI/NFPA No. 70 for the type of wire employed. The correction factors of the referenced tables need not be applied.		

10.9 The wiring of a range shall be located so that it will not be exposed to the vapors discharged from an oven vent.

Exception: This requirement does not apply to the leads to a blower motor.

10.10 Internal wiring other than a grounding lead shall be reliably secured in place and shall be routed so that:

a) No wiring is located directly beneath the opening of a surface unit drip pan,

b) The wiring will return to its normal position following any movement associated with a user cleaning or servicing operation, and

c) The wiring is protected against spillage or accumulations of spillage during normal operation.

Exception: Wiring that may be exposed to accumulation of spillage in the compartment beneath a surface unit is acceptable provided the wiring is secured or supported so that a spacing of not less than 1/2 in (12.7 mm) is maintained between the wiring and a tray or other spillage-collecting surface after the units have been returned to their normal operating position following a user cleaning or servicing operation, and the spillage-collecting surface is accessible without the use of tools for cleaning by the user.

10.11 Wire routing devices employed to reduce likelihood of exposure of wires to higher than investigated end-use temperatures, rough, sharp, or moving parts, spillage or accumulations of spillage, or employed to segregate insulated conductors shall be constructed of plated steel, aluminum, painted steel, brass, porcelain enameled steel, or a polymeric material. These devices shall be provided with smooth rounded surfaces or equivalent means upon which the insulated conductors may bear and shall be investigated for the temperatures involved. Additionally, polymeric wire routing devices shall comply with the applicable requirements in the Standard for Positioning Devices, UL 1565.

10.12 A hole through which insulated conductors pass in a sheet-metal wall within the overall enclosure of an appliance shall be provided with a smooth, rounded bushing; or shall have smooth, rounded surfaces or an equivalent means upon which the insulated conductors may bear, to prevent abrasion of the insulation.

10.13 In addition to the requirements in 10.11, Insulating bushings shall comply with the Standard for Insulating Bushings, UL 635.

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

10.15 The insulation of a conductor that is connected at all times to the identified terminal or lead described in 9.2.3.16 and 9.2.3.17 shall be finished to show a white or gray color, and shall be readily distinguishable from the finish of the insulation on other conductors.

10.16 Aluminum conductors, insulated or uninsulated, used as internal wiring, such as for internal connection between current-carrying parts or as motor windings, shall be terminated by a method acceptable for the combination of metals involved at the point of connection.

10.17 With reference to the requirements in 10.14, a wire-binding screw or a pressure wire connector used as a terminating device shall be acceptable for use with aluminum under the conditions involved – for example, temperature, heat cycling, vibration, and the like.

10.18 Quick-connect type wire connectors shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated, they shall be rated for the voltage and temperature of the intended use. They shall be applied per the installation instructions of the wire connector manufacturer.

10.19 Quick-connect terminals, both connectors and tabs, for use with one or two 22 – 10 AWG copper conductors, having nominal widths of 2.8, 3.2, 4.8, 5.2, and 6.3 mm (0.110, 0.125, 0.187, 0.205, and 0.250 in), intended for internal wiring connections in appliances, or for the field termination of conductors to the appliance, shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310.

Exception: Other sizes of quick-connect terminals shall be investigated with respect to crimp pull out, insertion-withdrawal, temperature rise, and all tests shall be conducted in accordance with UL 310.

10.20 Wire connectors shall comply with the Standard for Wire Connectors, UL 486A-486B.

10.21 Splicing wire connectors shall comply with the Standard for Splicing Wire Connectors, UL 486C.

10.22 Single and multi-pole connectors for use in data, signal, control and power applications within and between electrical equipment, and that are intended for factory assembly to copper or copper alloy conductors, or for factory assembly to printed-wiring boards, shall comply with the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977.

10.23 Multi-pole splicing wire connectors that are intended to facilitate the connection of hard-wired utilization equipment to the branch-circuit conductors of buildings shall comply with the Standard for Insulated Multi-Pole Splicing Wire Connectors, UL 2459.

10.24 Equipment wiring terminals for use with all alloys of copper, aluminum, or copper-clad aluminum conductors, shall comply with the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

10.24.1 Figure 10.3 provides a flowchart of the flammability requirements for polymeric materials in connectors. All electrical connections where the total circuit load is greater than 60 W during normal operation shall:

a) Comply with 10.24.3, 10.24.4, and 10.24.5, or

b) Be evaluated as specified in Abnormal Operation – Nichrome Wire Test, Section 77A.

10.24.1.1 A risk of fire is considered to exist at any two points in a circuit where a power of more than 15 watts can be delivered into an external resistor connected between the two points within 5 seconds. To deliver 15 watts at a connector, the circuit must have a nominal load of 60 watts or more. This is based on the maximum power transfer theorem that shows an electrical connection can only dissipate 1/4 of the power of the load when the resistance of the connection is equal to the resistance of the load.

10.24.1.2 Electrical connections are not required to comply with 10.24.1 when all mating parts of the electrical connection are provided with a component (e.g. contacts within a switch or relay, connections within a motor, etc.) that complies with the relevant component standard. Electrical connections that are mated to the component from the appliance are required to comply with 10.24.1.

10.24.2 The requirements in 10.24.1 shall not apply to welded or soldered connections.

10.24.3 With reference to 10.24.1, components such as wire, tubing, sleeving, or tape that are located within 3 mm of an electrical connection as shown in Figure 10.1 shall have a flammability classification as follows:

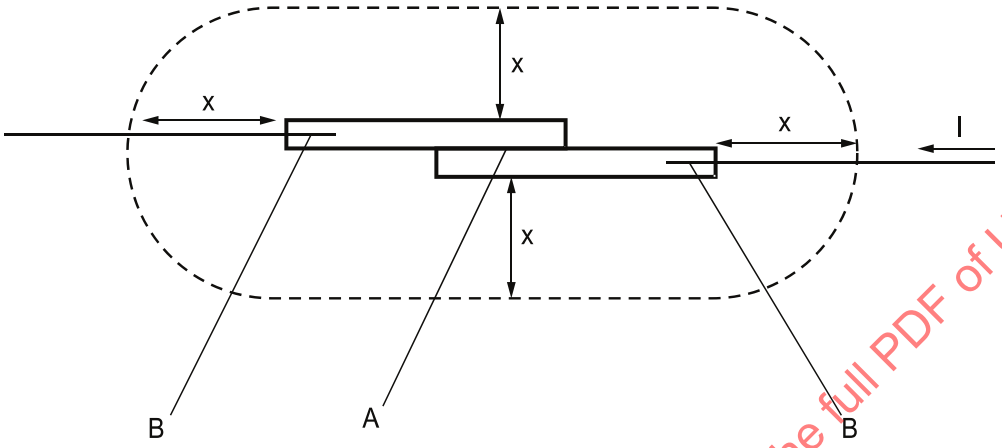
a) VW-1 for wire evaluated in accordance with the Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581;

b) VW-1 for tubing and sleeving evaluated in accordance with the Standard for Extruded Insulating Tubing, UL 224 or the Standard for Coated Electrical Sleeving, UL 1441; or

c) Evaluated in accordance with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510 for flame-retardant insulating tape.

Figure 10.1

Definition of “within 3 mm of an electrical connection”



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“Within 3 mm of an electrical connection” means falling within the dotted boundary formed by the cylinder with hemispherical ends, as shown in the above drawing.

A – Terminal connection zone

B – Wire crimp connection zone

I – Current through the connection

X – Distance from the connection

10.24.4 With reference to 10.24.1, polymeric materials located within 3 mm of an electrical connection as shown in Figure 10.1 shall have a flammability classification as follows:

a) A minimum V-0 or VTM-0, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94;

b) A minimum SC-0 or SCTC-0, in accordance with Standard for Tests for Flammability of Small Polymeric Component Materials, UL 1694;

c) A minimum glow wire ignition temperature (GWIT) of 775°C according to Fire Hazard Testing – Part 2-13: Glowing/Hot-wire Based Test Methods – Glow-wire Ignition Temperature (GWIT) Test Method for Materials, IEC 60695-2-13; or

d) The material withstands glow-wire test (GWT) according to Fire Hazard Testing – Part 2-11: Glowing/Hot-wire Based Test Methods – Glow-wire Flammability Test Method for End-products (GWEPT), IEC 60695-2-11 with a minimum test severity of 750°C, and during the test flames persists for no longer than 2 seconds.

10.24.5 With reference to 10.24.1, all non-metallic combustible materials located within the envelope of a vertical flame cylinder having a diameter of 20 mm and a height of 50 mm, placed above the center of the connection zone and on top of the non-metallic parts that are supporting current-carrying electrical connections as shown in Figure 10.2 shall have a flammability classification as follows:

a) minimum of V-0, VTM-0, or HF-1, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and Fire Hazard Testing – Part 11-10: Test Flames – 50 W Horizontal and Vertical Flame Test methods, IEC 60695-11-10;

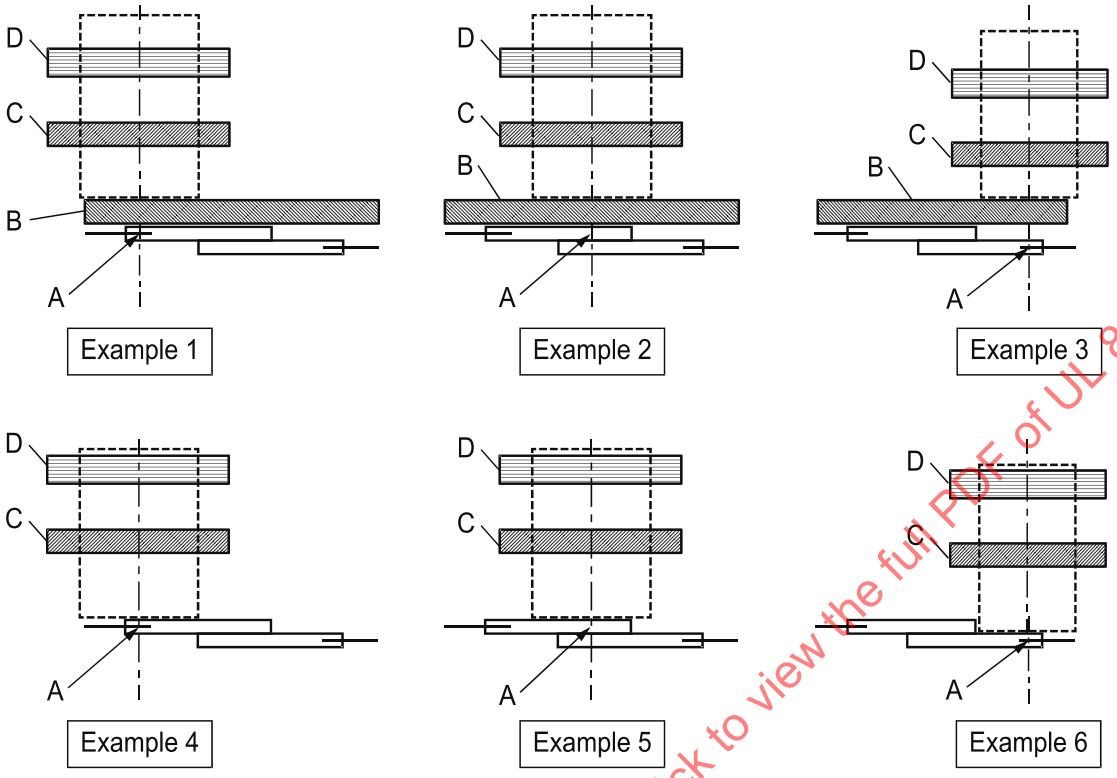
b) A minimum of SC-0 or SCTC-0, in accordance with the Standard for Tests for Flammability of Small Polymeric Component Materials, UL 1694; or

c) A minimum VW-1 for wire, tubing, sleeving and tape in accordance with 10.24.3.

10.24.6 With reference to 10.24.5 and Figure 10.2, the flame cylinder shall be placed above the center of each connection zone and on top of any polymeric parts that are supporting current-carrying connections as shown in Examples 1-3 of Figure 10.2. In the case of uninsulated connections, the flame cylinder shall be placed above the center of each connection zone and directly on top of current-carrying conductors as shown in Examples 4-6 of Figure 10.2. The flame cylinder shall project through all metallic and non–metallic material. If “C” is intended to act as a barrier to “D”, or if the flame cylinder extends beyond the outer enclosure of the appliance, then the adequacy of the barrier shall be demonstrated by testing as described in Abnormal Operation – Nichrome Wire Test, Section 77A.

Figure 10.2

Placement of flame cylinder



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A – Center of connection zone

B – Non-metallic material supporting current carrying connection

C – Metallic or non-metallic material

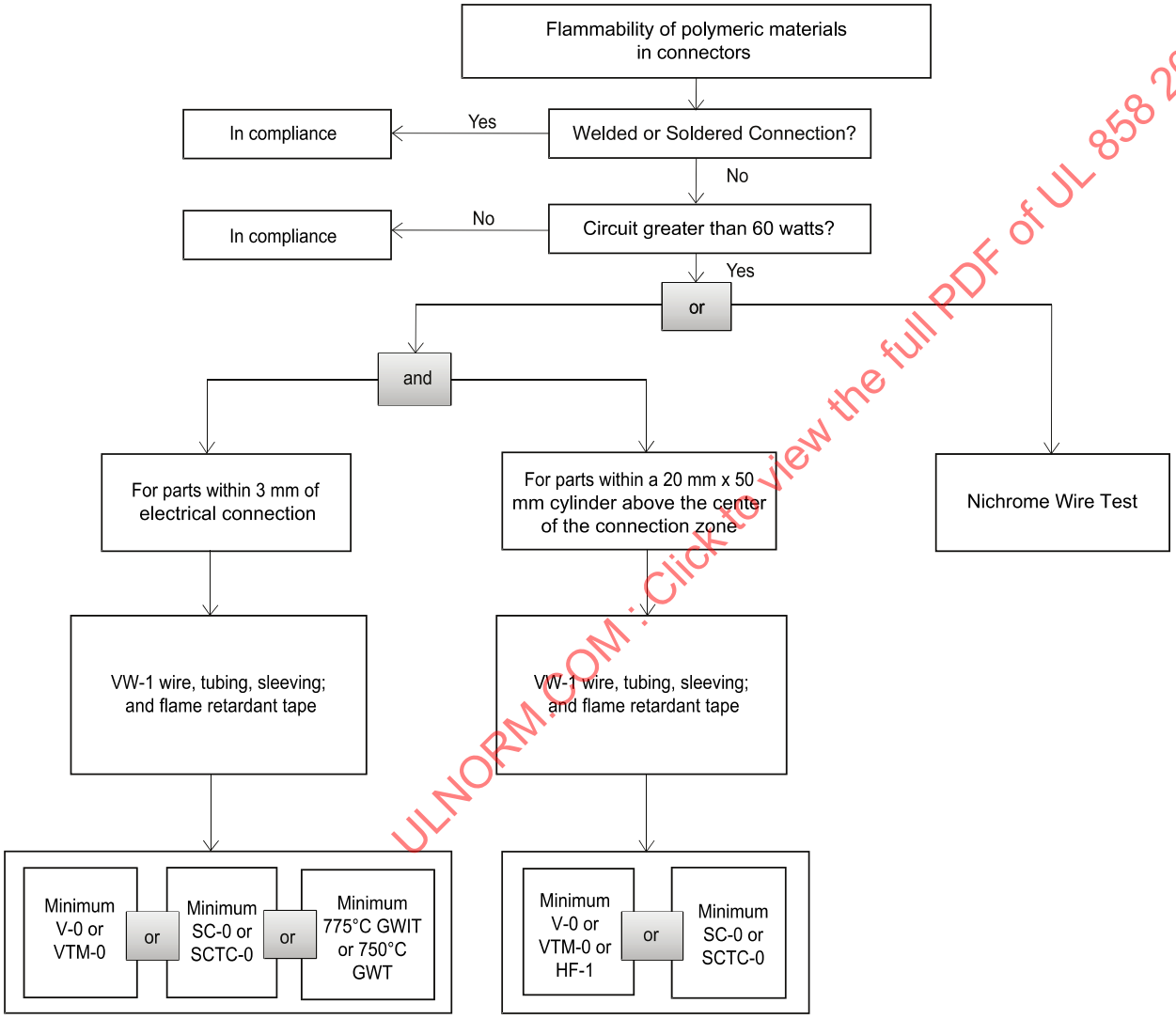
D – Metallic or non-metallic material

10.25 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and, if applicable, be suitably rated for field wiring.

Exception: A fabricated part performing the function of a terminal block need not comply with UL 1059 if the part complies with the requirements of Wiring terminals and leads, 9.2.3; Live Parts, Section 12; Electrical Insulation, Section 13; and Spacings, Section 26, of this end product Standard. This exception does not apply to protective conductor terminal blocks.

Figure 10.3

Flammability of polymeric materials in connectors



11 Separation of Circuits

11.1 Conductors of different circuits, including wires in a terminal box or compartment, shall be separated by barriers or shall be segregated.

Exception: Conductors other than those in a terminal box or field wiring compartment, provided with insulation acceptable for the highest voltage involved.

11.2 Internal wiring shall be separated or segregated from each uninsulated live part connected to a different circuit.

11.3 Segregation of insulated conductors may be accomplished by clamping, routing, or an equivalent means that will maintain permanent separation from insulated or uninsulated live parts of a different circuit.

11.4 A compartment intended for field installed conductors that contains provisions for connection of Class 2 or Class 3 circuit conductors, and Class 1, power, or lighting circuit conductors as defined in the National Electrical Code, ANSI/NFPA 70, shall be provided with a barrier to separate the conductors of the different circuits, or the arrangement of the compartment shall be such that a minimum spacing of 1/4 in (6.4 mm) can be maintained between the conductors of the different circuits including the conductors to be field installed.

11.5 With respect to 11.4, if the intended uses of an appliance are such that in some applications a barrier is required, a removable barrier or one having openings for the passage of conductors may be employed, provided instructions for the use of the barrier are a permanent part of the appliance, and complete instructions in conjunction with a wiring diagram may be used in lieu of a barrier if, upon investigation, the combination is found to be acceptable.

11.6 Segregation of field-installed conductors from other field-installed or factory-installed conductors and from uninsulated live parts of other circuits may be accomplished by arranging the location of the openings in the enclosure for the various conductors so that a permanent 1/4 in (6.4 mm) separation is maintained between the conductors or parts of different circuits. If the number of openings in the enclosure does not exceed the minimum required for the proper wiring of the appliance, and if each opening is located opposite a set of terminals, it is to be assumed – for the purpose of determining whether an appliance complies with the requirement in 11.4 – that the conductors entering each opening will be connected to the terminals opposite the opening. If more than the minimum number of openings are provided, the possibility of conductors entering at points other than opposite the terminals to which they are intended to be connected and contacting uninsulated conductors or uninsulated current-carrying parts connected to a different circuit is to be investigated. To determine whether an appliance complies with the requirement in 11.4, it is to be wired as it would be in service; and in doing so, a reasonable amount of slack is to be left in each conductor, within the enclosure, and no more than average care is to be exercised in stowing this slack in the wiring compartment.

11.7 Field-installed conductors of any circuit shall be separated by barriers from uninsulated live parts of any other circuit of the appliance, and from any uninsulated live part the short-circuiting of which results in unintentional operation of the appliance.

Exception No. 1: A construction in which field-installed conductors are able to make contact with wiring terminals is acceptable provided that conductors rated for 600 V are or will be installed.

Exception No. 2: A construction in which field-installed conductors are able to contact low-voltage-wiring terminals is acceptable if the conductors have insulation rated for use at a voltage less than 600 V and the short-circuiting of such terminals does not result in a risk of fire, electric shock, or injury to persons.

11.8 A barrier used to provide separation between the wiring of different circuits, shall be:

a) Of metal or of insulating material;

b) Of the necessary mechanical strength if exposed or otherwise likely to be subjected to mechanical damage; and

c) Reliably held in place.

11.9 Unclosed openings in a barrier for the passage of conductors shall not be larger in diameter than 1/4 in (6.4 mm) and shall not exceed in number, on the basis of one opening per conductor, the number of wires that will need to pass through the barrier. The closure for any other opening shall present a smooth surface wherever an insulated wire may be in contact with it; and the area of any such opening, with the closure removed, shall not be larger than required for the passage of the necessary wires.

11.10 A metal barrier shall have a thickness at least equal to the required thickness of the enclosure metal.

11.11 A barrier of insulating material shall have a thickness not less than 0.028 in (0.71 mm), and shall be thicker if it may be readily deformed so as to defeat its purpose.

12 Live Parts

12.1 Friction between surfaces is not acceptable as a means to prevent the turning of live parts, but a properly applied lock washer may be accepted.

12.2 The metal employed for any current-carrying part shall be acceptable for the application.

12.3 Plated iron or steel may be used for a current-carrying part only if the temperature during normal operation is greater than 100°C (212°F), but unplated iron or steel shall not be used regardless of temperature.

12.4 Stainless steel and other corrosion-resistant alloys may be used for current-carrying parts regardless of temperature.

12.5 Polymeric materials that support live parts, are in contact with uninsulated live parts, or serve as an electrical or mechanical barrier shall comply with the requirements for polymeric materials as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, as follows:

a) Hot Wire Ignition (HWI) – This test applies to a material that is in contact with an uninsulated live part. As an alternative, the Abnormal Overload Test, or the Glow-Wire End-Product Test as specified in UL 746C may be conducted.

b) Resistance to Impact – This test applies to a material that is subject to external impacts. A 5 ft-lbf (6.8 J) impact is to be used for the ball impact.

c) Maximum Use Temperature – The maximum operating temperature of the part shall not exceed the temperature rating for the material of that part.

d) Volume-Resistivity and Dielectric Voltage-Withstand Strength Tests – These tests apply to materials that serve as insulation between uninsulated live parts of opposite polarity or between uninsulated live parts and:

1) Dead metal parts that may be grounded; or

2) Any surface likely to be contacted by persons.

e) Comparative Tracking Index (CTI)– This test applies to insulating materials that are:

1) In contact with or in close proximity to [1/32 in (0.8 mm) or less] two or more uninsulated live parts;

2) Between an uninsulated live part and a deal metal part that may be grounded; or

3) Between an uninsulated live part and any surface exposed to contact by persons.

A maximum CTI Performance Level Category (PLC) of 2 is required for materials likely to be exposed to grease, cooking vapors, or other severe contaminant environments during normal use. A maximum CTI PLC of 3 is required for materials exposed to a general environment. A maximum CTI PLC of 4 is required for materials that are protected from airborne contaminants, high humidity and condensation.

Exception No. 1: This test is not applicable if the minimum spacing between an uninsulated live part and another live part, dead metal part, or surface exposed to contact by persons is 1/2 in (12.7 mm) or more.

Exception No. 2: The Inclined-Plane Tracking Test shall be used to evaluate the tracking resistance of materials at potentials greater than 600 V instead of CTI.

f) Dimensional Change after Water Exposure – This test applies to insulating materials that:

1) Are exposed to prolonged contact with water during normal use; and

2) Maintain the relative positioning of live parts.

g) Mold Stress-Relief Distortion – This test applies to all molded parts constructed of thermoplastic materials that serve as a direct or indirect support of live parts, or as an insulator or barrier. This test is not applicable to parts constructed of thermoset materials.

h) High-Current Arc Resistance to Ignition (HAI) – This test is applicable to materials that are in contact with or in close proximity [1/32 in for nonarcing parts, 1/2 in (12.7 mm) for arcing parts] to uninsulated live parts.

Exception: The High-Current Arc Resistance to Ignition (HAI) Test specified in UL 746C may be conducted on production samples. The current for the arcing test is to be equal to the maximum normal current through live parts in close proximity to the material, at minimum power factor.

13 Electrical Insulation

13.1 General

13.1.1 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 will not be adversely affected by the temperatures to which they will be subjected under conditions of actual use. Molded parts shall be constructed so that they will have the necessary mechanical strength and rigidity to withstand the stresses of actual service.

13.1.2 Insulating material employed in an appliance shall be judged with respect to the application. Materials such as mica, some molded compounds, and certain refractory materials are usually acceptable for use as the sole support of live parts; and some other materials that are not acceptable for general use, such as magnesium oxide, may be acceptable if used in conjunction with other acceptable insulating materials, or if located and protected so that mechanical damage is prevented and the absorption of moisture is unlikely. 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-resistance qualities, the degree to which it is enclosed or protected, and any other feature having a bearing on the risk of fire, electric shock, and injury to persons involved, in conjunction with conditions of

actual service. All of these factors shall be considered with respect to thermal aging. The appropriate tests in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, see Electrical Insulation, Section 13, shall be used to evaluate a material for the above mentioned properties.

13.1.3 Insulating parts shall be securely held in such a manner that there will be no cracking or breaking under any normal condition of use.

13.1.4 Sleeving or tubing used as an insulator for uninsulated live parts (such as glass fiber in rope heaters) shall be disposed or protected so that no damage to the sleeving or tubing results 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.

13.1.5 The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required to fulfill the requirements of 13.1.4, or a performance requirement of this Standard. In such cases:

a) Insulating tape shall comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510;

b) Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441; and

c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

13.1.6 A printed-wiring board shall comply with the requirements in the Standard for Printed-Wiring Boards, UL 796. A printed-wiring board shall be rated V-1 or better.

13.2 Film-coated wire (magnet wire)

13.2.1 The component requirements for film coated wire and Class 105 (A) insulation systems are not specified.

13.2.2 Film coated wire in intimate combination with one or more insulators, or the magnet wire of induction heating coil, incorporated with an insulation system rated Class 120 (E) or higher, shall comply with the magnet wire requirements in the Standard for Systems of Insulating Materials – General, UL 1446, and shall have a suitable temperature class.

14 Thermal Insulation

14.1 Material used for thermal insulation of an oven or similar heating compartment shall be noncombustible.

14.2 Electrically conductive thermal-insulating material shall not contact uninsulated live parts.

14.3 With reference to the requirement in 14.2, some types of mineral-wool thermal insulation contain conductive impurities in the form of slag, which may create a risk of electric shock or fire if it contacts an uninsulated live part.

14.4 Thermal insulation shall have a flammability rating of HBF, V-2, V-1, V-0 or 5V in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, or shall be tested in accordance with the Standard for Tests for Surface Burning Characteristics for Building Materials, UL 723. Fiberglass insulation is considered to comply with this requirement.

Exception: Thermal insulation which is enclosed in a metal or 5V rated material and is not exposed to electrical parts is not required to possess a flame rating. For the purpose of this requirement, the following components are not to be considered electrical parts:

a) VW-1 wiring;

b) A part enclosed in metal or 5V material; and

c) A component provided with an integral enclosure complying with the enclosure requirements for that component.

15 Lampholders

15.1 Except for a lampholder for a pilot light or indicating lamp requiring the use of tools for replacement, no lampholder shall be supplied as part of the appliance unless the appliance is intended for use only on a supply circuit operating at 250 V or less to ground having a grounded conductor and the screw shell is electrically connected to the grounded conductor. If the appliance is furnished with a cord, a polarized attachment plug shall be employed. See 82.17 and 84.1.2.

15.2 A lampholder shall be constructed and installed so that an uninsulated live part other than the screw shell will not be exposed to contact by persons removing or replacing a lamp in normal service.

Exception: The requirement does not apply if, in order to remove or replace a lamp, it is necessary to dismantle the appliance or to remove a cover plate or other part by means of a tool.

15.3 A lampholder having a paper liner shall not be employed.

15.4 A lampholder having an aluminum screw shell shall not be employed in an oven.

15.5 Wiring of a lighting fixture used on an electric range shall be enclosed.

15.6 Lampholders and indicating lamps with integral lamp/lampholder (e.g. neon pilot lamp) shall comply with the Standard for Lampholders, UL 496.

15.7 Lighting ballasts shall comply with one of the following:

a) The Standard for Fluorescent-Lamp Ballasts, UL 935; or

b) The Standard for High-Intensity Discharge Lamp Ballasts, UL 1029.

Exception: Ballasts for other light sources shall comply with the appropriate UL standard.

15.8 An automatic or manual starters intended for use with fluorescent lamps shall comply with the requirements in the Standard for Fluorescent Lamp Starters, UL 542.

15.9 Light emitting diode (LED) light sources shall comply with the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

Exception: Individual LED light sources mounted on printed-wiring boards and intended for indicating purposes need not comply with UL 8750, but shall comply with the applicable requirements of this end product Standard.

16 Grounding

16.1 Grounding means

16.1.1 An appliance shall have provision for grounding all dead metal parts that are able to become energized as described in 16.1.2.

Exception No. 1: An appliance that is provided with a 3-conductor power-supply cord or power-supply cable assembly, that is rated 125/250 V or less, including an appliance rated 120/208 V, and that is marked in accordance with 82.6 is not required to have the provision for grounding.

Exception No. 2: A grounding conductor of a component is not required to be larger than the conductors supplying power to the component.

16.1.2 The provision for grounding mentioned in 16.1.1 shall consist either of:

a) A pressure wire connector or a wire-binding screw; or

b) A grounding lead having a size not less than that required by the National Electrical Code, ANSI/NFPA 70 factory-connected to the frame of the appliance and brought out through the length of conduit provided for the power-supply leads. The grounding lead is able to be bare or insulated and, if insulated, the surface shall be green with or without one or more yellow stripes.

16.1.3 For a cord-connected appliance that is rated 120 V, 1.75 kW (14.6 A) or less, and that is not intended to be attached to the building structure, provision for grounding shall consist of the grounding conductor of the power supply cord. The grounding conductor shall be:

a) Constructed in accordance with 9.3.1.6,

b) Connected to the grounding blade of a grounding type attachment plug,

c) Connected to the frame of the appliance so that it is not required to be removed during any servicing operation not involving the supply cord. Solder alone does not meet the intent of this requirement for making this connection, and

d) Of a size not less than that required by Section 250-95 of the National Electrical Code, ANSI/NFPA 70.

16.1.4 The pressure wire connector or wire-binding screw mentioned in 16.1.2 (a) shall be capable of securing a grounding lead of the size required by the National Electrical Code, ANSI/NFPA 70.

16.1.5 The pressure wire connector, wire-binding screw, or lead mentioned in 16.1.2 shall be located in the field-wiring compartment and shall be identified in accordance with 9.2.3.18 and 9.2.3.19.

16.2 Grounding link

16.2.1 In addition to the provision for grounding required by 16.1.1, a 3-wire appliance rated 125/250 V or less, including an appliance rated 120/208 V, shall be equipped with a detachable link or the equivalent by which dead metal parts may be connected to the grounded wiring terminal.

Exception: The grounding terminal and the link may be omitted if a conductor as described in 16.1.2(b) is provided. The grounding lead is to be connected to the white or neutral lead by twisting or by a connection means with both leads extending an equal distance beyond their point of connection. The neutral conductor need not be larger than required by the rating of the appliance. See 82.9.

16.2.2 An appliance provided with a 4-conductor power-supply cord having a grounding conductor as described in 9.3.1.6 shall not be provided with the link mentioned in 16.2.1 and the grounding conductor of the flexible cord shall be connected to the equipment-grounding terminal.

16.2.3 The grounding link shall be copper and have a cross-sectional area not less than that of a conductor of the size required by the National Electrical Code, ANSI/NFPA 70 for equipment grounding.

16.2.4 The connection between dead metal parts of an appliance and the grounded terminal or lead by means of the link mentioned in 16.2.1 shall be made at the factory, and the link shall be accessible for inspection after the appliance is installed. See 82.4.

16.2.5 The grounded terminal of the appliance mentioned in 16.2.1 shall be capable of securing a conductor that will not be less than 10 AWG. If leads or a 3-conductor cord or cable assembly are provided, the grounded conductor shall not be smaller than 10 AWG copper.

16.3 Dead metal parts

16.3.1 Dead metal parts of the appliance that may become energized and are normally exposed to contact by persons, including a remotely-mounted ventilating hood, shall be reliably electrically connected to the equipment-grounding wiring terminal or lead, and to the point at which the power-supply circuit will be connected.

16.3.2 Resting on, overlapping of, or friction fit to the main frame is not acceptable as a grounding means for any factory or field installed accessory, or for any heating unit employed. Grounding shall be by a positive means, such as a bolted or screwed connection or with a bonding conductor. The bonding connection shall reliably penetrate nonconductive coating, such as paint.

Exception: Not more than two spring-contact connections, in series, as described in 16.3.3, may be employed in the grounding path between a sheathed heating element and the provision for grounding.

16.3.3 Upon insertion of a removable element, such as a surface, oven, or broiler element utilizing spring-contact connections, the grounding connection shall be engaged before the power connection to the element begins to engage.

16.3.4 A wire employed for grounding a part to the frame shall be copper conductor not smaller than 14 AWG. The connection of the grounding conductor shall not depend upon solder. If flexing will occur, a stranded conductor having insulation that is green with or without one or more yellow stripes shall be provided. If flexing is not encountered, and where the wire will not come in contact with any uninsulated live part, a bare, solid copper conductor is acceptable for grounding.

Exception: A grounding conductor of a component, such as a motor, is not required to be larger than the conductors supplying power to the component.

16.3.5 The construction of a removable part such as an oven lining, that may become energized and that is intended to be removed during user cleaning, shall be such that a reliable ground connection is reestablished each time that part is reinserted in the appliance.

17 Capacitors

17.1 A capacitor of a capacitor motor, and a capacitor connected across the line, such as a capacitor for radio-interference elimination or power-factor correction, shall be housed within an enclosure or container that will protect the plates against mechanical damage, and that will prevent the emission of flame or molten material resulting from breakdown or malfunction of the capacitor. The container shall be of metal

providing a strength and protection not less than that of coated steel having a minimum thickness of 0.020 in (0.51 mm).

Exception: The individual container of a capacitor may be of sheet metal thinner than specified, may be of material other than metal, or may be an integral part of the capacitor itself, provided the capacitor is mounted in an enclosure that houses other parts of the appliance, and provided that such box, case, or the like is acceptable for the enclosure of live parts.

17.2 The total capacitance of capacitors connected from one side of the line to the frame or enclosure of an appliance shall be such that not more than 5 mA will flow in the grounding conductor when the frame or enclosure is connected to ground.

17.3 With reference to 17.2, a capacitor connected between one side of the line and neutral is acceptable.

17.4 A capacitor shall comply with the Standard for Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14, or the Standard for Capacitors, UL 810.

18 Heating Elements

18.1 A heating element shall be constructed so that any motion that might occur during normal cleaning will not concentrate any stress on electrical connections.

18.2 A sheathed heating element shall comply with the requirements in the Standard for Sheathed Heating Elements, UL 1030.

18.3 A heating element shall be supported in a substantial and reliable manner.

18.4 To determine whether a heating element complies with the requirement in 18.3, consideration is to be given to sagging, loosening, and other adverse conditions of the element that may result from the most severe condition of use, such as cycling or continuous heating, and that may affect the test results.

18.5 If an air stream is employed so that the appliance will comply with the requirements in the temperature and abnormal tests with a heating element energized, the appliance shall be electrically connected so that the air moving device is energized whenever the element is energized. See 18.6 and 60.1.

18.6 If the absence of the air stream described in 18.5 would not be apparent to the user:

a) A heating element shall be controlled so that it can be energized only when the air stream is present; or

b) An oven-heating element shall comply with the following applicable requirements:

1) For all ovens – Abnormal Operation – Stalled-Fan Test, Section 62.

2) For self-cleaning ovens – 96.1.1 – 96.1.4.

19 Motors and Motor Protection

19.1 Motors

19.1.1 A motor shall be capable of driving the maximum normal load that may be applied to the motor without creating a risk of fire or electric shock.

19.1.2 A motor shall comply with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1.

19.1.3 Motors located in a low voltage circuit are evaluated for the risk of fire and personal injury in accordance with the applicable requirements of this end product Standard.

19.1.4 The motor of a fan in a ventilating hood shall be:

a) Located so that it will not be in the contaminated air stream from the cooking equipment; or

b) Constructed so that grease will not accumulate on the motor windings – such as by use of a totally enclosed motor, or by encapsulation of the windings in a substantial thickness of material that is resistant to grease.

19.1.5 A brush-holder assembly shall be constructed so that when a brush is worn out – no longer capable of performing its function – the brush, spring, and other parts of the assembly will be retained to the degree necessary:

a) To reduce the likelihood of accessible dead metal parts becoming energized; and

b) To reduce the likelihood of live parts becoming accessible.

19.2 Motor protection

19.2.1 An appliance employing a motor shall incorporate overload protection as part of the appliance.

19.2.2 Any of the following types of motor-overload protection is considered to comply with the requirements in 19.2.1:

a) A motor provided with inherent overtemperature protection shall be acceptable for use in the circuit to which the appliance would normally be connected and comply with one of the following:

1) The Standard for Thermally Protected Motors, UL 1004-3; and

2) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2 Particular Requirements for Thermal Motor Protectors, UL 60730-2-2; in conjunction with the Standard for Thermally Protected Motors, UL 1004-3, (to evaluate the motor-protector combination).

Exception: 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 required to have locked-rotor protection only.

b) An impedance-protected motor complying with the applicable requirements for locked-rotor protection in the Standard for Impedance Protected Motors, UL 1004-2, when tested as used in the appliance. An impedance protected motor that is subjected to restricted ventilation or to an external source of heat is to be tested in the appliance to determine whether it complies with the locked-rotor requirements.

c) A clock or timer motor provided with locked-rotor protection.

d) A motor for use in a ventilating-hood system that complies with the requirements for overload protection in the Standard for Electric Fans, UL 507.

19.2.3 Electronic protection integral to the motor shall comply with the Standard for Electronically Protected Motors, UL 1004-7.

19.2.4 Except as indicated in 19.2.3, electronically protected motor circuits shall comply with one of the following:

a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991. When the protective electronic circuit is relying upon software as a protective component, it shall comply with the requirements in the Standard for Software in Programmable Components, UL 1998. If software is relied upon to perform a safety function, it shall be considered software Class 1;

b) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1. If software is relied upon to perform a safety function, it shall be considered software Class B; or

c) The Standard for Power Conversion Equipment, UL 508C.

d) The Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy, UL 61800-5-1.

Exception: Compliance with the above standards is not required for an electronically protected motor circuit if there is no risk of fire, electric shock, or injury to persons during abnormal testing with the motor electronic circuit rendered ineffective; compliance with the applicable requirements of this end product Standard is then required.

19.2.5 With reference to 19.2.2 (b) and (d), the 15-day stalled-rotor test may be conducted in a test oven set to represent the ambient temperature at the motor location within the appliance during normal operation of the appliance.

19.2.6 The protection in accordance with the requirements in 19.2.1 – 19.2.5 shall function to accomplish the intended result at each setting of the speed-control device of a multispeed motor.

20 Overcurrent Protection

20.1 Overcurrent protection shall be provided as part of a range, wall-mounted oven, counter-mounted cooking unit, or combination thereof for each heater unit rated more than 30 A. If the maximum current demand of the complete appliance, when calculated in accordance with the National Electrical Code, ANSI/NFPA 70, demand load, is more than 60 A, it shall have two or more circuits provided as a part of the appliance, each of which shall have overcurrent protection rated not more than 50 A.

20.2 A fuse rated 300 V and used in a 480Y/277 V appliance shall be used only in a line-to-neutral circuit.

20.3 A transient voltage suppression assembly provided as part of an appliance shall comply with the requirements in the Standard for Surge Protective Devices, UL 1449.

20.4 Overcurrent protection shall be provided, by a circuit breaker or fuse that is acceptable for branch circuit use, as a part of a range, wall-mounted oven, counter-mounted cooking unit, or combination thereof, for each receptacle circuit included in the appliance.

Exception: The overcurrent protection may be omitted if the appliance would properly be connected to a branch circuit rated not more than 20 A.

20.5 With reference to 20.4, a 15-A protective device shall be provided when a single 15-A receptacle outlet is furnished. Two or more 15-A receptacles, two separate receptacles or a duplex receptacle, shall be protected by either a 15- or 20-A protective device. A 20-A receptacle or a combination of 15- and 20-A receptacle shall be protected by a 20-A protective device.

20.6 A fuseholder intended for the fuse mentioned in 20.4 shall be of Type S construction, or shall be of the Edison-base type with a factory-installed nonremovable adapter of Type S construction.

20.7 An overcurrent protective device shall not be connected in a grounded conductor unless the device opens all the supply conductors simultaneously.

20.8 The center contact of a plug-type fuseholder shall be connected to the line side under all conditions of use.

20.9 An overcurrent-protective device shall be:

a) Contained within the enclosure of the appliance;

Exception: The reset or operating mechanism of a manually reset device may project outside the enclosure.

b) Acceptable for the application, and

c) Readily visible and accessible for the purpose of resetting or replacing when, to gain access to the device, a door or cover is opened, a surface unit is raised or removed, or a drawer is removed.

20.10 A fuseholder, circuit breaker, or circuit protector shall be installed so that it will be protected against mechanical damage.

20.11 A fuseholder shall be constructed and installed so that no uninsulated live part other than the screw shell or clips will be exposed to contact by a person removing or replacing a fuse.

20.12 A door or a cover of an enclosure shall be hinged or otherwise attached in an equivalent manner if it gives access to any overcurrent-protective device, the normal functioning of which requires renewal; or if it is necessary to open the door or the cover in connection with the normal operation of the device, except in the case of an overcurrent-protective device located within the enclosure of the appliance and accessible upon the removal or displacement of a heating element or the opening of a drawer or utility-compartment door.

20.13 If a fuseholder is located in a compartment having restricted volume, such as behind a backsplash plate or in a separate fuseholder compartment, means shall be provided to hold the door or cover over the fuseholder in a closed position. The door or cover shall be tight-fitting, and shall:

a) Shut against a rabbet with an overlap of not less than 1/8 in (3.2 mm);

b) Telescope with a surrounding enclosure with a flange width of not less than 1/8 in; or

c) Have a flat – unflanged – overlap of not less than 1/4 in (6.4 mm) with the surrounding enclosure.

20.14 The requirement in 20.13 does not apply in the case of a fuseholder mounted in a utility compartment or in the wiring space beneath surface elements.

20.15 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1; and the applicable UL 248 Part 2 (e.g. Low-Voltage Fuses – Part 5: Class G Fuses, UL 248-5). Defined use fuses that comply with UL 248-1 and another appropriate UL standard for the fuse are considered to comply with this requirement.

20.16 Fuseholders shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1 , and the applicable Part 2 (e.g. Fuseholders – Part 9: Class K, UL 4248-9).

20.17 When provided, circuit breakers shall comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489.

Exception: Circuit breakers used in telecommunications circuitry that comply with the Standard for Circuit Breakers for Use in Communications Equipment, UL 489A, need not comply with UL 489.

20.18 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

20.19 Supplementary protectors shall comply with the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077.

21 Transformers

21.1 A transformer in a circuit involving a risk of fire or electric shock shall comply with the requirements in one of the following:

a) The Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1;

b) The Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2; or

c) The Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.

Exception No. 1: A transformer located within another component (for example, a power supply or temperature control) need not comply with this requirement provided that the overall assembly meets the requirements for that component.

Exception No. 2: A transformer located in a pollution degree 1 or 2 environment need not comply with this requirement provided that the transformer complies with the requirements in the Standard for Transformers and Motor Transformers for Use in Audio-, Radio-, and Television-Type Appliances, UL 1411.

21.2 Neon sign transformers shall comply with the Standard for Neon Transformers and Power Supplies, UL 2161.

22 Accessories for Field-Installation

22.1 An accessory intended for field installation shall be constructed so that such installation can be accomplished without disturbing the factory-installed wiring or assembly of the accessory or appliance, except that the removal of a cover plate, panel, or the like is acceptable. See 82.13 and 82.14.

22.2 The electrical connection of an accessory shall be accomplished by the use of plug-in connectors and receptacles, or by other similar means.

22.3 A control switch for an accessory motor shall be factory-assembled either to the appliance or to the accessory.

23 Filters and Vents

23.1 Each filter employed in a ventilating hood shall be readily removable for cleaning or replacement. See 83.8.

23.2 Each filter employed in a ventilating hood or with a fan shall be a heat transfer media that complies with the requirements for air filters in the Standard for Air Filter Units, UL 900.

Exception: A fan or ventilating hood employing one or more filters with or without one or more filters that complies with the requirements for air filters in UL 900, is acceptable if, when tested, the filter of a single-filter fan and the assembly of filters of a multifilter fan is found to comply with the requirements for air filters in UL 900, specified for that fan or hood. A test on an assembly of filters is to be conducted with the filters mounted in the normal manner.

23.3 Air filter units covered by the Standard for Air Filter Units, UL 900, are classified as those that, when clean, burn moderately when attacked by flame or emit moderate amounts of smoke, or both.

23.4 A range or oven that includes a fan and integral duct assembly for removal of grease-laden air shall be constructed so that cleaning of the fan and internal surfaces of the duct can be accomplished without completely removing the range or oven from its installed position.

Exception: A construction that does not comply with the requirement may be acceptable if it can be demonstrated by tests with all filters in place that accumulation of grease on internal surfaces of the duct that cannot be cleaned will not create a risk of fire. The tests consist of producing conditions that result in excessive amounts of grease-laden air at the duct intake followed by an evaluation of the possibility of flame propagation along the surfaces of the duct.

23.5 The oven cavity of a wall-mounted oven shall not be vented into the building structure or cabinet in which it is mounted.

23.6 An oven vent shall be located so that wiring of a range will not be exposed to the vapors discharged from the vent.

Exception No. 1: An oven vent that discharges through a surface unit is acceptable if:

a) The plane of the vent-duct exhaust opening is not more than 1/4 in (6.4 mm) below the plane of the opening in the bottom of the reflector pan under the surface unit;

b) The vent-duct exhaust opening is entirely and directly below the reflector-pan opening and the diameter of the reflector-pan opening is larger, but not more than 1 in (25.4 mm) larger, than the vent-duct exhaust opening; and

c) An opening in the bottom of the vent duct, if provided, is not more than 1/2 in (12.7 mm) in diameter and is located in the bottom of the vent duct directly below the vent-duct exhaust opening.

Exception No. 2: A range having a form of construction other than that described in Exception No. 1 in which there is an opening from the vent duct into a wiring compartment will be given appropriate consideration to determine that it complies with the intent of the requirement.

Exception No. 3: This requirement does not apply to the leads to a blower motor.

24 Receptacles

24.1 A receptacle intended for general use shall not be provided on an appliance unless the surface heating elements and oven are inoperative and covered when the receptacle is energized and accessible. A receptacle may be provided solely for connecting an accessory as mentioned in 22.1 and 22.2.

24.2 A receptacle that is mounted where it would be accessible for general use – for example, a receptacle to be used for connecting a separate griddle – shall not accept a standard two-prong, parallel-blade, attachment plug of either the grounding or nongrounding type.

24.3 A receptacle located on the horizontal cooking surface of an appliance shall be mounted so that the plane of the face of the receptacle is at an angle of not less than 60 degrees above the horizontal.

24.4 An electrical component of a receptacle interlock system, such as a switch, shall withstand 100,000 cycles of operation without mechanical or electrical malfunction that would allow the use of the receptacle when a surface unit or oven is energized.

24.5 A 125 V, single-phase, 15- or 20-A receptacle intended for general use shall have ground-fault circuit-interrupter protection for personnel. A 125 V, single-phase, 15- or 20-A receptacle intended for general use shall comply with the Standard for Attachment Plugs and Receptacles, UL 498, and have ground-fault circuit-interrupter protection for personnel.

25 Switches and Controls

25.1 Switches

25.1.1 A switch shall have a current and voltage rating not less than that of the load that it controls when the appliance is operated while connected to a test supply circuit as provided in 56.4. See 67.1 and 75.1.1.

25.1.2 A switch that is subjected to a temperature of more than 65°C (149°F) is to be judged with respect to the temperature limitations of the materials employed.

25.1.3 No single-pole switch shall be connected in the grounded conductor or terminal.

Exception No. 1: A door-operated, single-pole switch controlling an oven lampholder may be connected in the grounded conductor.

Exception No. 2: A single-pole automatic control without a marked off position may be connected in the grounded conductor.

Exception No. 3: A single-pole switch may be connected in the grounded conductor:

a) If it is in the same circuit and controls the same lampholder as a door-operated switch; or

b) If it controls a hood motor and is operated by the hood visor.

25.1.4 A switch shall be provided for controlling each section or unit part, including a lampholder but not including an attachment-plug receptacle or a clock, of an appliance.

25.1.5 A built-in oven shall employ a main switch integral with the appliance. The switch may be an electro-mechanical device or an electronic control and shall be clearly marked to indicate that it serves to turn the overall appliance to it's off position. This disconnect means in its off position shall disconnect the heating element(s) from all ungrounded conductors of the supply circuit. See 25.1.6.

25.1.6 If a timer or a control device with a marked off position, including the touchpad of an electronic control, functions as a switch to control a heating element, or functions to control an attachment-plug receptacle, the timer or control device in its off position shall disconnect the element or the receptacle from all ungrounded conductors of the supply circuit. The simultaneous disconnection of the element or the receptacle from the grounded supply conductor, if any, is acceptable if the grounding supply conductor connection is the last conductor to be disconnected and the first to be reconnected.

25.1.7 If a switch is provided for the control of a heating element, other than a surface unit, intended to operate at more than one heat, the various positions of the switch with respect to the heating of the element shall be indicated. See Marking of Controls, Section 53.

25.1.8 With reference to 25.1.7, actual markings of off, high, medium, and low are not required if the switch handle is of such a shape or so constructed that the position of the switch is indicated clearly; but if a key or legend is necessary in order to inform the user regarding the element heats corresponding to the various positions of the switch handle, such key or legend shall appear on the appliance at a point where it can be readily found.

25.1.9 A switch or other means of control intended to permit the use of a limited number of elements at one time shall be so located or of such a type that the user cannot readily change the connections to permit the use of more elements than intended.

25.1.10 A switch that controls a medium-base lampholder of other than an oven, pilot, or indicating light shall be acceptable for use with tungsten-filament lamps.

25.1.11 If a circuit breaker is used as a switch in a 120 V fluorescent lighting circuit, it shall be marked "SWD."

25.1.12 The wiring of surface element switches and the elements they control shall be such that one set of switch contacts in the closed position, due to a contact failure in a switch controlling an element, shall not allow the element to become energized when another element switch is activated.

25.1.13 Manually operated snap-switches shall comply with one of the following, as applicable:

a) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1;

b) Deleted

c) The Standard for Low-Voltage Switchgear and Controlgear – Part 1: General Rules, UL 60947-1;

d) The Standard for Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-Starters, UL 60947-4-1; or

e) The Standard for Low-Voltage Switchgear and Controlgear – Part 5-2: Control circuit devices and switching elements – Proximity Switches, UL 60947-5-2.

Exception: Switching devices that comply with the appropriate UL standard for specialty applications (e.g. transfer switch equipment), industrial use (e.g. contactors, relays, auxiliary devices), or are integral to another component (e.g. switched lampholder) need not comply with this requirement.

25.1.14 A clock-operated switch, in which the switching contacts are actuated by a clock-work, by a gear-train, by electrically-wound spring motors, by electric clock-type motors, or by equivalent arrangements shall comply with one of the following:

a) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7; or

b) The Standard for Clock-Operated Switches, UL 917.

25.1.15 A timer or time switch shall comply with the requirements of the Standard for Time-Indicating and -Recording Appliances, UL 863.

25.1.16 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, shall comply with the requirements for an operating control with Type 1 action for 6000 cycles of operation, or as a manual control for 5000 cycles of operation, in accordance with the one of the following:

a) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7; or

b) The Standard for Solid-State Controls for Appliances, UL 244A.

25.1.17 Switches, including relays or other switching devices in electronic controls, that control surface elements shall be configured so that a single failure in a switching mechanism cannot result in a heating element remaining energized when the control is turned off.

Exception: A surface element which doesn't ignite cheesecloth when tested per 72.5.2 need not comply with this requirement.

25.2 Temperature controls

25.2.1 An automatic control for temperature limitation or regulation shall be acceptable for the maximum temperatures to which it will be subjected.

25.2.2 An oven employing a temperature-regulating control, the malfunction or breakdown of which would result in a risk of fire, as determined by the Abnormal Operation Test, Section 72, and 96.3.1 and 96.3.2, during any operation including self-clean operation, shall be provided with a temperature-limiting control. The control shall open a sufficient number of ungrounded conductors to the heating elements to limit the oven temperature and shall be:

a) A thermal cutoff;

b) A manually reset control not capable of being reset from outside the appliance without using a tool to gain access to the reset mechanism; or

c) An automatically reset control if a means, such as an indicator light or audible signal, is provided to alert the user that the oven is not operating normally when in the self-cleaning mode. See 25.2.4 and 25.2.5.

Exception: The means to alert the user of oven malfunction may be omitted if it can be shown that, for all alternate temperature-regulating devices employed, any malfunction of the device during the self-clean mode will always result in a malfunction that will not permit normal operation in the bake mode.

25.2.3 A limiting control provided to comply with the requirements in 25.2.2 shall not function during the Temperature Test, Section 59.

25.2.4 With regard to 25.2.2(c), if an indicator light is provided to alert the user that the oven in the self-cleaning mode is not operating normally, the following conditions apply:

a) The light shall withstand, without burning out or failing to light, an endurance test consisting of 6000 cycles of 1 min on and 30 s off.

b) The light shall have a minimum rated life of 20,000 continuous hours at the operating voltage and shall be connected in a circuit in which the increased voltage incident to switching or any other operational characteristic of the appliance does not exceed 120 percent of the voltage recommended to provide the required life.

c) The light shall be visible under the conditions specified in 49.3.

d) If the light turns on as a result of a malfunction when the oven is operating in the self-cleaning mode, the light shall remain on even though the limiting control functions to reduce oven temperatures.

e) The marking and instructions described in 84.2.4 and 87.11 shall be provided.

25.2.5 With regard to 25.2.2(c), if an audible signal is provided to alert the user that the oven is not operating normally, the following conditions apply:

a) The signal shall withstand, without malfunction or breakdown, an endurance test consisting of 6000 cycles of 1 min on and 30 s off.

b) The signal shall withstand, without malfunction or breakdown, a durability test consisting of 72 h of continuous energization while in an ambient 10°C (18°F) higher than the maximum operating temperature of the device under normal operating conditions, but not less than 70°C (158°F).

c) The marking and instructions described in 84.2.5 and 87.11 shall be provided.

25.3 Electromechanical and electronic controls

25.3.1 Electromechanical and solid-state controls shall comply with the applicable requirements of Safety of Electromechanical and Electronic Controls, Supplement SB.

25.3.2 *Deleted*

25.3.3 A temperature sensing positive temperature coefficient (PTC) or a negative temperature coefficient (NTC) thermistor, that performs the same function as an operating or protective control shall comply with one of the following:

a) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9, with Annex J; or

b) The Standard for Thermistor-Type Devices, UL 1434.

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

25.4 Programmable controls

25.4.1 A programmable controller shall comply with the Standard for Programmable Controllers – Part 2: Equipment Requirements and Tests, UL 61131-2. Depending on the specific functions the controller

provides (i.e. temperature control, timing, etc.) addition requirements in this end use Standard may also be applicable.

Exception: A programmable controller is not required to meet UL 61131-2 if it has been evaluated to requirements elsewhere in this Standard for the application and function it provides.

26 Spacings

26.1 Spacings between uninsulated live parts of opposite polarity, and between an uninsulated live part and a dead metal part, shall not be less than the values specified in Table 26.1.

Exception No. 1: As an alternative approach to the spacing requirements specified in Table 26.1, clearances and creepage distances may be evaluated in accordance with the requirements in Spacings On Printed Wiring-Boards, Section 27.

Exception No. 2: In the immediate vicinity of a separate component, such as a switch, the spacings specified in Table 26.1 for points other than wiring terminals do not apply between a terminal of the component and an uninsulated, rigidly mounted bus bar connected to the component. Such spacings are judged under the requirements for the component.

Table 26.1
Spacings

	Voltage between parts involved			
	0 – 250 V		251 – 600 V	
	Minimum spacings, in (mm)			
	Through air	Over surface	Through air	Over surface
Between a wiring terminal and dead metal of the enclosure	1/2 (12.7)	1/2 (12.7)	1/2 (12.7)	1/2 (12.7)
Between wiring terminals of opposite polarity and between a wiring terminal and dead metal other than the enclosure	1/4 (6.4)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)
At points other than wiring terminals – between live parts of opposite polarity, and between a live part and dead metal part	1/4[a,b,c] (6.4)	1/4 [a,b,c] (6.4)	1/4[b] (6.4)	1/4[b] (6.4)

[a] A spacing of not less than 1/16 in (1.6 mm) is acceptable at a closed-in point, such as the screw-and-washer construction of an insulated terminal mounted in metal.

[b] A spacing of not less than 1/16 in is acceptable in an appliance rated 300 V or less between the open end of a heating element sheath and the terminal pin, and between parts positively separated by barriers, recesses, or the like molded inside a heating element terminal block. Parts rigidly attached to the terminal pin are to have either a 1/4 in spacing or a construction of barriers or the like such that the spacing cannot be reduced to below 1/16 in by unintentional bending of the pin.

[c] The spacings of a microwave oven portion of a household electric range may comply with the Standard for Microwave Cooking Appliances, UL 923, if (1) the microwave portion is connected to the load side of a 20-A or smaller overcurrent-protective device acceptable for branch-circuit protection either integrally or in the branch circuit to which the appliance can properly be connected, and (2) if the microwave oven portion is completely separate and distinct (such as separate oven cavities and wiring compartments).

26.2 The spacings for a motor shall comply with the spacing requirements in the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1.

26.3 Spacings to an uninsulated live part of a component shall not be less than the values specified in Table 26.1 for a part not involved in the normal functioning of the component, but included therein merely

to facilitate use of the component in the range – for example, a switch terminal not electrically connected to any switch contacts, but provided solely to permit ready connection to the unswitched line.

26.4 An insulating liner or barrier of polymeric material employed where spacings would otherwise be insufficient shall comply with the applicable requirements for internal barriers in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. The liner or barrier shall be used in conjunction with an air spacing of 1/16 in (1.6 mm) or more.

Exception No. 1: The air spacing may be omitted if the liner or barrier is employed between a dead metal part and a normally grounded live part.

Exception No. 2: The requirements do not apply to barriers or liners of phenolic composition or of other material acceptable for the support of uninsulated live parts. See Electrical Insulation, Section 13.

27 Spacings on Printed-wiring Boards

27.1 As an alternative to the spacing requirements of Table 26.1, a printed-wiring board with spacings between opposite polarity circuits (other than a low-voltage circuit) 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;

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;

c) Comply with the spacing requirements in the Standard for Solid-State Controls for Appliances, UL 244A. 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; or

d) Comply with the spacing requirements in the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840. The spacing requirements of UL 840 shall not be used for field wiring terminals and spacings to a dead metal enclosure. Table 9.2 of UL 840 is excluded for criteria of creepage distances for printed wiring boards.

27.2 When conducting evaluations in accordance with the requirements in the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840, the following guidelines shall be used:

a) A cord connected household electric cooking appliance is to be categorized as Overvoltage Category II;

b) The pollution degree shall be pollution degree 2;

c) Any printed-wiring board which complies with the requirements in the Standard for Printed-Wiring Boards, UL 796, shall be determined to provide a Comparative Tracking Index (CTI) of 100, and when it further complies with the requirements for Direct Support in UL 796 then it shall be determined to provide a CTI of 175.

27.3 In order to apply Clearance B (controlled overvoltage) clearances, control of overvoltage shall be achieved by providing an overvoltage device or system as an integral part of the product. This voltage limiting device or system shall comply with the Standard for Surge Protective Devices, UL 1449.

28 Adhesives

28.1 An adhesive used for securement of parts that are relied upon to reduce the risk of electric shock, fire, or injury to persons shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluation, UL 746C.

Exception: When the appliance complies with all of the requirements in this Standard without the adhesive, an adhesive that is used to secure electrical or thermal insulation, an electrical component (such as control touch pad, film, or similar part), an internal barrier that does not support weight, or a part that affects the routing of a cooling air stream is not required to comply with the requirements in UL 746C.

28.2 The requirement in 28.1 also applies to an adhesive used to secure a conductive part, including a nameplate, that when the part is loosened or dislodged results in:

a) An accessible dead metal part becoming energized;

b) A live part becoming accessible;

c) Spacings being reduced below the minimum acceptable values; or

d) Short-circuiting of live parts.

28.3 An adhesive material that is used to secure a load-bearing structural part (such as a metal enclosure to the bottom of a cooktop, oven door glass, or an enclosure panel) shall comply with Structural (Load-Bearing) Adhesives Tests, Section 77.

29 Ground-Fault, Arc-Fault, and Leakage Current Detectors/Interrupters

29.1 Ground-fault circuit-interrupters (GFCI) shall comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943. The following statement, or equivalent, shall be included as a marking near the GFCI, or as an instruction in the manual: "Press the TEST button (then RESET button) every month to assure proper operation."

29.2 Appliance-leakage-current interrupters (ALCI) shall comply with the Standard for Appliance-Leakage-Current Interrupters, UL 943B. An ALCI is not considered an acceptable substitute for a GFCI when a GFCI is required by the National Electrical Code, NFPA 70.

29.3 Equipment ground-fault protective devices shall comply with the Standard for Ground-Fault Sensing and Relaying Equipment, UL 1053, and applicable requirements of the Standard for Ground-Fault Circuit-Interrupters, UL 943.

29.4 Arc-fault circuit-interrupters (AFCI) shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

29.5 Leakage-current detector-interrupters (LCDI) and any shielded cord between the LCDI and appliance shall comply with Standard for Arc-Fault Circuit-Interrupters, UL 1699.

29.6 An arc-fault circuit-interrupter (AFCI) or leakage-current detector-interrupter (LCDI), when used on equipment having a power supply cord and plug, shall be installed as an integral part of the attachment plug or located in the supply cord within 4 in (102 mm) of the attachment plug.

29.7 Arc fault detection testing shall include the applicable UL 1699 tests required for cord-type arc-fault circuit-interrupters.

Exception: The carbonized path arc clearing time test is not applicable for LCDIs that are provided with shielded power-supply cords.

29.8 Evaluation of all ground-fault, arc-fault, and leakage current detectors/interrupters is to take into account the use of the device in it's final application and the possibility of a grease spill or similar food spill that could affect the device.

30 Surge Protective Device

30.1 A device providing surge protection or transient suppression comply with the Standard for Surge Protective Device, UL 1449.

PROTECTION AGAINST INJURY TO PERSONS

GENERAL

31 Scope

31.1 There are risks of injury to persons inherent in some appliances that, if completely eliminated, would defeat the utility of the appliance. The requirements in Sections 32 – 53 are intended to reduce such risks while retaining the normal function of such an appliance.

32 Sharp Edges and Projections

32.1 An appliance or accessory shall be free of sharp edges, corners, burrs, and the like in normal work areas, which may cause injury to the user during normal use, cleaning, and servicing functions such as fuse, lamp, and filter replacement.

33 Oven Racks, Drawers, and Sliding Cooking Units

33.1 An oven rack or a drawer shall have a reliable means, such as a mechanical stop, to reduce the likelihood of inadvertent removal of the rack or drawer from its guides.

33.2 A sliding cooking unit that is designed to be pushed back into the appliance when not in use shall have a reliable means to reduce the likelihood of unintentional moving of the cooking unit while in use. A cooking unit that is intended for either two burner or four burner use shall be provided with a reliable means to reduce the likelihood of unintentional moving of the cooking unit in either position.

33.3 An oven rack shall not fall from its supports and the test weight shall not slide off the rack when tested per 33.4 – 33.9. Testing shall be performed with the oven at room temperature except for 33.9. If a unit is provided with two or more different rack styles each rack style shall be tested through 33.4 – 33.9.

33.4 The test weight shall be 8.85 inches (225 mm) square and shall weigh the amount shown in Table 33.1.

Table 33.1
Oven rack loading based on rack positions

Width of Rack	Load
Up to 14 in (355.6 mm)	20 lb (9.1 kg)
Greater than 14 and up to 18 in (greater than 355.6 and up to 457.2 mm)	25 lb (11.3 kg)
Greater than 18 in (Greater than 457.2 mm)	30 lb (13.6 kg)

33.5 With the oven rack in the lowest position, pull the rack out to the full extent of its travel and place the weight on the center of the rack. Slide the rack in as far as possible with the weight in place, then slide the rack back out to the full extent of its travel.

33.6 Repeat the test specified in 33.5 with the rack in the centermost position.

33.7 Repeat the test specified in 33.5 with the rack in the uppermost position. If there is less than 1.8 inches of vertical space for the load, then the test shall be performed on the next lower rack position.

33.8 Perform thermal conditioning. On self-clean ovens, run the longest available self-clean cycle with racks in place unless instructions indicate to remove the rack. On non-self-clean ovens, run bake at 475°F (246 °C) for 3 hours with racks in place. Allow the oven to fully cool.

33.9 Repeat the tests specified in 33.5, 33.6 and 33.7.

33.10 Heat oven to 475°F (246 °C). After one-hour repeat 33.5. Allow oven temperature to recover to 475 °F (246 °C), then repeat 33.6 and 33.7.

34 Lamps

34.1 A lamp employed in an oven shall be installed or guarded so that it is not likely to be unintentionally broken by utensils, such as pans and trays, inserted in the oven.

34.2 To determine whether a lamp complies with the requirement in 34.1, the surface of a lamp shall not be contacted by a 1/8-in (3.2-mm) diameter rod, 3 in (76.2 mm) long that is supported horizontally in the oven and is held parallel to and moved horizontally toward the rear of the oven; and is held parallel to and moved horizontally toward either side of the oven, both conditions at any elevation. The lamp used is to be the one furnished with the appliance.

Exception No. 1: For a lamp mounted in an oven wall near an upper rear corner, contact with the rod is acceptable if the following three conditions are met:

a) More than one-half of the cylindrical or spherical surface of the lamp is recessed behind the plane of the surface in which it is mounted;

b) The opening in the surface in which the lamp is mounted is no larger than necessary to relamp and the edge of the opening is within 1 in (25.4 mm) of the other two walls; and

c) No portion of the lamp projects more than 3/4 in (19 mm) from the surface in which it is mounted.

Exception No. 2: A lamp mounted in an oven wall near an upper rear corner is considered to be adequately guarded if a fixed part of the oven compartment, such as a broil element or rack support:

a) Is located at least 1-1/2 in (38 mm) in front of the lamp; and

b) Extends beyond the exposed area of the lamp.

34.3 A lens, shield, or shade employed as a guard shall not be supported by the lamp, and shall be made of material that will not be adversely affected by the temperatures encountered in normal operation.

35 Strength of Glass Panels In Oven Doors

35.1 An inner or outer glass panel in an oven door having any dimension, including a diagonal, more than 18 in (457 mm):

a) Shall be reliably secured so that it cannot be readily displaced in service;

b) Shall comply with the requirements in 35.2; and

c) Shall not be used for the support of any component.

35.2 With reference to 35.1 (b), the glass shall:

a) Be of a nonshattering or tempered type that complies with the requirements in the Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings, ANSI Z97.1 Class A; or

b) Withstand an impact, as described in 35.3, without cracking or breaking to the extent that pieces are released or dropped from their normal position.

35.3 With reference to 35.2(b), the impact is to be produced by allowing a steel sphere, 2 in (50.8 mm) in diameter and weighing 1.18 lb (535 g), to fall through a vertical distance of 25-1/2 in (648 mm). The test is to be conducted with the glass at room temperature.

36 Strength of Mounting

36.1 The support brackets, hangers, and the like, of a wall-mounted appliance shall not weaken, crack, or break when subjected to the conditions described in 36.2.

36.2 To determine whether a wall-mounted appliance complies with the requirement in 36.1, a complete appliance is to be mounted on a smooth vertical surface in accordance with the manufacturer's instructions, and using the brackets, hangers, and the like that are provided with the appliance as shipped. A 50-lb (22.7 kg) weight is to be suspended from or applied to the outer edge of an open door so as to cause the greatest moment, and a 50-lb weight is to be placed at the center of the bottom oven liner.

37 Oven Doors – Integrity

37.1 An oven door hinged at the bottom shall not close when released from any position within a 30 degree angle from the open position.

37.2 Loading of an oven door as described in 37.3 shall not result in:

a) Breakage or permanent damage to any part of the door or appliance; or

b) Deflection, measured at a point 6 in (152 mm) from the rear edge of the door, of more than 1/2 in (12.7 mm) from the normal open position of the door.

37.3 To determine whether an appliance complies with the requirements in 37.2, it is to be installed as intended, but is not to be connected to the power supply. The appliance is to be mounted to a level surface, precluded from tipping during this test, and loaded as described in 37.4.

37.4 A load is to be uniformly applied, without impact, for 5 min to the fully open oven door. The load is to be:

a) 50 lb (22.7 kg) for a door located more than 36 in (914 mm) above the floor, and

b) 75 lb (34 kg) for a door located 36 in or less above the floor.

For a side-hinged door, the load is to be applied to the top of the door midway between the vertical edges. For a bottom-hinged door, the load is to be distributed along the center line (midway between the front and

back edges) of the door. For an appliance with two or more doors, the test is to be conducted on one door at a time. For a slide-in door (a door that slides into the appliance), the load is to be hung from the top center edge of the door.

38 Stability

38.1 General

38.1.1 An appliance provided with casters shall be tested in accordance with 38.2 and 38.3. For each test, the casters are to be in the most unstable position, either locked or unlocked.

38.2 Normal use

38.2.1 When subjected to this test, a floor-supported, cabinet-supported (cabinet below) or counter-supported (counter-hung) appliance shall not break contact with the floor or surrounding structure. The reference to a cabinet-supported appliance here is not intended to include a wall-mounted appliance as specified in 1.5. For this test, the appliance is to be completely assembled, except the broiler pan is to be removed. The appliance is to be installed as intended, but it is not to be connected to the power supply and a floor-supported appliance is not to be secured to any adjacent structure. The appliance is to be mounted on a level surface. For a floor-supported appliance with adjustable feet, the appliance is to be level with the feet set at their most unfavorable position. The load shall be secured to the door so that it is retained in its position for the duration of the test. Any apparatus used to secure the load shall be included in the overall test weight and shall not exceed 10% of the overall test weight. The appliance is to be loaded as follows:

a) 50 lb (22.7 kg) for a door located more than 36 in (914 mm) above the floor, and

b) 100 lb (45.4 kg) for a door located 36 in or less above the floor.

38.2.2 An appliance with plug-in modules is to be tested with the combination of modules that will result in the most unfavorable condition. Any optional accessories (for example, a rotating spit, backguard, or the like) are to be removed or placed in the most severe normal operating position, whichever is worse, for the test.

38.3 Abnormal use

38.3.1 A floor-supported, cabinet-supported (cabinet below), or counter-supported (counter-hung) appliance employing a bottom hinged oven or storage door, a storage drawer, or slide-in door (a door that slides into the appliance), located 36 in (911 mm) or less above the floor when fully open is to be subjected to the tests described in 38.3.1 – 38.3.6. The reference to cabinet-supported appliance here is not intended to include a wall-mounted appliance as specified in 1.5. The tests are to be repeated for each such door or drawer and for each test the appliance shall not tip to the extent that the pan described in 38.3.5 slides off the cooktop – sliding of the pan on the utensil supporting surface and on the cooktop is acceptable.

38.3.2 An appliance with removable broiler pans, racks, oven rack guides, oven side panels, plug-in modules, surface units, drip bowls, and the like that can be removed by the user for cleaning, user servicing, or the like, is to be tested with the items removed except one module and/or surface unit with drip bowl (the most unfavorable one) is to remain in order to support the pan described in 38.3.5. Any optional accessories (for example, a rotating spit, backguard, or the like) are to be removed or placed in the most severe normal operating position, whichever is worse, for the test.

38.3.3 The appliance is to be installed as intended to a level surface and set up as specified in 38.3.2. The installation is to use any mounting hardware provided for securing to a wall, floor, or cabinet structure,

but the appliance is not to be connected to a power supply. For a floor-supported appliance with adjustable feet, the appliance is to be level with the feet set at their most unfavorable position. A load of 75 lb (34.0 kg) is to be placed on the door and then is to be uniformly increased, at a rate not to exceed 20 lb (9.1 kg) per minute, without impact, separately to each fully open door or drawer, one at a time. For a bottom hinged door, the load is to be distributed along the center line (midway between the front and back edges) of the door. For a drawer or slide-in door (a door that slides into the appliance), the load is to be hung from the top center of the outer edge of the drawer or door. The load is to be increased up to a maximum of 250 lb (113.4 kg) or until the door or drawer (including hinges) deforms to the extent that the test weight can no longer be supported, breaks away, or the like. If the maximum load can be applied, it is to remain on the door for 5 min.

38.3.4 When mounting hardware for securing the appliance to the wall, floor, or cabinet structure is required in order to comply with 38.3.1 and 38.3.3, the appliance shall comply with all of the following:

a) A fastening means shall be provided to secure the appliance to one of the constructions specified in 38.3.6. A second fastening means shall also be provided to secure the appliance to a second construction specified in 38.3.6. (Only one means of securing the appliance is intended. In the event the first fastening means is not suitable for the specific installation, the second fastening means shall be available, using the same device or a separate device.) All hardware, including fastening devices, screws, wall anchors, and similar devices, required to secure the appliance as intended to two or more of the constructions specified in 38.3.6 shall be provided with the appliance, including instructions in the same package. The package shall be located where it will be apparent to the installer;

b) Only common tools shall be required to install the hardware and appliance as intended;

c) No tools shall be required to remove and replace a floor-supported appliance for operations such as servicing or cleaning. No tools, or at most, common tools shall be required to remove and replace the other types of appliances noted in 38.3.1 for similar operations;

d) Clear and explicit instructions shall be provided with the appliance detailing the intended method of installation. Instructions for securing the appliance shall be included to cover installations when the enclosed hardware is unusable. The instructions shall also warn the installer and user that a risk of tipover exists when the appliance is not installed in accordance with the installation instructions. See 82.15, 83.12, 83.13, 86.13, 86.14, and 87.8;

e) The user manual shall contain instructions regarding the intended method of appliance removal and replacement, and shall also warn the user of possible risks that result from abnormal usage, including excess loading of the oven door and of the risk of tipover, where the appliance is not reinstalled as intended. See 87.8;

f) For an appliance provided with casters, the anti-tip hardware shall automatically re-engage or realign with the appliance after returning the appliance to the original installed position.

38.3.5 The pan mentioned in 38.3.1 is to be aluminum, 9 in (230 mm) in diameter at the rim, flat-bottomed, have vertical sides 4 in (102 mm) high, and contain a 4.6 lb (2.08 kg) weight. The pan is to be centered on the utensil supporting (cooking) surface nearest the front edge of the appliance.

38.3.6 With reference to 38.3.3, if mounting to a wall, floor, cabinet, or countertop is specified in the installation instructions, the mounting surface is to be fixed to reduce the likelihood of movement and is to be constructed as follows:

a) Wall – 3/8 in trade size plasterboard (dry wall) on nominal 2 by 4 [1-5/8 by 3-5/8 in (41 by 92 mm)] wood studs spaced on 16-in (406-mm) centers;

b) Floor – A single thickness of 3/8-in (9.5-mm) thick plywood on nominal 2 by 4 [1-5/8 by 3-5/8 in (41 by 92 mm)] wood joists spaced on 16-in (406-mm) centers; and

c) Cabinet or Countertop – As specified in 59.4.2.2, 59.4.2.3 and 59.4.2.5, as applicable.

SURFACE TEMPERATURES

39 General

Section 39 deleted

39A Surface Temperature Test

39A.1 When operated under test conditions described in 39A.2 – 39A.11, surface temperature rises shall not exceed those specified in:

a) Table 39A.1 for the exterior of ranges or ovens;

b) Table 39A.2 for handles and control knobs.

Table 39A.1
Maximum surface temperature rises

Part	Maximum temperature rise, °C (°F)		
	Condition: During 246 °C (475 °F) oven operation, surfaces less than 31 in (787 mm) above the floor level, if accessible, as installed	Conditions: 1. During self-clean: surfaces less than 31 in (787 mm) above floor level as installed (see Clause 39A.8(k)); and 2. During 246 °C (475 °F) oven operation: surfaces less than 36 in (914 mm) but more than 31 in (787 mm) above the floor; and 3. In gaps around oven doors and drawers per 39A.11	Condition: Surfaces more than 36 in (914 mm) above floor level as installed, during cooking modes of operation
Bare or painted metal	33 (59)	42 (76)	59 (106)
Porcelain enamel	37 (67)	46 (83)	63 (113)
Glass	46 (83)	53 (95)	70 (126)
Plastic	51 (92)	58 (104)	75 (135)

Table 39A.2
Maximum temperature rises of handles and knobs

Part	Maximum temperature rise, °C (°F)	
	For a self-cleaning or continuous-cleaning oven, these temperature limits apply only during the time an oven door can be opened	At cleaning temperatures when the door is locked, these temperature limits apply
Bare or painted metal	30 (54)	42 (76)
Glass	40 (72)	53 (95)
Plastic[a]	50 (90)	58 (104)

[a] Includes plastic with a metal plating not more than 0.005 in (0.13 mm) thick; and metal with a plastic or vinyl covering not less than 0.005 in (0.13 mm) thick.

39A.2 With respect to 39A.1, thermal imaging is an acceptable technology to help identify hot spots.

39A.3 All values for temperature rise in Table 39A.1 are based on an ambient temperature of 25°C (77°F); however, tests may be conducted at any ambient temperature within the range of 20 – 30°C (68 – 86°F).

39A.4 Ranges shall be installed as for the normal Temperature Test, Section 59, except that the alcove walls are omitted from the sides. Built-in ranges or built-in ovens shall be installed in accordance with the manufacturer's instructions. Temperatures shall be measured only on accessible surfaces of built-in ranges and built-in ovens.

39A.5 The appliance shall be operated under the following conditions:

a) OVEN OPERATION – The oven thermostat shall be set to maintain an oven temperature of 246 ±3°C (475 ±5°F). When two ovens are provided, both are to be operated simultaneously. The surface elements, if any, shall be turned off;

b) SELF-CLEANING OVEN OPERATION – Ovens having self-cleaning features shall be operated at the designed operating temperature through the longest-obtainable cleaning cycle, or until the temperatures being measured become constant, whichever results in a shorter time. The surface elements, if any, shall be turned off. A non-self-cleaning oven is to be off during the cleaning cycle. If such operation is possible, two self-cleaning ovens are to be operated simultaneously;

c) SURFACE UNIT OPERATION – Each surface unit is to be covered with a pan as described below. Each pan is to be uncovered, and is to contain a minimum of 2 qt (1.9 L) of water. Each unit is to be adjusted to maintain an input of 400 plus W/6 watts – W equals the wattage rating of the element; however, if this setting does not result in a rolling boil, the unit is to be readjusted to maintain a rolling boil. A built-in griddle is to be adjusted to maintain an average temperature at the center of its top surface of 204°C (400°F), or to the setting that results in its maximum temperature, whichever results in a lower temperature. All units are to be operated simultaneously, and all ovens are to be off. The pans are to be metal, flat-bottomed, are to have straight sides at least 4 in (102 mm) high, and a diameter at the bottom at least equal to but not more than 1 in (25.4 mm) larger than the maximum diameter of the active part of the unit on which the pan is used.

Exception: If the manufacturer's instructions specify the use of specific cooking pans or utensils, they are to be used for the operation described.

39A.6 Temperatures shall be recorded:

a) For oven operation, 1 hour after oven reaches set temperature.

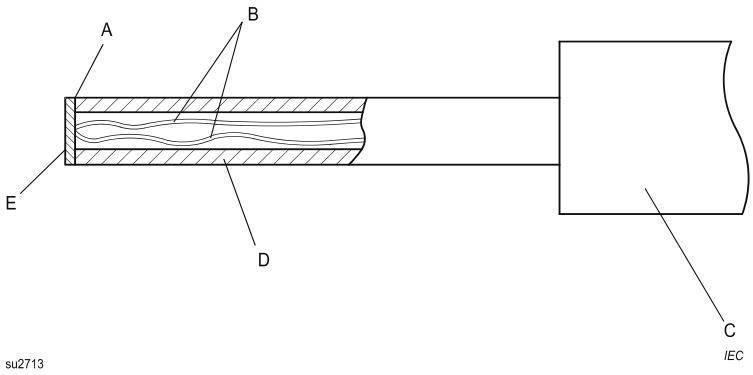
b) For self-clean operation, when surface temperatures are at their maximum during a complete self-clean cycle.

c) For surface unit operation, 1 hour after the surface units are energized.

39A.7 Temperatures shall be measured by the probe shown in Figure 39A.1. The probe is applied with a force of 0.9 lbf ±.22 lbf (4 N ±1 N) to the surface in such a way that the best possible contact between the probe and the surface is ensured. The probe is to be held in position for 30 seconds. Temperatures on handles and knobs shall be measured with thermocouples with conductors between 24 AWG and 30 AWG.

Figure 39A.1

Temperature probe



Legend:

A = adhesive

B = thermocouple wires 0.01 in (0.3 mm) diameter to IEC 60584-1 Type J or K

C = handle arrangement permitting a contact force of .9 lbf ±.22 lbf (4 N ±1 N)

D = polycarbonate tube: inside diameter 0.1 in (3 mm), outside diameter 0.02 in (0.5 mm) thick

E = flat tinned copper disc: 0.2 in (5 mm) diameter, 0.02 in (0.5 mm) thick

39A.8 When the range or oven is installed as specified in 39A.4, the temperature of all accessible exterior surfaces shall be measured, with the following exceptions:

a) Areas behind guards, knobs, and handles;

b) Surfaces within 0.39 in (10 mm) of the edge of an oven door window [see Figure 39A.2 (a) and (d)];

c) Surfaces within 0.39 in (10 mm) of the front edge of a side panel [see Figure 39A.2 (b) and (c)];

d) Exposed surfaces on the side of an oven door within 0.39 in (10 mm) of the gap between the door and the side panel [see Figure 39A.2(f)];

e) Vertical and horizontal surfaces contained in the spaces between the oven door and the top or side panels higher than 31 in (787 mm) above the floor. [see Figure 39A.2(g)];

f) For handles with the top of the handle located 16 in (410 mm) or higher above the floor, the area located within an included angle of 45 degrees, [see Figure 39A.2(f)]:

1) Measured upwards from the horizontal;

2) Contained in a vertical plane perpendicular to the front of the appliance; and

3) With the vertex of the angle positioned at the point on the extremity of the handle of an oven door, a guard, or similar parts that results in the largest area.

g) Door trim and side panel recess surfaces that are inaccessible to a 3 in (75 mm) diameter probe having a hemispherical end [see Figure 39A.2(g)];

h) Surfaces of cooking ranges that are within 1 in (25.4 mm) below the level of the cooking surface. The cooking surface is the horizontal part of the appliance on which vessels can be placed;

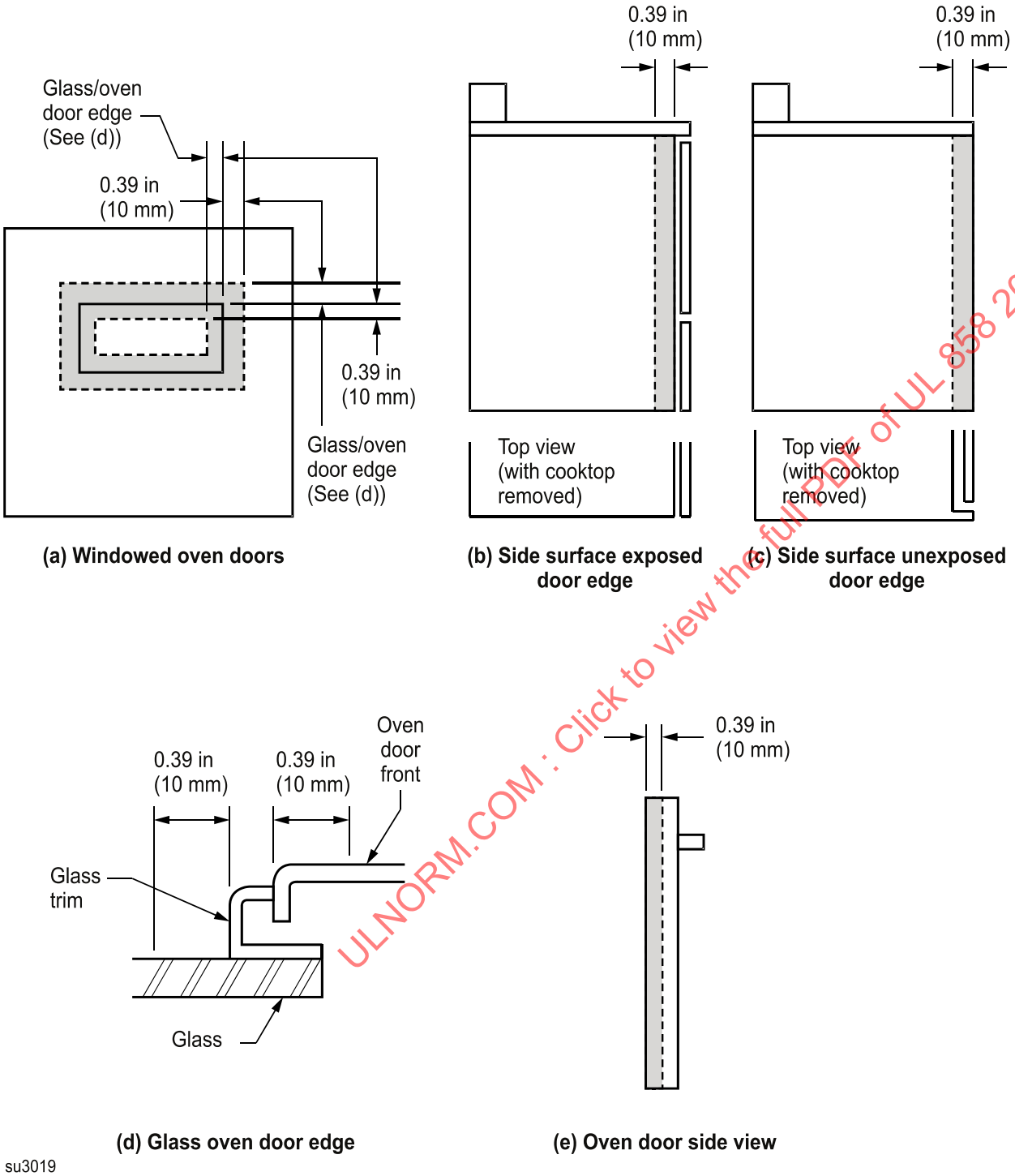
i) Surfaces that are above the cooking surface. The cooking surface is the horizontal part of the appliance on which vessels can be placed;

j) Small parts such as oven vents, hinges and trim where the width of the accessible surface is less than 0.39 in (10 mm);

k) During the cleaning cycle of a self-cleaning oven, the surfaces higher than 31 in (787 mm) above the floor.

Figure 39A.2

Exempt areas



(a) Windowed oven doors

(b) Side surface exposed door edge

(c) Side surface unexposed door edge

(d) Glass oven door edge

(e) Oven door side view

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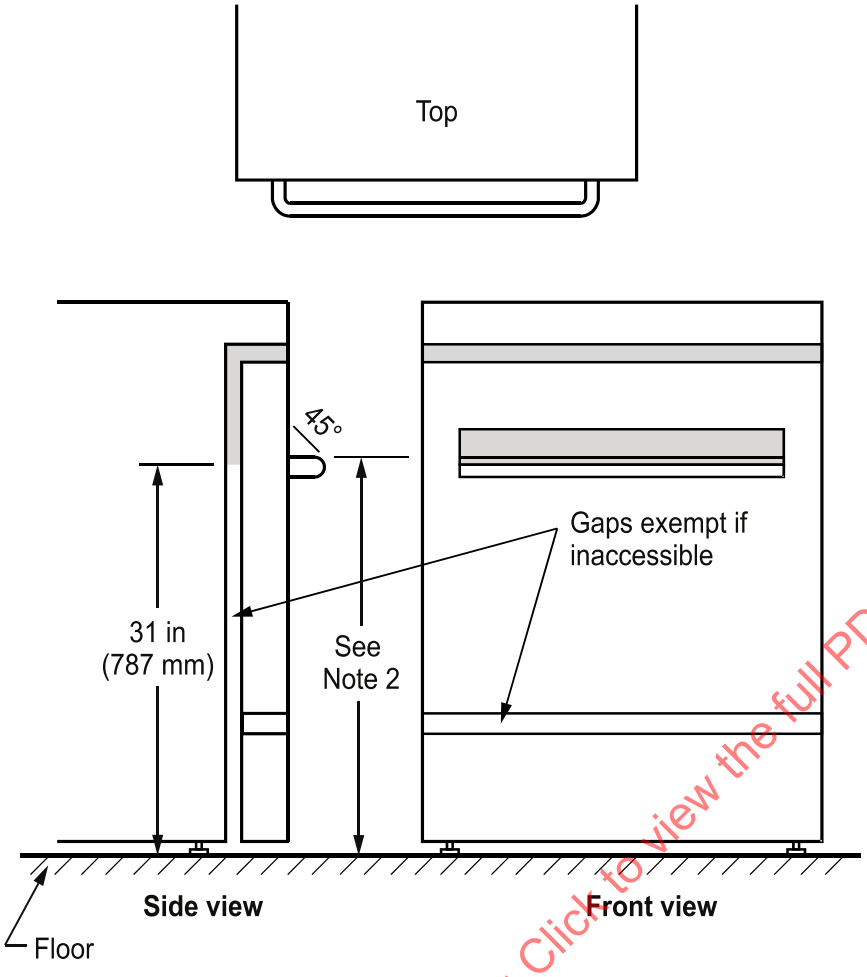
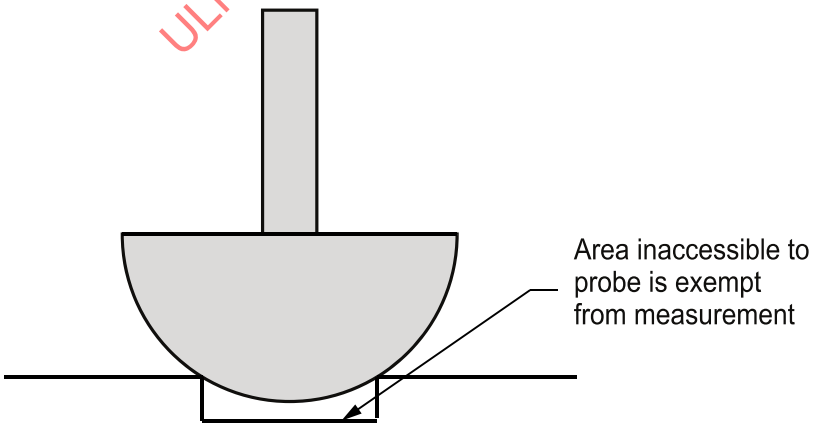
(Continued)

Figure 39A.2 (cont'd)



(f) Door handles and top



(g) Access probe

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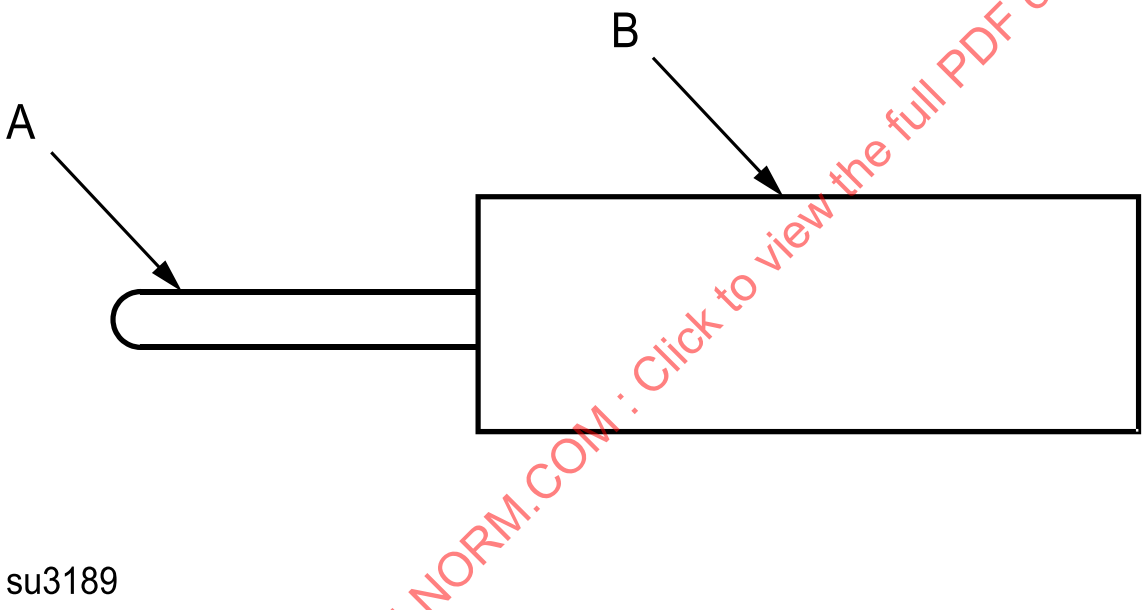
39A.9 In determining the temperatures of handles, knobs, grips, and the like, measurements shall be made only at locations that are gripped during normal use.

39A.10 For electric ranges in combination with gas-fired room heaters, the tests of 39A.5 shall be conducted with the fuel-fired section operated at normal operation.

39A.11 During oven operation per 39A.5(a), gaps around oven doors and drawers less than 31 in (787 mm) from the floor are to be checked with the test probe shown in Figure 39A.3. Any surfaces in the gaps that can be contacted by any portion of the test probe and exceed 0.2 in (5 mm) in minor dimension shall meet the temperature rise limits in Table 39A.1. The test probe is applied to any depth or angle that the probe will permit. Temperature measurements are to be made using the probe shown in Figure 39A.1 provided full contact can be made between the probe and the surface. If a surface shape or orientation prevents full contact with the probe, temperatures shall be measured using thermocouples. Measurement in gaps is not required during self-clean operation. Gaps at the top of a door are not required to be measured if they are protected by a handle per 39A.8(f).

Figure 39A.3

Probe for door gaps



A – Cylindrical Test Probe: Rod Diameter 8.6 ±0.1 mm, Rod length 57.9 ±0.15 mm, with a hemi-spherical tip with radius of 4.3 ±0.05 mm

B – Handle 38.4 ±0.3 mm dia, 101.6 ±0.3 mm long

40 Ambient Temperature

Section 40 deleted

41 Temperature Measurements

Section 41 deleted

42 Set-Up and Installation of Appliance

Section 42 deleted

43 Operation of Appliance

Section 43 deleted

IGNITION OF FABRIC

44 General

44.1 The requirements in Sections 46 – 53 are intended to reduce the likelihood of ignition of fabric and other risks of fire.

45 Test Fabric

45.1 Fabric used in the tests described in Sections 46 – 52 shall be white, 100 percent untreated cotton terry cloth having a pile weave and a nominal weight of 8 oz/yd^2 (270 g/m^2).

45.2 Freshly conditioned fabric shall be used for each test. The conditioning is to consist of subjecting the fabric to a controlled atmosphere maintained at a temperature of 25°C (77°F) and a relative humidity of not more than 25 percent for 24 h.

46 Location of Controls

46.1 The actuating member of a control shall have its center at least 6 in (152 mm) above the utensil support surface if the control is located:

a) On a panel of the backguard; and

b) Within an area defined by vertical planes 4 in (102 mm) outside the outermost edges of any surface unit and perpendicular to the backguard.

46.2 With reference to 46.1, if the center axis of the actuating member is not parallel to the surface of the cook-top, the center of the smallest cylinder that will completely enclose the actuating member is considered to be the center of the actuating member.

46.3 With reference to 46.1, for touch-type controls, the measurement shall be made from the utensil supporting surface to the horizontal centerline of the touch pad or the horizontal centerline of the graphics area of the touch pad which defines the function of the touch pad, whichever is lower.

46.4 An actuating member is the part of the operating mechanism that extends outside the enclosure of the range or for touch-type controls the involved surface area to be touched, and is intended to be exposed to contact by the user.

46.5 A switch as described in 47.1, shall be provided with mechanical means – such as raised edges around the switch – to reduce the risk of unintentional actuation during cleaning or other unintentional contact such as with utensils, pans, or similar items. The switch shall employ a separate, adjacent, indicating light that complies with 49.1 – 49.3. The switch shall be located on the backguard or otherwise positioned to restrict access from unintentional contact.

46.6 A warming element which is energized by a single operation control shall be provided with a device to limit the temperature at the center of the warming element surface to a maximum of 347°F (175°C). The temperature limiting device shall comply with the requirements for temperature limiting controls for electric ranges in the Standard for Temperature-Indicating and -Regulating Equipment, UL 873. 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.

47 Operation of Controls

47.1 The control for a surface unit shall require a minimum of two operations to activate the surface unit.

Exception: A switch intended to control a warming element that complies with 46.5, 46.6 and Abnormal Operation Test for Warming Elements, Section 72, employing a single operation for actuation is acceptable.

47.2 Only one operation shall be required to turn a surface unit off.

47.2.1 A single switch or control which turns all cooktop elements of the cooktop off satisfies the requirements of 47.2 provided that the control also resets all individual cooktop elements to an off state and the requirements of 47.1 are required to subsequently activate a cooktop element.

47.3 A rotary switch having a push and turn or a pull and turn operating sequence will generally be considered to meet the intent of the requirement in 47.1.

47.4 With reference to 47.1, for touch-type controls, two operations that consist of touching two different touch pads but not the same touch pad twice meets the intent of the requirement. A nonvalid or a single input shall be cancelled within 30 s. A single motion of a finger or hand across the control shall not activate the surface unit. The following comply with the requirement:

a) A construction in which it would be necessary for the user to remove their finger or hand from contact with the control between each operation. If a cancel pad is used to comply with the single motion requirement, the pressure and time necessary to activate the cancel pad shall not be greater than the Step 1 and Step 2 pads.

b) A construction in which the distance between Step 1 and Step 2 pads and the timing software are such that a surface unit will not be energized when a finger or hand touches each pad, traveling along any path not affected by 47.4(a) above, at a rate of 15 in (381 mm) per second between the pads. In addition, a control employing this means shall be such that activation of the Step 1 and Step 2 pads require contact by the user for a minimum time of 100 ms.

47.5 If more than one front surface unit of an appliance having exposed sheathed heating elements is larger than 6 inches (152 mm) in diameter, all front units larger than 6 inches in diameter and capable of igniting the fabric described in 45.1 shall be provided with a control that will permit the user to energize the central 6 inch portion of the unit independently of the outer section.

47.6 If more than one front surface unit of a glass/ceramic-top appliance is larger than 7 inches (178 mm) in diameter as determined by 48.1, then a minimum of one front surface unit larger than 7 inches in

diameter and capable of igniting the fabric described in Section 45 shall be provided with a control that will permit the user to energize the central portion of the unit, no larger than 7 inch (178 mm) in diameter, independently of the outer section.

47.7 Induction heating appliances shall be constructed so that they can only be operated with the recommended vessel placed on the cooking zone and shall comply with Small Metal Object Heating Test – Induction Cooktop Surface Units, Section 59.6.

47.8 An automatic shutoff means shall be provided on an induction heating appliance that will de-energize the induction cooktop surface unit when a cooking vessel is removed for more than 30 seconds, even if the switch controlling the surface unit is in the "on" position. A manual reset feature shall be required to reenergize the induction cooktop surface unit when the vessel is replaced. See 47.1.

47A Closed Loop Cooking Using Surface Units

47A.1 The temperature limiting function shall be demonstrated to comply with Section 60A if it has a nominal rating of 350 W or greater.

47A.2 Temperature limiting functions used in surface units having a nominal rating of 350 W or greater are required to comply with the Type 2, Class B Control and Software Functions of a Protective Control as required in Table SB5.1.

47A.3 If a part of the circuit that is responsible for the temperature limiting function is not integral to the appliance, the following test shall be performed. With the appliance at normal ambient condition, the device with sensor on the cooktop shall be in a location other than the element being controlled. The stove plate shall be placed per 59.3.2.3 on the element(s) being controlled. The control temperature for the element with the stove plate is set to maximum setting. The system shall detect lack of feedback and shut down the element(s) being controlled within 2 minutes.

47A.4 The temperature regulating function for closed loop cooking surface units are required to comply with the requirements for Type 1, Class A Control functions in Table SB5.1.

48 Determination of Size of Surface Units

48.1 If it is necessary to determine the size of a surface unit by test, such as for a glass/ceramic-top range, the test fixture described in 50.3 is to be placed on the cook-top in such a manner that the cloth will be perpendicular to the cook-top, and is then to be located in the vicinity of the surface unit. The surface unit is to be operated at maximum temperature as described in 50.4. The fixture is to be held in place for 30 s, and ignition of the cloth within this period is to be considered to indicate that the unit is present at that location. This procedure is to be repeated until the size of the unit can be accurately determined.

48.2 The procedure described in 48.1 can only be used to determine the size of a unit that will ignite the cloth. A warming tray is an example of a unit that may not ignite the cloth.

49 Lamps

49.1 A signal lamp shall be provided on an appliance to indicate when a surface unit is on.

49.2 A hot-surface signal lamp that turns on not more than 30 s after any surface unit is energized at its lowest setting and with the surface unit covered or uncovered meets the intent of the requirement in 49.1.

49.3 The lamp mentioned in 49.1 shall be visible from a point 10 ft (3 m) in front of the center of the appliance and 5 ft (1.5 m) above the floor with pans as described in 49.4 on each surface unit.

Exception: This requirement does not apply to an induction type range that will not operate unless a pan larger than 4 inches (102 mm) in diameter is placed above a work coil and that is also provided with a control that automatically shuts off the coil if the pan should boil dry.

49.4 With reference to 49.3, for a nominal 6 in (152.4 mm) surface unit, a pan 3-1/2 in (88.9 mm) high and having a 7 in (178 mm) diameter at the rim is to be used; and for a nominal 8 in surface unit, a pan 4 in (102 mm) high and having a 9 in (230 mm) diameter at the rim is to be used.

50 Surface-Unit Setback

50.1 When tested as described in 50.2 – 50.7, a surface unit shall not ignite the fabric described in 45.1.

50.2 The appliance is to be tested with all unmounted guards supplied by the manufacturer installed in accordance with the manufacturer's instructions. A counter-mounted cooking unit is to be installed in a counter in accordance with the installation instructions provided with the unit and using the guards supplied.

50.3 A test fixture is to be assembled by using the fabric described in 45.1 and an inverted U-shaped frame. A 4- by 16-in (100- by 400-mm) piece of the fabric is to be folded to a size of 4 by 8 in (100 by 200 mm). If the fabric has pile on one side only, after the fold, the pile is to be exposed. The folded fabric is to be attached across the inverted U-shaped frame so that the fabric will be taut, and the folded edge will be at the open end – the lower end – of the frame.

50.4 The test is to be conducted with the surface unit at maximum temperature – ordinarily, operation at the maximum setting for 10 min is considered to meet this condition. The surface unit is not to be covered by a cooking utensil.

50.5 With the appliance installed in accordance with 50.2 and operating in accordance with 50.4, the test fixture described in 50.3 is to be placed so that the outer surface of the fabric along the folded edge at the open end of the frame will be in the plane of the utensil-support surface, and that the fabric will be perpendicular to the cook-top – horizontal top surface of the appliance nearest the surface units – and parallel to the front of the appliance. The fixture is then to be located in accordance with 50.6 or 50.7, whichever results in the most severe condition. The test fixture is then to be held in place for 30 s.

50.6 The test fixture is to be located so that the surface of the cloth facing the surface unit will be 2 in (50 mm) from the maximum forward projection in the plane of the cook-top and spanning the entire width of the surface unit. The fixture is then to be moved along this line until the center of the folded edge is closest to the surface unit.

Exception: The 2-in dimension specified may be reduced to 1 in (25 mm) provided that the horizontal distance between the front of the surface unit and the forward projection of the appliance located within 2 in vertically of the utensil support surface and spanning the entire width of the surface unit is at least 3 in (76 mm). The forward projection may be a handle, guard, or the like.

50.7 The test fixture is to be located so that the surface of the cloth facing the surface unit will be 4 in (100 mm) from the forward projection of the appliance – including the projection of a guard, handle, or barrier – located within 6 in (152 mm) of the utensil-support surface and spanning the entire width of the surface unit. The fixture is then to be moved along this line until the center of the folded edge is closest to the surface unit. If the forward projection changes across the width of the surface unit – for example, due to curvature at the end of a handle – the forward projection is considered to be the minimum projection across the width of the surface unit.

50.8 With reference to 50.7, two adjacent handles are considered as a continuous projection if they are separated by not more than 1 in (25 mm).

51 Loading and Unloading of Ovens

51.1 The test described in 51.2 – 51.4 shall not result in ignition of the potholder described in 51.2.

51.2 The potholder used for the tests described in 51.3 and 51.4 is to be a 6 by 6 in (150 by 150 mm) square made of six layers of the fabric described in 45.1, and is to be assembled so that no cut edge of the fabric will be exposed. If the fabric has pile on one side only, the pile is to be exposed.

51.3 Immediately prior to the test, the oven is to be operated for 10 min with the oven set for a temperature of 204°C (400°F), and with the oven door open. During the test, the oven rack is to be in its lowest position and the oven is to be on and set for a temperature of 204°C.

51.4 The test is to be conducted by grasping the front center of the oven rack, holding it momentarily, pulling it to the full out position, returning it to the full in position, holding it momentarily, and then releasing it. The test is to be conducted twice – first with the potholder folded to form a rectangle; then with the potholder folded to form a triangle.

52 Exposure of Bake Elements

52.1 When tested as described in 52.2 – 52.4, the bake elements of an oven for which the bottom is or is intended to be 36 in (914 mm) or less from the floor shall not ignite a potholder as described in 51.2.

52.2 Immediately prior to the test, the oven is to be operated for 10 min with the oven set for a temperature of 204°C (400°F), and with the oven door open. During the test, all oven racks are to be removed and the oven is to be on and set for a temperature of 204°C (400°F).

52.3 For an oven provided with a door hinged at the bottom, one corner of a potholder as described in 51.2 is to be held at the intersection of the vertical plane of the oven opening – the opening includes side trim or panels extending beyond the oven itself; the vertical plane of the side of the oven door; and, with the oven door completely open, the horizontal plane of the door surface that contacts the oven seal. The potholder is then to be oriented in any position possible, and is to be held in each position for 30 s. The potholder is to be extended over the top of any hinge, and appropriate consideration is to be given to any barrier or guard that may be provided.

52.4 For an oven provided with a door hinged at the side, one corner of a potholder as described in 51.2 is to be held at any point along the intersection of the vertical plane of the oven opening – the opening includes panels extending beyond the bottom of the oven – and the horizontal plane of the bottom of the oven. The potholder is then to be oriented in any position possible, and is to be held in each position for 30 s. Consideration is to be given to any barrier or guard that may be provided.

53 Marking of Controls

53.1 Each surface-unit control of an appliance shall clearly identify the unit it controls. The identification shall be by symbol or orientation, and shall not be by wording alone.

53.2 The identification mentioned in 53.1 shall be:

a) Visible and interpretable from a point 3 ft (914 mm) in front of the control and 5 ft (1.5 m) above the floor; and

b) Located on a part that is not interchangeable by the user.

53.3 The control for each surface unit shall be marked to indicate the off position by:

a) The single word “Off” (“OFF”); or

b) An open circle (O) at least 1/8 inch (3 mm) in diameter; or

c) The symbol IEC 60417-5010.

Each surface unit shall also indicate the position for multiple heat levels from lowest to highest. When numeric values are used, 0 may only be used to indicate the Off position. Graphic symbols may be used provided color is not the primary indication.

53.4 The marking mentioned in 53.3 shall be visible and interpretable from a point 5 ft (1.5 m) above the floor and:

a) For a range, no closer to the appliance than its forward projection.

b) For a counter-mounted cooking unit, no closer to the unit than the forward projection of the counter when the unit is installed in accordance with the manufacturer's instructions.

PERFORMANCE

54 General

54.1 The cheesecloth mentioned in this standard is to be untreated cotton cloth running 14 – 15 yd^2/lb (26 – 28 m^2/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 threads in the other direction). Unless otherwise specified, tests involving cheesecloth are to be conducted in a closed draft-free room.

55 Leakage Current Test for Cord-Connected Appliances Rated 120 V, 1.75 kW or Less

Section 55 revised and relocated to Section 55A

55A Leakage Current Test for Cord-Connected Appliances

55A.1 The leakage current of a cord-connected appliance rated for a nominal voltage equal to or less than 120 V supply when tested in accordance with 55A.3 – 55A.8 shall not be more than 0.75 mA.

Exception: For appliances employing sheathed heating elements, the leakage current may exceed the limits specified above during heatup and cooldown during a period not more than 5 min. However, at no time shall the leakage current exceed 2.5 mA.

55A.2 The leakage current of an appliance rated for a nominal voltage greater than 120 V supply when tested in accordance with 55A.3 – 55A.8 shall not be more than 3.5 mA.

Exception No. 1: For an abnormal condition where the appliance that upon loss of grounding dependably disconnects all sources that can produce leakage current, the leakage current to ground shall not exceed 5 mA with the grounding conductor open and with the loss-of-grounding circuit disabled. The leakage current between simultaneously accessible parts on the appliance shall not be more than 5 mA.

Exception No. 2: For an abnormal condition, such as described in 55A.8(a) and 55A.8(c)(3) that includes loss of phase, the leakage current shall not be more than 5 mA.

55A.3 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.

55A.4 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 evaluated as exposed surfaces unless guarded by an enclosure acceptable for protection against electric shock as defined in 6.2.1 – 6.2.3.2. Surfaces are evaluated as simultaneously accessible when they are readily contacted by one or both hands of a person at the same time. These measurements do not apply to terminals operating at voltages that do not involve a risk of electric shock as described in 2.6.

55A.5 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 in contact with the surface. If 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.

55A.6 An appliance employing water or other liquid is to be tested with a hard water solution of 0.5 g of calcium sulfate ($CaSO_4$) per liter of distilled water (0.07 oz $CaSO_4$ per gal of distilled water).

Exception: The composition of the water solution is not specified when it is determined by engineering evaluation that the leakage current will not be affected.

55A.7 The measurement circuit for leakage current is to be as shown in Figure 55A.1. The measurement instrument is defined in (a) – (d). The meter that 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 Ω resistive shunted by a capacitance of 0.15 µF.

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.

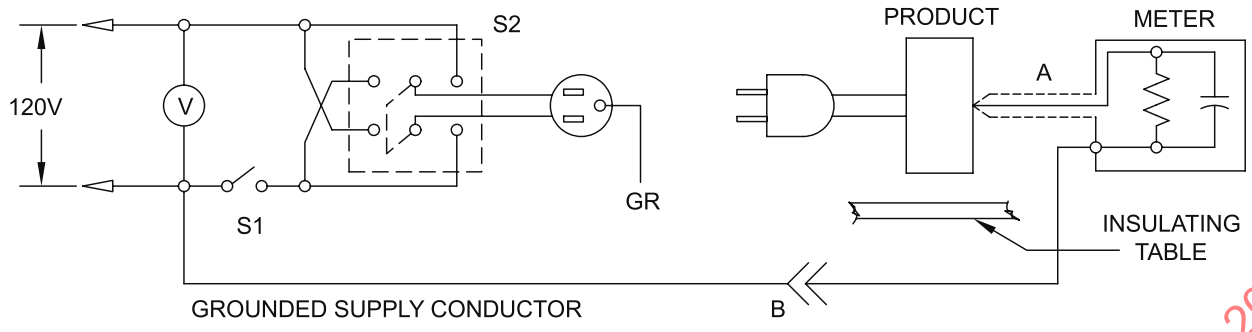
c) Over a frequency range of 0 – 100 kHz, the measurement circuit is to have a frequency response (ratio of indicated to actual value of current) that is equal to the ratio of impedance of a 1500-Ω resistor shunted by a 0.15 µF capacitor to 1500 Ω. At an indication of 0.75 mA, the measurement is to have 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 an accessible part and the grounded supply conductor.

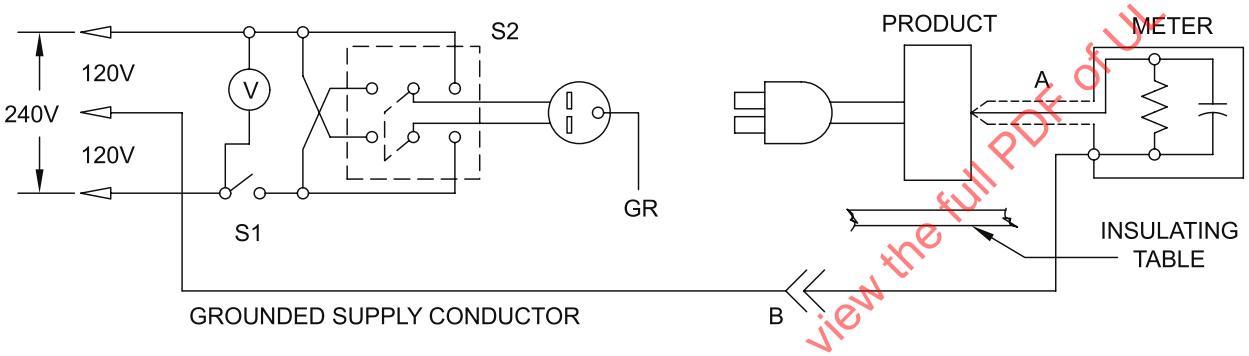
Figure 55A.1

Leakage-current measurement circuits

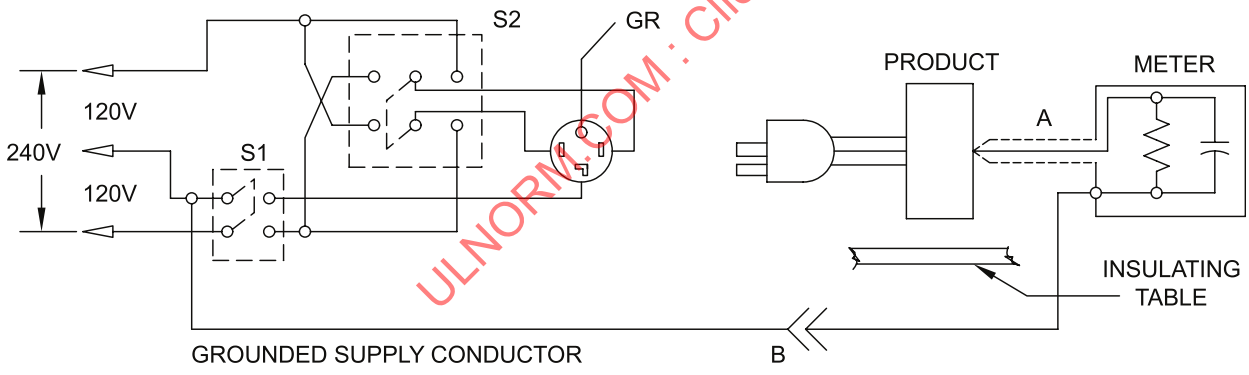
Product intended for connection to a 120 V or 240 V power supply



Product intended for connection to a 120-volt power supply, as illustrated above.



Product intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.



Product intended for connection to a 4-wire power supply, as illustrated above.

lc300v

Product intended for connection to a 120 V power supply.

A – Probe with shielded lead.

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

55A.8 A sample of the appliance is to be tested for leakage current starting with the as-received condition with all its switches and thermostats closed, but with its grounding conductor open at the attachment plug (open at receptacle – see Figure 55A.1). Appliances being evaluated per 55A.2 shall be evaluated in the 4-wire configuration if the appliance installation is compatible with a 4-wire power supply. The as-received condition is without prior energization except as may occur as part of the production-line testing. The supply voltage shall be adjusted to the voltage specified in 56.4. The test sequence, with reference to the measuring circuit (Figure 55A.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, thermostats set for maximum heating and with switching devices in all their operating positions.

For products described in 55A.1:

1) Switch S1 is then to be closed, energizing the appliance, and within a period of 5 s the leakage current is to be measured using both positions of switch S2, and with the appliance operated at the maximum heat setting of thermostats and with switching devices in all their operating positions.

2) After all operating modes have been energized individually, all operating modes that result in the maximum energy usage condition shall be energized. Leakage current is to be monitored until thermal stabilization under the maximum-heat conditions and the maximum value is to be recorded. Both positions of switch S2 are to be used. The equivalent of thermal stabilization is obtained as in the temperature test. If an adjustable temperature-regulating thermostat does not cycle at the maximum heat setting, it is to be adjusted until it does cycle before the final measurements at thermal stabilization are taken. Measurements are to be made with each heating-element thermostat, if any, open and closed and with switching devices in all their operating positions. Upon evidence of stabilizing readings, monitoring periods may be increased.

3) Switch S1 is then to be opened and monitoring of a leakage current is to continue, using both positions of switch S2, until the leakage current stabilizes or decreases during cool down.

c) For products described in 55A.2:

1) Switch S1 is then to be closed, energizing the appliance, and within a period of 5 s the leakage current is to be measured, and with the appliance operated under no load conditions until stabilized. Each operating mode is subsequently energized for a period not less than 5 minutes at the maximum heat setting. An operating mode consists of an oven cycle such as bake or broil or energizing an individual surface element. Ensure all heating elements are exercised during mode selection.

2) After all operating modes have been energized individually, all operating modes that result in the maximum energy usage condition shall be energized. Leakage current is to be monitored until thermal stabilization under the maximum energy usage conditions and the maximum value is to be recorded. The equivalent of thermal stabilization is obtained as in the temperature test. If an adjustable temperature-regulating thermostat does not cycle at the maximum heat setting, it is to be adjusted until it does cycle before the final measurements at thermal stabilization are taken. Measurements are to be made with each heating-element thermostat, if any, open and closed and with switching devices in all their operating positions. Upon evidence of stabilizing readings, monitoring periods may be increased.

3) Switch S1 is then to be opened and monitoring of a leakage current is to continue, until the leakage current stabilizes or decreases during cool down.

56 Input Test

56.1 The power input to a range, a wall-mounted oven, a counter-mounted cooking unit, or a combination thereof shall not be more than 110 percent of its marked rating under either of the conditions described in 56.2.

56.2 The power input is to be measured with the appliance and all accessories at normal operating temperature under full-load conditions, and while connected to a supply circuit as specified in 56.4. The power input is also to be measured with the setting of the various heating elements adjusted to result in the greatest unbalanced condition, taking into consideration all accessories. As an alternative method, the power input to the individual heating elements and accessories may be measured and the total input computed. See 80.2.

56.3 For the power-input test, oven and broiler heating elements are to be connected into each receptacle intended for such elements.

Exception: Receptacles that are provided expressly for slightly changing the location of the heating units, and in which it is not feasible to operate additional elements, may be disregarded.

56.4 If the voltage rating of an appliance is within the range of 110 – 120 V, the test voltage is to be 120 V. If the voltage rating of an appliance is within the range of 220 – 240 V, the test voltage is to be 240 V. An appliance having a voltage rating other than in either of the ranges mentioned is to be tested at the marked voltage rating.

57 Test on Flasher Units

57.1 When tested as described in 57.2, a counter-mounted cooking unit incorporating a rapid initial-heat – flasher – unit shall not open an ordinary – not time-delay – fuse.

Exception: A counter-mounted cooking unit that is marked in accordance with 84.1.3 need not comply with the requirement if a time-delay fuse having the same rating as, and used in lieu of, the ordinary fuse described in 57.2 does not open during the test.

57.2 For the test discussed in 57.1, the current rating of the fuse is to be the same as the ampacity of wire of the smallest size that can properly be used for the branch circuit to the appliance. Each unit of conventional type comprising part of the assembly is to be energized at high heat for 30 min prior to the test and is to remain so energized while each flasher unit is turned on. If more than one flasher unit is involved, the test is to be performed with all flasher units turned on simultaneously.

58 Grounding Continuity Test

58.1 The resistance between the grounding means provided on an appliance and a dead metal part such as the oven lining or an element sheath shall not exceed 0.1 Ω. The grounding means may be either the neutral lead, the neutral terminal, the grounding lead, or the grounding terminal, depending on the rated voltage of the appliance and on its means of power-supply connection.

58.2 With reference to 58.1, the resistance may be determined by any convenient method. If unacceptable results are recorded, either a direct or alternating current of 30 A is to be passed from the grounding terminal to the dead metal part, and the resulting drop in potential is to be measured 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.

59 Temperature Test

59.1 General

59.1.1 An appliance shall be tested as described in 59.2.1 – 59.5.3.5 and shall not reach a temperature at any point high enough to cause a risk of fire, to damage any material used, or to exceed the temperature rises specified in Table 59.1.

Table 59.1
Maximum acceptable temperature rises

Materials and components	°C	°F
1. Insulated wire or cord	25°C (77°F) less than its temperature rating	
2. At any point within an outlet box or wiring terminal compartment, including leads therein	35	63
3. At any point on the inside surfaces of a storage drawer	65	117
4. At any point on a surface located directly above a storage drawer or directly above the plane of the top surface of the base of the test enclosure, see Figure 59.5.	125	225
5. Fiber employed as electrical insulation	65	117
6. Wood and other combustible material	65	117
7. Copper conductors and copper parts other than parts of an oven lampholder, bare or insulated, without tinning, nickel coating, or silver plating, except as noted in item 8[a]	175	315
8. Terminations of copper conductors[b]	125	225
9. Fuses	65	117
10. At any point on the walls or cabinets mentioned in 59.4.2.1 – 59.4.5.2 or on the surfaces described in 59.5.1.1 – 59.5.3.4 [e]	65	117
11. At any point on the enclosure of an electric-discharge-lamp ballast	65	117
12. Capacitors	25°C (77°F) less than the marked limit	
13. Coil windings of an alternating-current motor 7 in (178 mm) or less in diameter, not including a universal motor– thermocouple or resistance method:		
A. Class A insulation systems:[c]		
Open motor	75	135
Totally enclosed motor	80	144
B. Class B insulation systems:[c]		
Open motor	95	171
Totally enclosed motor	100	180
C. Class F insulation systems:[c]		
Open motor	120	216
Totally enclosed motor	125	225
D. Class H insulation systems:[c]		
Open motor	135	243
Totally enclosed motor	140	252
14. Class 105 insulation systems:		
A. Coils of a Class 2 transformer:		
Thermocouple method	65	117
Resistance method	85	153

Table 59.1 Continued on Next Page

Table 59.1 Continued

Materials and components	°C	°F
B. Coils of a relay, a solenoid, and the like:[c]		
Thermocouple method	65	117
Resistance method	85	153
C. Coils of an electric-discharge-lamp ballast[c]		
Thermocouple method	65	117
Resistance method	80	144
D. Coils of a power transformer, resistance method	70	126
15. Class 130 insulation systems		
A. Coils of a relay, a solenoid, and the like[c]		
Thermocouple method	85	153
Resistance method	105	189
B. Coils of an electric-discharge-lamp ballast[c]		
Thermocouple method	85	153
Resistance method	95	171
C. Coils of a power transformer, resistance method	95	171
D. Coils of a Class 2 transformer		
Thermocouple method	85	153
Resistance method	95	171
16. Phenolic composition employed as electrical insulation or as a part the deterioration of which would result in a risk of fire or electric shock	125[d]	225[d]
17. Sealing compound	40°C (104°F) less than the melting point	
18. At any point on those surfaces of a wall-insert surface unit, having a wiring-terminal compartment, expected to be contacted by the conduit or cord. See 59.5.1.3.	35	63

[a] No limit if conductor or part is tinned, nickel-coated, or silver-plated.

[b] No limit if both conductor and termination – terminal screw, wire connector, or similar part – are tinned, nickel-coated, or silver plated.

[c] At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature rise measured by a thermocouple is able to be more than the maximum rise specified by the following amount:

Additional Temperature Rise

Item	°C	(°F)
13, subitem A and C	5	(9)
13, subitem B and D	10	(18)
14, subitem B and C	15	(27)
15, subitem A	20	(36)
15, subitem B	10	(18)

provided that the temperature rise of the coil as measured by the resistance method is not more than that specified in the table.

[d] The limitation of phenolic composition does not apply to a compound that has been investigated and found to have heat-resistance properties acceptable for the higher temperature.

[e] During grill operation as specified in 59.3.7.1 – 59.3.7.3, the maximum acceptable temperature rise is 95°C (171°F) on walls and surfaces visible after installation of the appliance. This 95°C rise does not apply when a grill is operated as described in 59.3.7.4 using the manufacturer's recommended clearances.

59.1.2 The ambient temperature of a solid-state control is to be measured by thermocouples on the appliance corrected to a 25°C room ambient whenever temperature measurements are required in this standard. The thermocouples are to be located away from the control so as not to be influenced by control heating, but close enough to accurately reflect the maximum control ambient temperature (T_{max}).

59.1.3 To determine the control use ambient temperature (T_a) for the test procedure in the Demonstrated Test Method requirements of the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, either the maximum control ambient temperature (T_{max}) recorded in accordance with 59.1.2 may be used, or the following alternative method may be used. The Temperature Test, Section 59, is to be conducted on the appliance with the alcove walls removed and the appliance operating with:

a) Only one surface element heating a pan of water or the stove plate as applicable, or

b) The oven in any normal operating mode.

The option chosen is to be the one that results in the greatest control ambient temperature. The elements and/or the oven are to be controlled as specified in 59.3.2.1 – 59.3.3.1 for this test. The control use ambient temperature (T_a) used for the Demonstrated Test Method is the average of this temperature and the maximum control ambient temperature recorded during the normal temperature test.

59.2 Temperature measuring equipment

59.2.1 Ordinarily, coil or winding temperatures are to be measured by thermocouples, except that temperatures are to be measured by the resistance method if:

a) The coil is inaccessible for mounting thermocouples – for example, a coil immersed in sealing compound; or

b) The coil wrap includes thermal insulation, or more than two layers [1/32 in (0.8 mm) maximum] of cotton, paper, rayon, or the like, the wrap is to be lifted and a thermocouple is to be mounted on the integral insulation of the conductor beneath the wrap if this is possible without damage to the coil or its terminal assembly.

59.2.2 For a thermocouple-measured temperature of a coil of an alternating-current motor, other than a universal motor, having a diameter of 7 in (178 mm) or less, the thermocouple is to be mounted on the integrally applied insulation of the conductor.

59.2.3 In using the resistance method, the windings are to be at room temperature at the start of the test. The temperature rise of a winding is to be calculated from the formula:

$$\Delta t = \frac{R}{r}(k + t_1) - (k + t_2)$$

In which:

Δt is the temperature rise in °C;

R is resistance of the coil at the end of the test in ohms;

r is resistance of the coil at the beginning of the test in ohms;

t_1 is room temperature at the beginning of the test in °C;

t_2 is room temperature at the end of the test in °C; and

k is 234.5 for copper, 225.0 for electrical conductor grade (EC) aluminum. Values of the constant k for other grades must be determined.

59.2.4 Except as noted in 59.2.1 and 59.2.5, temperatures are to be measured by thermocouples consisting of wires not larger than 24 AWG, and a temperature is considered to be constant when three

successive readings taken at intervals of 10 percent of the previous elapsed duration of the test, but not less than 5-min intervals, indicate no change.

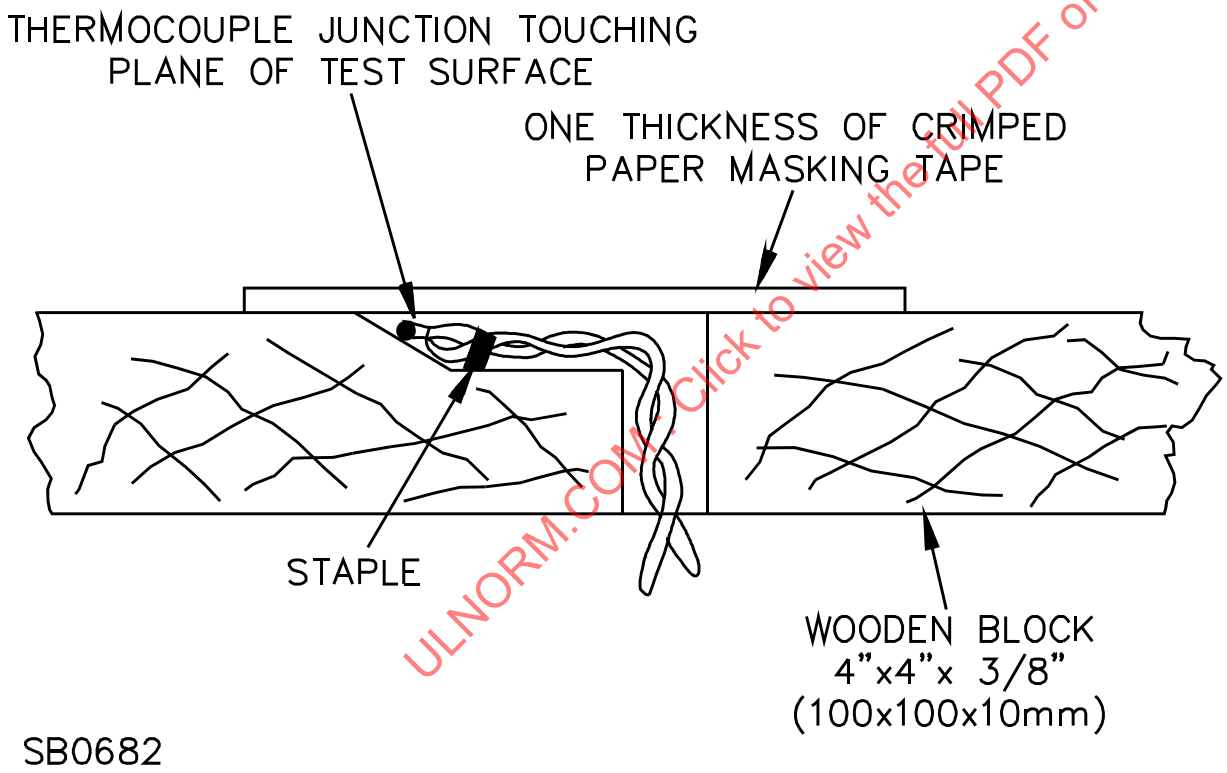
59.2.5 For the Fire and Explosion Tests in Sections 100 – 109, the ambient air temperature is to be measured by a not larger than 20 AWG, unweighted Type J iron-constantan or Type K chromel-alumel thermocouple located as specified in 59.3.1.3.

59.2.6 When thermocouples are used in the determination of temperatures in connection with the heating of electrical devices, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wires and a potentiometer type of indicating instrument; and such equipment is to be used whenever referee temperature measurements by thermocouples are necessary.

59.2.7 Thermocouples are to be mounted on the walls of the test booth, on the cabinet, and on the other surrounding structural members. See Figure 59.1 for method of mounting thermocouples.

Figure 59.1

Method of mounting thermocouple



59.2.8 If the magnetic field of an induction heating appliance unduly influences the results, the temperatures can be measured using non-iron type thermocouple or using platinum resistances with twisted connecting wires or any equivalent means.

59.3 Procedure

59.3.1 General

59.3.1.1 All values for temperature rise in Table 59.1 are based on an 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).

59.3.1.2 Temperatures on surfaces:

a) Inside a storage drawer;

b) Located directly above a storage drawer; or

c) Directly above the plane of the top surface of the base of the test enclosure; see Figure 59.5,

are to be measured by thermocouples securely taped, cemented, brazed, or soldered to the surface in question.

59.3.1.3 Unless otherwise indicated, when reference is made to an oven temperature, the temperature is to be measured at the center of the oven – that is, midway between the sides, midway between the front and back, and midway between the bake and broil elements if both are provided or between an element and the oven wall if only one element is provided. The temperature measurement is to be made with an unweighted thermocouple. If convection air currents cause erratic readings, a baffle is to be provided to shield the thermocouple.

59.3.1.4 The appliance is to be operated under each condition of normal service; if a multispeed motor is provided, this includes operation at high and low speed and at one intermediate speed. Unless otherwise indicated in these requirements, operation is to be continued until temperatures have become constant.

59.3.1.5 Normal operating conditions are considered to be represented when an appliance is operated in accordance with 59.3.2.1 – 59.5.3.5 while connected to a supply circuit as specified in 56.4.

59.3.1.6 Unless otherwise indicated, the appliance is to be installed as specified in 59.4.1.1 – 59.5.3.5.

59.3.1.7 If a heat-deflection shield is removable without the use of tools and is required to maintain compliance with the requirements in 59.1.1, that portion of the appliance requiring the shield shall be interlocked or constructed so that it cannot be operated without the shield installed as intended.

59.3.2 Surface units, including induction cooktops

59.3.2.1 A stove plate is to be placed on one surface unit if there are not more than four surface units, and on each of two units if there are more than four surface units. Each remaining surface unit is to be covered with a pan of water. The unit or units to be covered with a plate is to be in accordance with the following order of precedence:

a) Front unit, if any.

b) Units having highest wattage rating.

c) Units farthest from the wall of the test booth.

d) Units having largest diameter.

59.3.2.2 With reference to 59.3.2.1, the front of a counter-mounted surface assembly is considered to be the long side adjacent to the highest-wattage unit unless the manufacturer's installation instructions or some other feature positively indicates otherwise.

59.3.2.3 The stove plates mentioned in 59.3.2.1 and 59.3.2.9 are to be circular cast-iron or steel plates. The plate used with a 6-inch (152-mm) or smaller surface unit is to be 7-1/2 inches (190 mm) in diameter and is to weigh approximately 3 lb (1.4 kg); and the plate used with a surface unit larger than 6 inches is to be 10-1/2 inches (267 mm) in diameter and is to weight approximately 7 lb (3.2 kg). The plates are to be flat on one side but may be ribbed on the other side to reduce the likelihood or warping. The plates are to be kept free from rust and other foreign material by the use of steel wool or a wire brush as may be necessary.

Exception No. 1: If the construction of the appliance is such that a stove plate cannot be located as specified in 59.3.2.5 due to interference with one or more of the pans specified in 59.3.2.1, the diameter of the stove plate is to be reduced to the largest diameter possible without contacting any of the pans.

Exception No. 2: If the construction is such that the specified circular stove plate covering an elliptical or similar non-circular surface unit cannot be made to cover the entire active part of the surface unit as described in 59.3.2.4, a non-circular stove plate shall be used. A non-circular stove plate is to have the same approximate shape as the active portion of the surface unit and, except as noted in Exception No. 1, is to have major and minor axes that are 2 in (50 mm) greater than the major and minor axes of the active portion of the surface unit.

59.3.2.4 Each stove plate is to be placed such that it completely covers the active area of the surface unit. If centering the stove plate over the surface unit results in the stove plate overlapping an edge of a cooktop, or if interference with trim, knobs, or the like would not allow a stove plate to lie flat on the surface unit or cooking surface, the position of the stove plate is to be adjusted so that the stove plate lies flat without overlapping the edge of the cooktop. In any case, the center of the stove plate is to be positioned as close to the center of the surface unit as possible.

59.3.2.5 The pans mentioned in 59.3.2.1 are to have approximately vertical sides. The diameter of the bottom plane surface of the pan is to be no less than the maximum diameter of the active part of the surface unit on which the pan is used, and is to be not more than 1 in (25.4 mm) larger than that diameter. Other than as noted in 59.3.2.6, the pans are to be of aluminum.

Exception: A pan covering an elliptical or similar non-circular surface unit is to have the same approximate shape as the active portion of the surface unit. The bottom plane surface of the pan is to have major and minor axes that are within minus 0 and plus 1 in (minus 0 and plus 25.4 mm) of the major and minor axes of the active portion of the surface unit.

59.3.2.6 If the design of an appliance requires that pans of a material other than aluminum be used to reduce the likelihood of overheating of the surface unit and the appliance is marked in accordance with 84.2.3, such pans are to be used during the test. However, an additional test is to be conducted to demonstrate that the use of aluminum pans will not create a risk of fire.

59.3.2.7 A well cooker is to contain water during the test.

59.3.2.8 All surface and well units are to be operated as indicated in 59.3.2.9 and 59.3.2.10.

59.3.2.9 The control for each surface unit covered with a stove plate is to be adjusted to result in a temperature of 246°C (475°F) at the center of the top surface of the stove plate. An automatic or cycling type – intermittent input – control is to be set so that the average temperature at the center of the top surface of the stove plate will be 246°C. If a control having a definite number of settings cannot be set to result in this temperature, the surface unit is to be connected to an external power supply having means

for varying its output voltage; and the voltage is to be set so that temperature at the center of the top surface of the stove plate is 246°C.

Exception: If setting the surface unit control in the position that provides maximum heat results in a temperature less than 246°C at the center of the top surface of the stove plate, or if the control has only one setting, the test is to be conducted with the control set in this position.

59.3.2.10 The control for each surface unit not covered with a stove plate, and for each well cooker, is to be set as follows for the test:

a) A control having only one on setting is to be set in that position.

b) A control having a definite number or an infinite number of settings is to be set so that the power input of the unit is not less than:

1) Fifty percent of the rated power input for a unit rated 1200 W or less; and

2) Four hundred + w/6 watts for any other unit – w equals the wattage rating of the unit.

c) A control, as mentioned in (b), of an automatic or cycling type – intermittent input – is to be set so that the average power input of the unit is not less than that specified in (b).

59.3.3 Ovens

59.3.3.1 The interior of an oven is to be maintained at an average temperature of 246°C (475°F), or at the temperature resulting from the maximum setting of the thermostat, whichever is lower.

59.3.4 Rotating spits

59.3.4.1 An oven having a rotating spit is also to be tested as follows. The instructions provided with the appliance by the manufacturer are to be followed with reference to:

a) Which element, upper or lower, is to be energized;

b) The thermostat setting – see 84.2.2; and

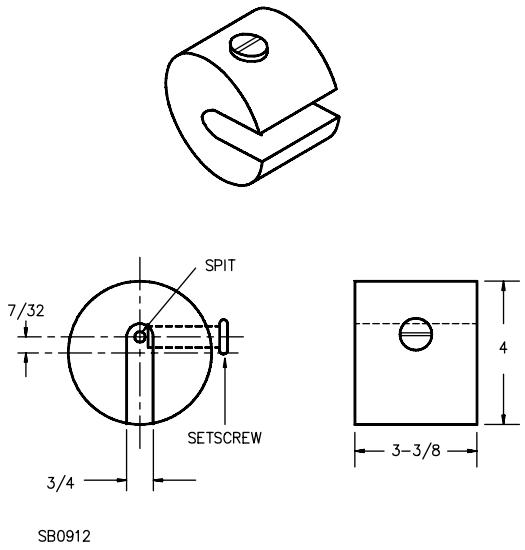
c) The position of the oven door, closed or ajar.

The spit is to be loaded with a 10-lb (4.5-kg) weight as illustrated in Figure 59.2. With the surface units operating in accordance with 59.3.2.8 – 59.3.2.10, the oven is to be operated until constant temperatures are obtained.

Exception: Operation may be terminated at the end of 1-1/2 h if the oven is obviously intended only for short-time cooking operations as indicated by small size or other factors.

Figure 59.2

Load for rotating spit



SI Equivalents

in	mm
7/32	5.6
3/4	19.0
3-3/8	85.7
4	102.0

59.3.4.2 With reference to 59.3.4.1, in the absence of instructions or marking for setting of the oven control, the test is to be conducted with the control at maximum setting. If marked in accordance with 84.2.2, the test is to be conducted with the control at that setting.

59.3.4.3 A rotating spit that is intended to be used with a grill element is to be operated in accordance with 59.3.7.1 and 59.3.7.3.

59.3.5 Griddles

59.3.5.1 A griddle is to be operated:

a) With the control switch set to give a temperature nearest to, but not less than 246°C (475°F) at the center of the griddle plate; or

b) At the temperature resulting from the maximum setting of the control, whichever is lower.

59.3.6 Deep-fat fryers

59.3.6.1 A deep-fat fryer is to be operated continuously with the regulating thermostat set at the maximum heat position and while filled with previously unused vegetable oil to the height recommended by the manufacturer. A limiting control, if provided, is not to function during this test, except for an initial overshoot that occurs when the test is started from room temperature. Temperatures need not be measured on the oil. See 59.3.6.2.

59.3.6.2 Following the test described in 59.3.6.1, the regulating thermostat is to be short-circuited. Starting at room temperature, the fryer is to be operated continuously until the oil temperature:

a) Has stabilized;

b) Has peaked if a manually reset limit thermostat is provided; or

c) Peaks have become constant if an automatically reset temperature control is provided.

The temperature is to be measured at the approximate center of the oil pool, 1 in (25.4 mm) below the surface, and shall not exceed 246°C (475°F).

Exception: The temperature of the oil may exceed 246°C if a temperature-limiting control is provided that de-energizes the fryer heating elements before the oil temperature exceeds 246°C and any temperature overshoot does not result in ignition of the oil.

59.3.7 Grills

59.3.7.1 The appliance is to be operated under conditions representing normal service. An adjustable thermostat or other temperature-control device for the grill, if provided, is to be set to produce maximum temperatures.

59.3.7.2 When a grill is not operated in conjunction with a rotating spit, the appliance is to be operated with the grill de-energized until constant temperatures are attained. The grill is then to be energized and appliance operation continued for 1 h.

59.3.7.3 When a grill is operated in conjunction with a rotating spit, the appliance is to be operated with the grill and spit energized together until constant temperatures are attained. During this test, the spit is to be loaded with a 10-lb (4.5-kg) weight as illustrated in Figure 59.2.

59.3.7.4 If the temperature rise on walls and surfaces visible after installation of the appliance exceeds 65°C (117°F), but does not exceed 95°C (171°F), during operation as specified in 59.3.7.1 – 59.3.7.3, the appliance shall be:

a) Provided with installation instructions indicating minimum required clearances to adjacent surfaces in order that the temperature rise on the subject surfaces does not exceed 65°C;

b) Marked in accordance with 83.10; and

c) Operated as specified in 59.3.7.1 – 59.3.7.3 with the appliance installed with clearances to the test enclosure in accordance with 59.3.7.4 (a) and (b).

59.3.8 Accessories

59.3.8.1 If one or more specific plug-in accessories, such as a griddle, is intended for use with an appliance, consideration is to be given to the test setup in order that the most adverse conditions of normal operation will be represented.

59.3.8.2 Temperatures are to be observed throughout the test, and the test is to be continued until constant temperatures are attained.

59.3.9 Induction Woks

59.3.9.1 A wok filled to its maximum capacity by a mixture of rice and water in accordance with the manufacturer's instructions, and is to be operated for two complete cycles of rice cooking. The cycle is

considered as having ended when the thermostatic control automatically switches to the “low” or “off” position. The second cycle is to begin immediately after completion of the first cycle, as the control allows. The temperatures are to be measured throughout the two cycles, and also when the wok has subsequently operated on low heat until temperatures having become stabilized.

59.3.9.2 A wok shall have an equivalent sphere diameter that does not differ from the sphere diameter of the induction wok cavity by more than 0/-1 %. This wok may be supplied by the manufacturer. The vessel shall be made of low carbon steel having a maximum carbon content of 0.08% with a thickness of 2 mm +/- 0.5 mm. The height of the wok shall not be less than twice the depth of the induction wok cavity or as recommended in the manufacturer’s instructions.

59.4 Test enclosures

59.4.1 General

59.4.1.1 The panels for the test enclosures described in 59.4.2.1 – 59.5.3.5 are to consist of a single thickness of 3/8-in plywood or other material of equivalent thermal conductivity. The inside surface of the enclosures are to be painted dull black.

59.4.2 Ranges

59.4.2.1 The walls of the enclosure in which a range is tested are to extend at least to the top of the top cabinets, and are to project not less than 12 inches (305 mm) in front of the range. The enclosure is to be firmly assembled with 90 degree angles between the back and the side walls. The end panels of the range are to be located as near the side walls of the enclosure as the end panel construction will permit– a sliding fit. The side walls are then to be adjusted at the front until contact is established between the test enclosure and the front edges of the range at its widest point. See Figure 59.3.

59.4.2.2 The simulated building cabinets are to be constructed of the same type of material as the walls of the enclosure.

59.4.2.3 The base cabinet is to be 6 ±1/4 in (146 – 159 mm) wide, 36 in (914 mm) high, and the same depth as the cook top of the range, except that it is to extend not less than 1 in (25.4 mm) beyond the junction of the door and the body of the oven.

59.4.2.4 The top cabinet is to be 12 in (305 mm) high, a width sufficient to extend to the side walls of the booth, and 13 in (330 mm) deep, except that it may be of lesser depth if an integral cabinet stop is provided, in which case the cabinet is to be of sufficient depth to extend to the stop.

59.4.2.5 The bottom cabinet for a range not floor supported is to be the same depth as the side cabinets and a width sufficient to support the range and necessary cabinets and walls.

59.4.3 Counter-level ranges

59.4.3.1 A counter-level range, with or without a warming tray located on the top of the back guard, is to be installed close against vertical walls at the back and at both sides, and a top cabinet is to be installed 30 in (762 mm) above the top of the cooking platform. See dimension A in Figure 59.3.

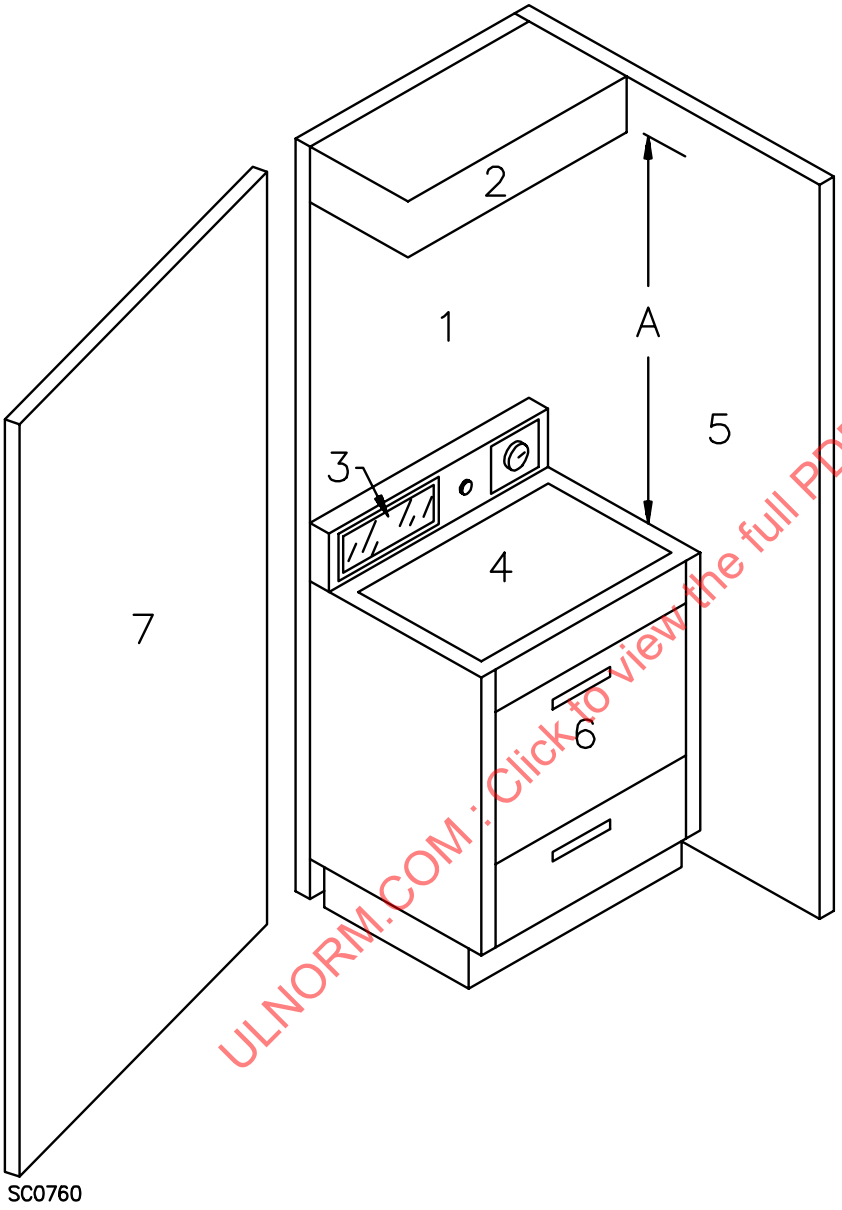
59.4.4 Eye-level ranges

59.4.4.1 Except as noted in 59.4.4.3 – 59.4.4.5, an eye-level range, with either one or two ovens, is to be installed close against a vertical back wall, and a top cabinet is to be installed above the upper oven. A vertical wall, an upper end cabinet, and a base cabinet are to be installed at the end of the range opposite

the hinged end of the door. The end of the range on which the hinges are located is to be installed close against a vertical wall. See Figure 59.4.

Figure 59.3

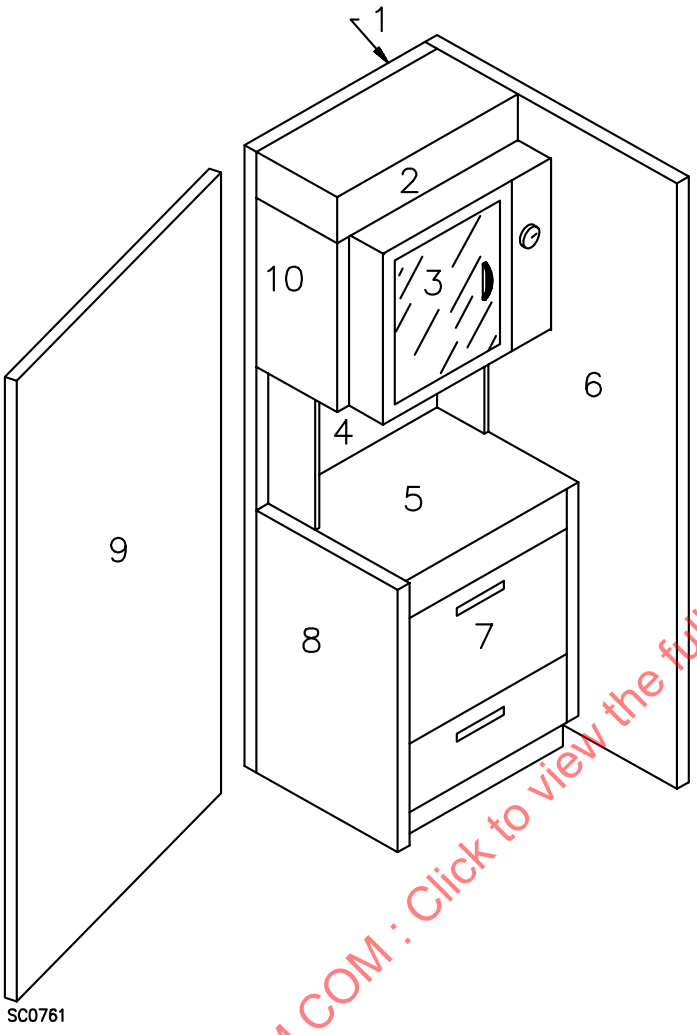
Test enclosure for counter-level range



1. Building back wall
2. Top building cabinet
3. Control panel
4. Cooking surface
5. Building side wall
6. Oven
7. Building side wall

Figure 59.4

Test enclosure for eye-level range



1. Building back wall
2. Top building cabinet
3. Oven and top control panel
4. Range backguard
5. Cooking surface
6. Building side wall
7. Oven or bottom building cabinet
8. Base building cabinet
9. Building side wall
10. Upper end building cabinet

59.4.4.2 If the wall reduces the likelihood of opening of the door to a position that will permit removal of an oven rack, an upper end cabinet and a base cabinet, both wide enough to permit opening of the door as required, are to be installed.

59.4.4.3 If a control panel is provided opposite to the hinged end, the upper end cabinet and base cabinet are to be omitted.

59.4.4.4 If a lower oven or storage area is not provided to permit floor mounting, the range is to be installed on a bottom cabinet or over any specific appliance with which the range is intended to be used. See 82.11.

59.4.4.5 The upper end cabinet installed opposite the hinged end of the door is to be 6 ±1/4 in (152 ±6.4 mm) wide, the same depth as the cabinet above the oven, and the same height as the upper oven.

59.4.4.6 The upper end cabinet installed to provide clearance at the hinged end of the door is to be the same depth as the cabinet above the oven; the same height as the upper oven; and with the base cabinet, a width sufficient to allow the oven door to be opened. If the width is 3/8 in (9.5 mm), solid plywood is to be used.

59.4.5 Combination ranges

59.4.5.1 A combination range is to be installed close against a vertical wall or with not more than a 6 in (152 mm) air space to a vertical wall at the end where electrical units are located. The spacings at the flue or vent and at the end of the range where solid fuel is burned are to be in accordance with Table 59.2.

Table 59.2
Minimum spacings at nonelectrical end of combination range

Type of range	Spacing to wall from nonelectrical end of range, in	(mm)	Spacing from flue or vent, in	(mm)
Solid fuel, fire pot without fire-clay lining	36	(914)	18	(457)
Solid fuel, fire pot with fire-clay lining	24	(610)	18	(457)

59.4.5.2 During the test of a combination coal and electric range, there is to be a uniform coal fire or equivalent heating in the fire pot that will produce a temperature of 400°C (752°F) at the center of the cooking top over the fire. Temperatures on a wall or walls adjacent to the coal end of the range are not to be investigated as a part of this test.

59.5 Wall-mounted ovens and counter-mounted cooking units

59.5.1 General

59.5.1.1 Wall and counter-mounted cooking equipment is to be tested with zero spacings to all combustible surface in accordance with the conditions described in 59.5.1.2 – 59.5.3.5.

59.5.1.2 Thermocouples are to be located 6 in (152 mm) apart in lines and columns spaced 6 in from one another on those surfaces of a cord-connected, wall-mounted oven, or a counter-mounted cooking unit considered likely to be contacted by the cord upon installation.

59.5.1.3 If a wiring-terminal compartment is provided on a wall-insert oven or a counter-insert surface unit, it is anticipated that either cord or flexible conduit will be used for connection to the source of supply.

Accordingly, temperatures are to be measured as described in 59.5.1.2 on those surfaces of the oven or surface unit considered likely to be contacted by the conduit or cord. The maximum acceptable temperature rise on such surfaces of the oven or surface unit during the test is 35°C (63°F).

59.5.1.4 With reference to 59.5.1.2 and 59.5.1.3, a thermocouple is to be in intimate contact with the surface of the material the temperature of which is being measured. In most cases, adequate thermal contact will result from taping or cementing the thermocouple in place; but where a metal surface is involved – particularly where it is in contact with combustible material– brazing or soldering the thermocouple to the metal may be necessary.

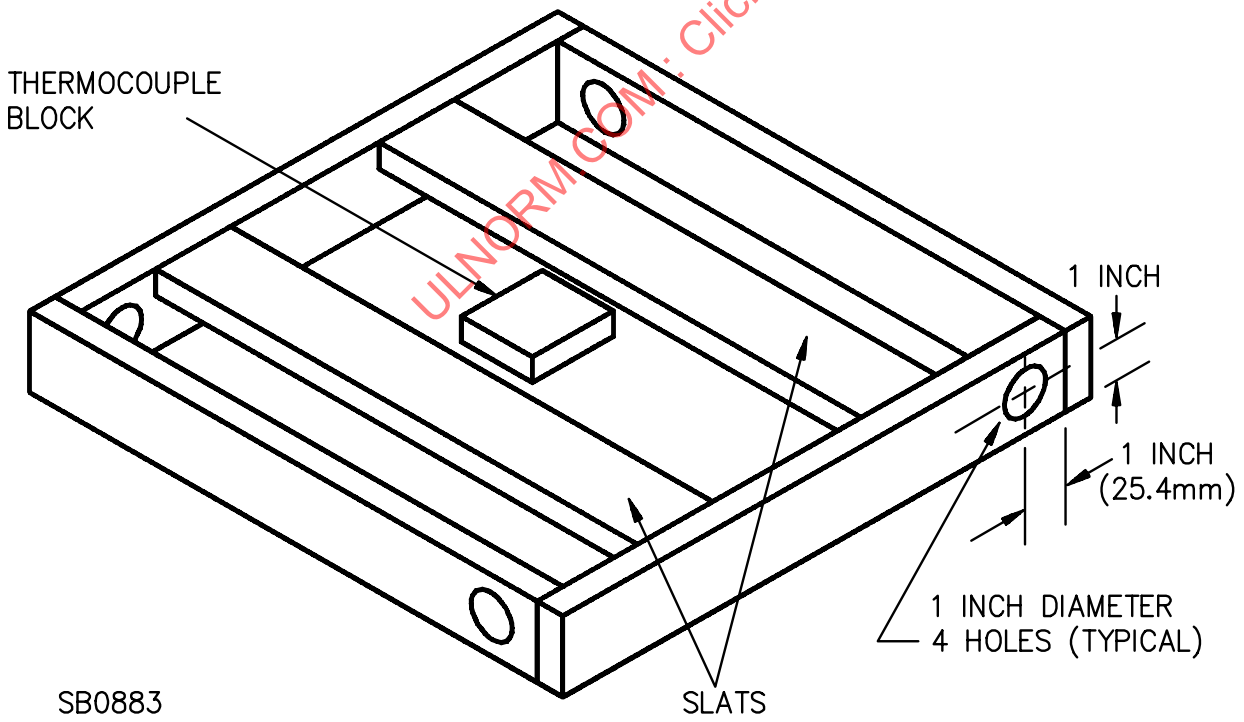
59.5.2 Wall-mounted ovens

59.5.2.1 A wall-mounted oven is to be supported on a base as described in 59.5.2.2. The base is to rest on a bench or table. The test enclosure as described in 59.5.2.3 is to be firmly assembled so that the sides, back, and top will provide as close a fit as the construction of the oven will permit – a sliding fit. The trim around the oven door is to be mounted in the intended manner. A gasket intended to provide a spacing between the trim and the wall in which the oven is mounted is to be removed before the oven is set in place for the test, unless it is secured for shipment from the factory so that it cannot be separated readily from the trim.

59.5.2.2 The base for supporting the oven is to be as illustrated in Figure 59.5. The sides of the base are to be constructed of wooden boards of such length as to be flush with the side, front, and back panels. The slats are wooden boards, and are to be mounted in such position as to line up with the feet or skids on the bottom of the oven. The stops of the slats and the thermocouple side of the thermocouple block are to be in the horizontal plane of the top surface of the base. See Figure 59.1.

Figure 59.5

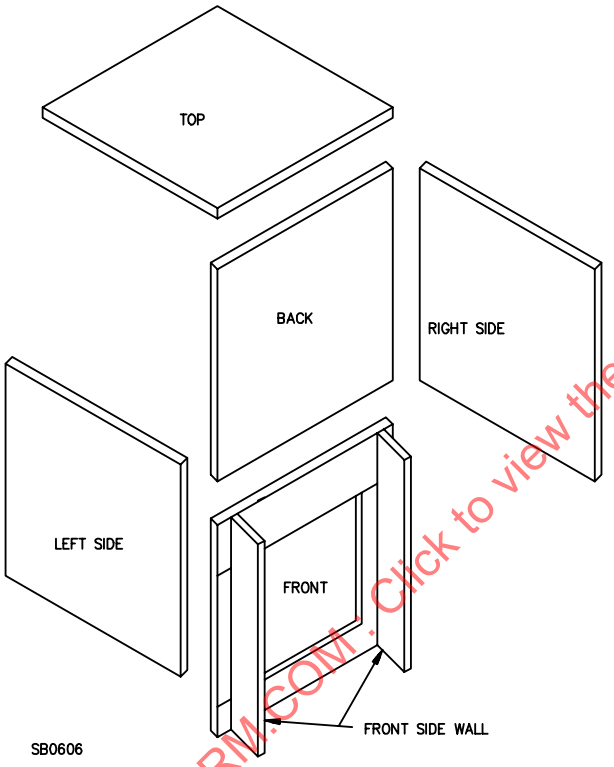
Base for wall-mounted oven test



59.5.2.3 The panels for enclosing the oven are to be as illustrated in Figure 59.6. The dimensions of the panels are to be as determined by the overall outer dimensions of the oven, in accordance with 59.5.2.1. The opening in the front panel is to be no larger than necessary to permit the oven to be inserted. The width of the top member of the front panel is to be 12 in (305 mm), and the width of the other members is to be 6 in (152 mm). The front side-wall panels are to be no less than 12 in wide and are to extend the full height of the overall front panel and are to be located as close as possible to the trim of the oven; except that, if the oven door covers the trim, the front side-wall panels are to be located 1/4 in (6.4 mm) from the edge of the door.

Figure 59.6

Enclosure panels for wall-mounted oven test



59.5.2.4 An oven with a door that is hinged on the side is to be tested with only one front side-wall panel located at the hinged side of the door.

59.5.2.5 An oven with a door that is hinged at the bottom is first to be tested with both front side-wall panels in place. If temperatures exceeding those specified in Table 59.1 are recorded, the test may be repeated with one front side-wall panel in place followed, if necessary, by a test with the other panel in place. The temperatures shall not exceed those specified in Table 59.1 in at least one of the tests.

59.5.2.6 If the manufacturer wishes an oven to be investigated for operation installed adjacent to an identical oven – side by side – or one above the other, the setup for the test is to be as follows. Each of the two ovens is to be enclosed in the manner described in 59.5.2.1 – 59.5.2.5, except as noted in this paragraph, and the front of each oven is to be in the same vertical plane as that of the other. For operation side by side, the two assemblies are to rest on a common horizontal surface, and for operation one above the other, one assembly is to be set on top of the other. In either case, the separation between the two assemblies is to be no larger than that necessary to accommodate the trims, except that the separation may be larger than the trims will permit if the oven is marked in accordance with 82.12. If the minimum

separation is employed for ovens mounted one above the other, the height of the base – see 59.5.2.2 – for mounting the uppermost oven may be increased from the specified value if necessary to accommodate the trim. If the minimum separation is employed for ovens mounted side by side, the width of each of the two adjacent front panels may be less than the 6-in (152-mm) value specified in 59.5.2.3, as may be necessary to bring the two trims into contact with each other. After the assemblies have been mounted as described above, any open space at the top, back, or sides is to be closed with plywood.

59.5.2.7 The block on which the thermocouple is mounted and the method of securing the thermocouple, are to be as illustrated in Figure 59.1.

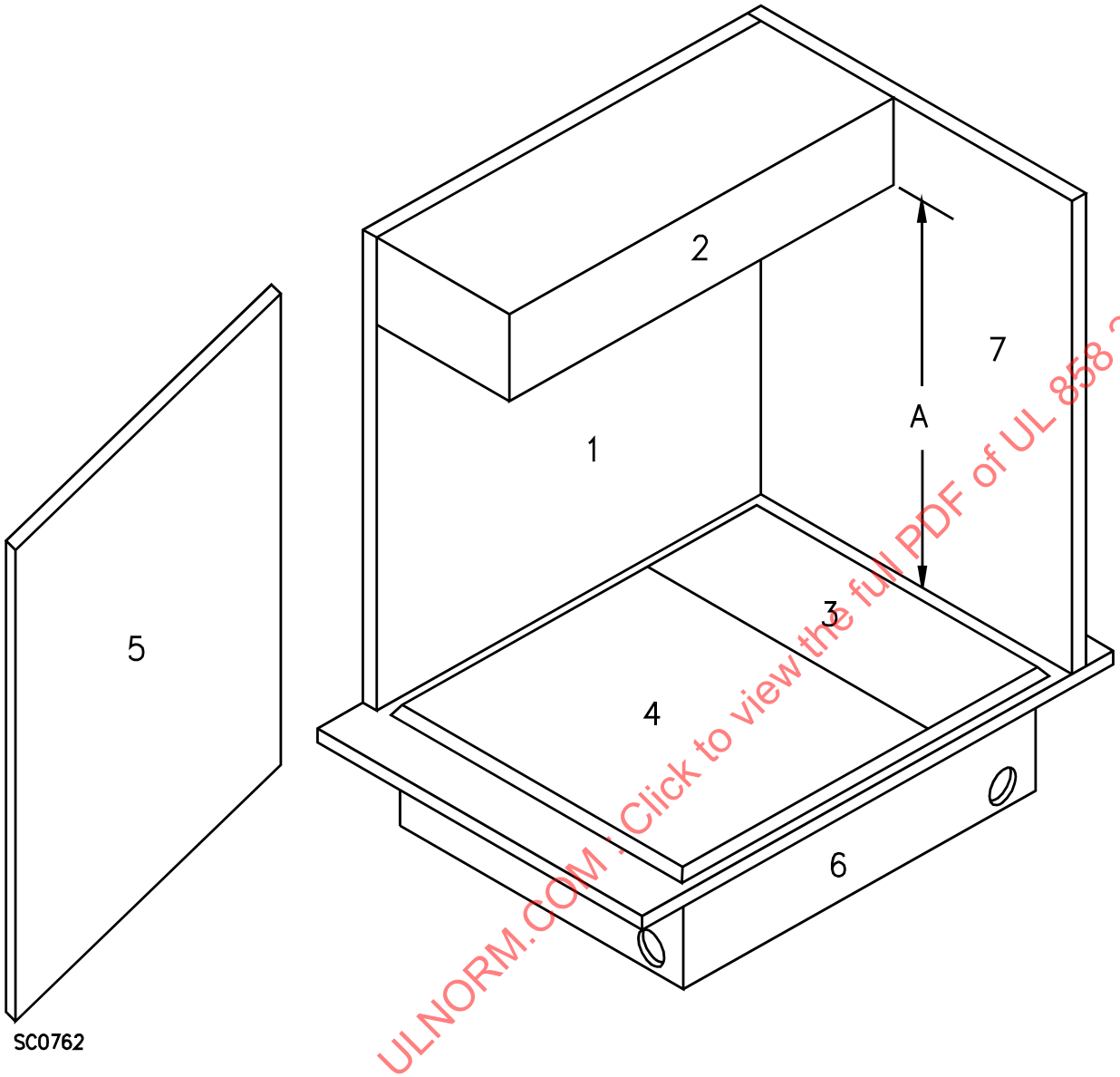
59.5.3 Counter-mounted cooking units

59.5.3.1 A counter-mounted cooking unit is to be mounted as illustrated in Figure 59.7. The base on which the unit is to be supported is to rest on a bench or a table. The sides of the supporting base are to be brought as close to the sides of the cooking unit as its construction permits. The panels above the cooking surface are to be placed as close to the elements as permitted by the trim with which the unit is equipped. If a unit is to be installed adjacent to another unit, they are to be mounted for the test as close together as their construction will permit. The block on which the thermocouple is mounted is to be supported against the bottom of the unit at the hottest area. A top cabinet as described in 59.4.2.4 is to be installed 30 in (762 mm) above the horizontal cooking surface.

Exception: If in an intended installation configuration, the width (left-to-right dimension) of a counter-mounted cooking unit is less than 16 in, the distance between the side walls above the cooking surface shall be maintained as specified by the manufacturer and shall be no more than 16 in (406.4 mm). The unit is to be oriented so that a minimum of two walls above the cooking surface are placed as close to the elements as permitted by the trim. The unit shall be marked in accordance with 83.11 and the installation instructions shall indicate the minimum required clearances to adjacent surfaces.

Figure 59.7

Test enclosure for counter-mounted cooking unit

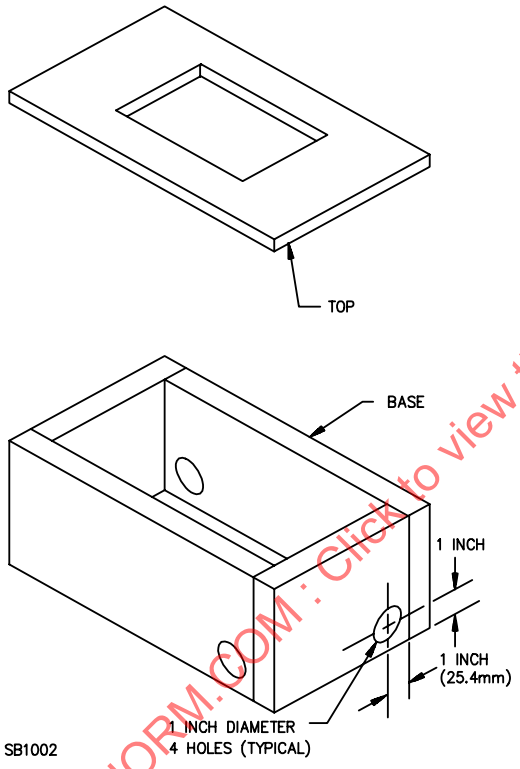


1. Building back wall
2. Top building cabinet
3. Control panel
4. Cooking surface
5. Building side wall
6. Base
7. Building side wall

59.5.3.2 The base mentioned in 59.5.3.1 is to be constructed as illustrated in Figure 59.8. The sides of the base are to be boards 3/4 in (19.1 mm) thick, and are to have such length as is necessary to enclose the unit in accordance with 59.5.3.1. The width of the boards – the height of the base – is to be equal to the depth of the enclosure of the counter-mounted cooking unit plus 2 in (51 mm). If the manufacturer's instructions require that ventilating accessories accompanying the range be installed for additional ventilation, the additional ventilation is to be provided in the base of the test enclosure. The top panel is to be of nominal 3/8-in (9.5-mm) plywood, and the opening in this panel is not to be larger than is necessary to permit insertion of the unit with the trim as tight against the top panel as configuration will permit. The size of the top panel is to be in accordance with the position of the above-surface panel.

Figure 59.8

Enclosure for counter-mounted cooking unit test



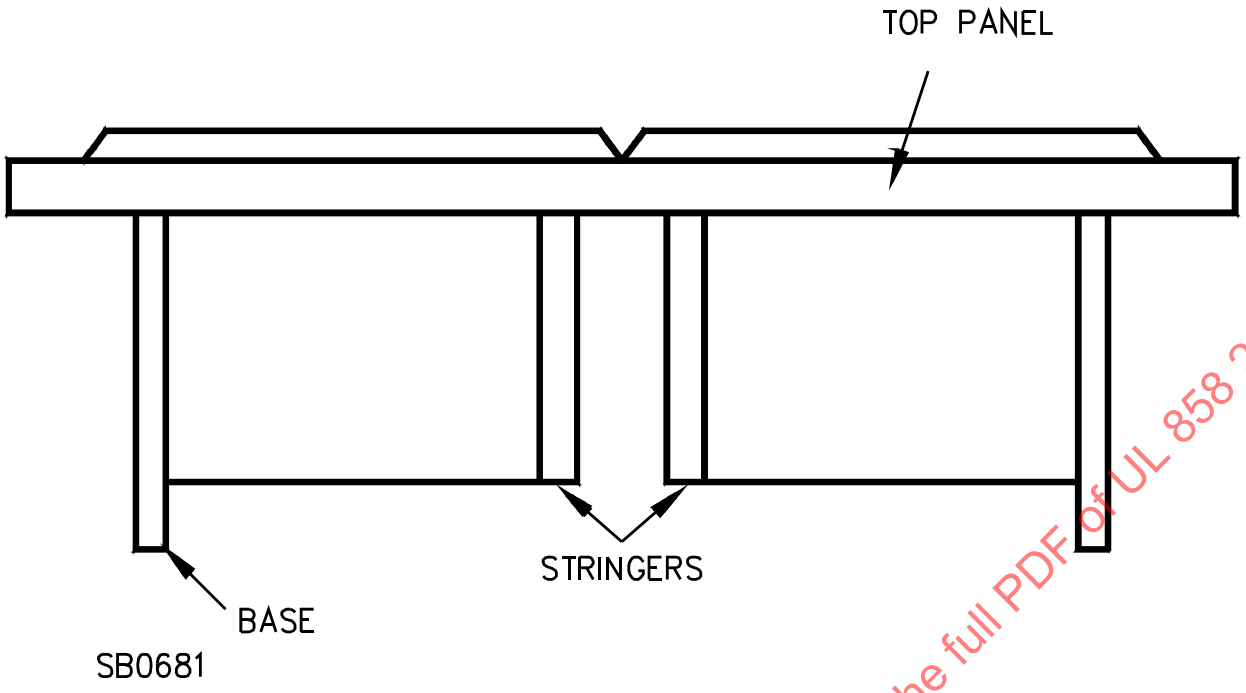
59.5.3.3 The simulated side and back walls illustrated in Figure 59.7 are to extend at least to the front edge of the cooking surface and are to be mounted as close to the units as the trim will permit.

59.5.3.4 If two counter-mounted cooking units are to be tested for installation adjacent to each other, they are to be mounted as illustrated in Figure 59.9. The units are to be placed as close together as the trim will permit. The stringers are to be of 3/8-in (9.5-mm) nominal plywood, and one or both stringers is to be omitted if space is inadequate.

Exception: The spacing between units may be larger than the trim will permit if the unit is marked in accordance with 82.16.

Figure 59.9

Method of mounting two counter-mounted cooking units



59.5.3.5 A counter-mounted cooking unit intended for installation directly above a wall-mounted oven is to be tested while assembled in that manner. See 83.6.

59.6 Small metal object heating test – induction cooktop surface units

59.6.1 Induction cooktop surface units shall be constructed so that the induction coil can only be operated when a vessel is placed on the cooking zone. The appliance shall be operated at rated voltage with the controls adjusted to their highest setting. An iron bar, 5/64 in (2 mm) thick having dimensions approximately 4 in (100 mm) x ¾ in (20 mm), is to be placed in the most unfavorable position on each cooking zone, tested one at a time. The temperature rise of the bar shall not exceed 35 °C (95 °F).

59.7 Thermal aging

59.7.1 General

59.7.1.1 A polymeric material shall be resistant to thermal degradation at the maximum temperature to which it is exposed during normal use of the appliance.

59.7.2 Thermal aging test

59.7.2.1 Three specimens of a polymeric part shall be tested as specified in 59.7.2.2. As a result of the test, a part shall comply with the following:

a) Spacings shall not be reduced to less than those specified in Table 26.1,

b) Current-carrying parts or internal wiring shall not be exposed, as determined in accordance with Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts, Section 6.2 and Internal Wiring, Section 10,

c) A condition shall not be produced that could increase the risk of fire, electric shock, or injury to persons (see 6.2), and

d) A part exposed to liquids shall not crack or leak.

59.7.2.2 The specimens shall be placed in an air-circulating oven for 1,000 h at the temperature specified in Table 59.3. The parts shall be removed from the oven, cooled to room temperature, and examined to determine compliance with the requirements in 59.7.2.1.

Table 59.3
Temperatures for oven conditioning

Maximum operating temperature of polymeric enclosure part, °C	Oven temperature,	
	°C	°F
> 50 ≤ 75	85	(185)
> 75 ≤ 85	95	(203)
> 85 ≤ 95	105	(221)

59.7.2.3 A polymeric part shall be considered to comply with the requirements in 59.7.1.1 if the material has a temperature index, based on historical data or a long-term thermal aging program that indicates its acceptability for use at the temperature involved.

59.7.2.4 A polymeric part shall be considered to comply with the requirements in 59.7.1.1 if the maximum temperature to which the material is exposed during normal use of the appliance does not exceed 50°C (122 °F).

60 Flare-Up Test

60.1 A grill provided as part of an appliance shall comply with the requirements in 60.2 if:

a) The heat source is below the cooking surface; and

b) The average temperature at any point of the heat source exceeds 260°C (500°F) or the maximum temperature at any point of the heat source exceeds 300°C (572°F).

In addition, the grill shall comply with the requirements in 18.5. See 60.5.

60.2 There shall be no glowing or flaming of combustible material, either wood or cheesecloth, in proximity to the appliance as installed when the appliance is operated under the conditions described in 60.3 – 60.5. In addition, there shall be no visible damage to the insulation of wire or components.

60.3 The appliance is to be installed as described in 59.4.1.1 – 59.5.3.5, as applicable, and the surfaces of the test enclosure above, to each side of, and behind the appliance are to be covered with two layers of cheesecloth secured as tightly as practicable to the enclosure surface. The cheesecloth on the side and back walls of the test enclosure is to extend below the horizontal top cooking surface of the appliance. The cheesecloth is to be as described in 54.1.

60.4 After the appliance has been subjected to maximum normal heating for 10 min, the cooking surface above the active heating element area is to be covered uniformly with 3-in (76.2-mm) diameter, 1-in (25.4-

mm) thick patties of ground beef. The adjacent edges of the patties are to be touching as the cooking begins. The ground beef is to consist of a mixture of 50 percent each by weight of lean beef and suet that have been ground together twice. For this test, lean beef is considered to be beef with all fat cut away from the edges and from the interior of the cut. The patties are to be broiled on one side until they appear to be half-cooked and then turned over once. The patties are then to be cooked until substantially all fat has been rendered. Melted fat is to be allowed to accumulate in the normal manner except that any instructions for adding water or similar material to the fat receptacle are to be disregarded.

60.5 For a range with an integral cooling or exhaust system, the test described in 60.2 – 60.4 is to be conducted:

a) With the cooling or exhaust system both on and off, if the grill can be operated with or without the air system or if the absence of the air stream would not be apparent to the user; or

b) With the cooling or exhaust system on, if the grill can be operated only with the air system operating and the absence of the air stream would be apparent to the user.

60A Abnormal Operation – Coil and Induction Surface Unit Cooking Oil Ignition Test

60A.1 Each surface unit provided as part of an appliance shall comply with 60A.3 if it has a nominal rating of 350 W or greater. Whenever a surface unit is equipped with user-selectable multiple heating zone configurations, each zone configuration shall be tested separately.

Exception: This requirement does not apply to non-circular induction surface units.

60A.1.1 The surface unit shall be allowed to operate for:

a) 30 minutes for coil surface units.

b) 15 minutes for induction surface units.

60A.2 When an appliance is equipped with multiple surface units of equivalent construction (including control system) and wattage, only one of those units need be subjected to this test. When applicable, the subjected unit should be that nearest the front of the appliance.

60A.3 A surface unit shall not cause ignition of cooking oil when tested as described in 60A.4 – 60A.12 or alternatively meet the temperature requirements of 60A.13.

60A.4 The appliance shall be tested at voltage specified in 56.4.

60A.5 *Deleted*

Figure 60A.1

Pan dimensions

(bottom curvature exaggerated for clarity)

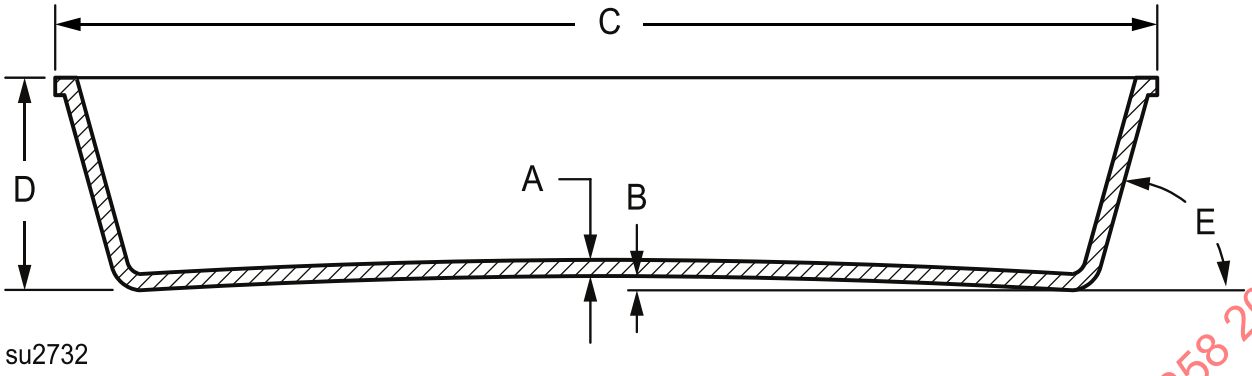
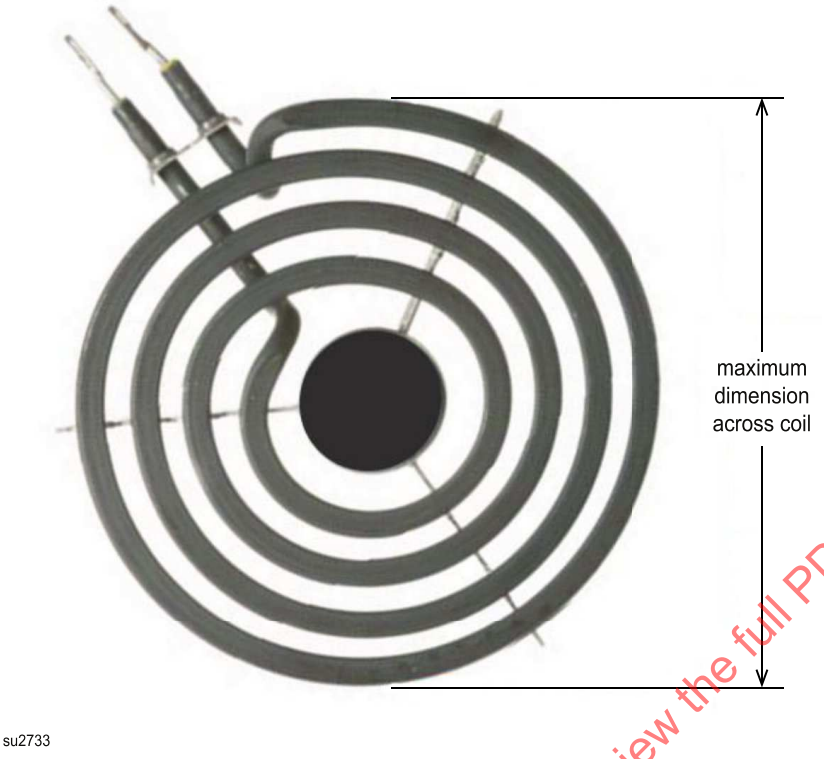


Table 60A.1
Reference cast iron test pan dimensions and oil amounts

Heating Element Size per 60A.8 in (mm)	Reference Bottom Thickness A in (mm) ± 0.010	Reference Bottom Flatness B in (mm) ± 0.010	Reference Overall Diameter C in (mm) ± 0.1	Reference Height D in (mm) ± 0.1	Reference Side Angle E degrees ± 5°	Oil Amount oz (g) ± 1g
≤ 7 (178)	.15 (3.8)	0.010 (.25)	8.26 (210)	1.90 (48.3)	68	2 (58)
7 < X ≤ 10 (178 < X ≤ 254)	.15 (3.8)	.03 (0.8)	10.40 (264)	2.04 (52)	70	3.74 (106)
> 10 (254)	.15 (3.8)	0.03 (0.8)	12 (305)	2.04 (52)	69	5.54 (157)

Figure 60A.2

Determination of coil heating element size



60A.6 *Deleted*

60A.7 *Deleted*

60A.8 *Deleted*

60A.8.1 The cast iron pan specified in Table 60A.1 and Figure 60A.1 shall be placed on the center of the surface unit. For purposes of selecting pan size, the surface unit size shall be determined by the active area of the surface unit. A detailed specification for the reference pans can be found in AHAM ER-2-2022 clause 5.7.5.

60A.8.2 The active area of coil element is determined by the maximum heating diameter as shown in Figure 60A.2.

60A.8.3 The active area of an induction element is defined as the maximum dimension across coil.

60A.8.4 For remote closed-loop cooking of an induction cooktop according to SA3.7, peripheral devices specified by the manufacturer, such as cookware or non-cookware feedback devices, shall be evaluated. Integral and peripheral devices shall be evaluated as follows:

a) Surface units capable of remote closed-loop cooking operation where the temperature limiting device is integral to the appliance shall be evaluated with the specified cast iron pan per Table 60A.1 and Figure 60A.1.

b) Surface units that are capable of remote closed-loop cooking operation where the temperature limiting device is not integral to the appliance shall be evaluated with the manufacturer specified device.

1) If the device is integral to the cookware (cooking vessels such as pots and pans), the cookware shall be used. The surface unit to be evaluated is that with a diameter less than or equal to the bottom diameter of the cookware with maximum rated power.

NOTE – If the device may be used on a surface unit with a larger diameter and the input power is higher with the defined device on that surface unit, the surface unit with the larger diameter is to be used.

2) If the device is not integral to the cookware (devices such as thermal cameras), the cast iron pan per Table 60A.1 and Figure 60A.1 shall be used. Evaluation shall be undertaken with the peripheral device installed according to its instructions.

Exception: Non-cookware peripheral devices such as a temperature probe required for remote closed-loop cooking with liquids other than oil do not require evaluation for 60A.8.4(b)(2). The instructions provided with such devices shall include the word "WARNING" and the following instructions, or equivalent:

a) "Do not operate without bath fluid in the cooking vessel."

b) "Do not use a flammable liquid as a bath fluid."

c) "Do not use with any non-food products."

d) "Periodically check to ensure that the liquid depth is within the acceptable range. Refill bath fluid as required."

60A.9 Canola oil shall be added directly to the pan until an amount equal to the weight specified in Table 60A.1 is obtained. For reference, this will result in an approximate depth of 0.125 in (3.175 mm).

60A.10 The surface unit shall be turned on to its maximum heat setting or, based on analysis of the control system, another heat setting that will create a higher pan temperature, and allowed to operate according to 60A.1.1 or until the cooking oil ignites, whichever comes first.

60A.11 *Deleted*

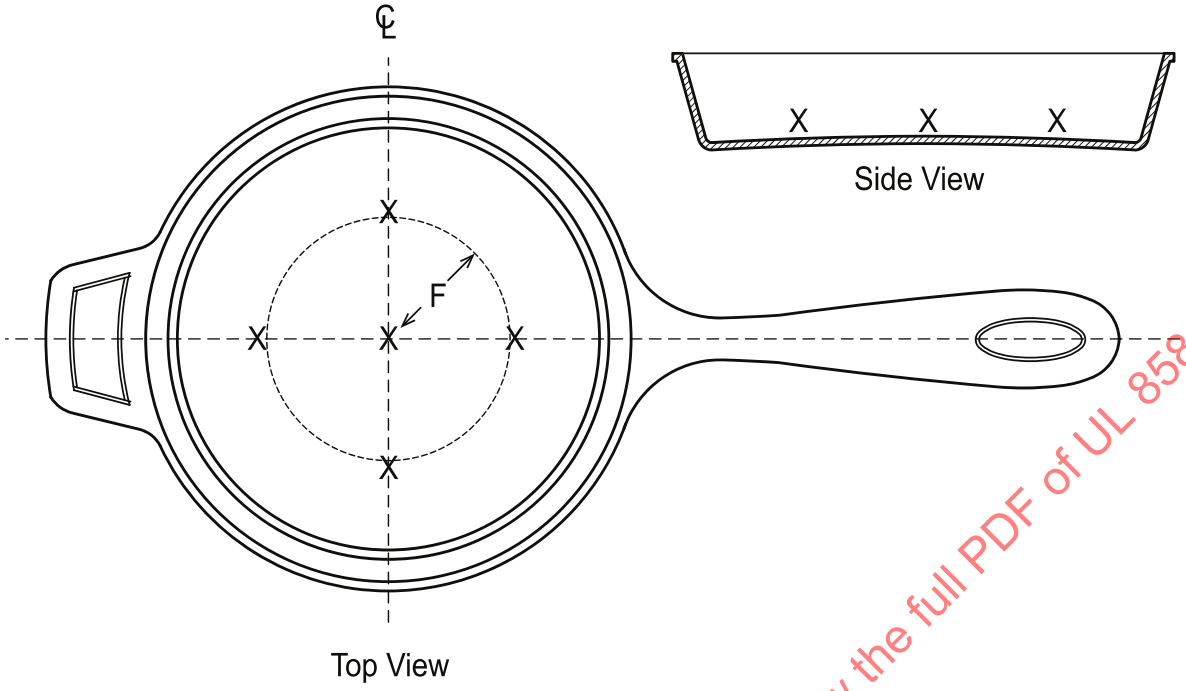
60A.12 The test room is to be of sufficient volume or the room shall be vented so that the appliance area remains reasonably clear of smoke. Room ventilation and airflow from heating or air conditioning shall be such that they do not affect the results of the test by moving air currents across the test pan.

60A.13 When testing the temperature of the pan referenced in Table 60A.1 or the remote closed-loop cooking device referenced in 60A.8.4 without oil, the surface unit shall be turned on to its maximum heat setting or, based on analysis of the control system, another heat setting that will create a higher pan temperature, and allowed to operate according to 60A.1.1. The pan temperature shall be measured using 5 thermocouples spot welded to the inside bottom cooking surface of the pan in the locations as shown in Figure 60A.3. The average of the 5 temperatures shall not exceed 725°F (385°C).

Figure 60A.3

Welded thermocouples

1 thermocouple in center of pan and 4 welded F inches from center and 90 degrees apart as shown



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X – Thermocouple (TC) Locations

for ≤ 7 in heating elements F=2.0 in (50.8 mm)

for > 7 in to 10 in heating elements F=2.5 in (63.5 mm)

for > 10 in heating elements, F = 3 in (76.2 mm)

TCs to be welded to inside bottom surface

61 Abnormal Operation Test for Deep-Fat Fryers

61.1 An appliance incorporating a deep-fat fryer shall be tested as described in 61.2 and 61.3. As a result of the test:

a) Flame or molten metal shall not be emitted;

b) Combustible material in proximity to the appliance as installed shall not glow or flame;

c) Conductor insulation or components shall not be visibly damaged;

d) The appliance shall comply with the dielectric voltage-withstand requirements in 66.1;

e) There shall be no ignition of the oil in the reservoir (flaming of oil or carbon on the element is acceptable); and

f) A control shall de-energize the appliance before the temperature in the center of the oil pool exceeds 245°C (475°F), and any overshoot shall not result in ignition of the oil.

61.2 Unless otherwise indicated, tests are to be conducted with the applied voltage and method of installation in accordance with the Temperature Test, Section 59. The fryer is to be operated with the oil at various levels and once with only a residual film of oil in the reservoir. The regulating thermostat is to be adjusted to the maximum temperature setting and the limiting control, if provided, is to remain in the circuit, functioning. Each test is to be started with the appliance at room temperature and operation is to be continued until it has been determined that ignition of the oil is unlikely. During each test, the rest of the appliance is to be operated in accordance with the Temperature Test, Section 59. The element or elements may be dry or covered with a film of oil.

61.3 Each series of tests is to be started with unused vegetable oil. New oil is to be added as required to raise the level for successive tests but the used oil in the deep-fat fryer is not to be replaced between tests. The thermocouple for measuring the oil temperature is to be placed in the center of the pool of oil, 1 in (25 mm) below the surface.

Exception No. 1: For oil depths of less than 2 in (50.8 mm), the thermocouple is to be placed at a point corresponding to half the depth of the oil.

Exception No. 2: For a thermocouple location that would be on or immediately above a heating element, the thermocouple is to be placed approximately in the center of the pool but between elements; and for depths less than 2 in above the elements, halfway between the elements and the surface.

Exception No. 3: No temperature measurement is to be made with only a residual film of oil in the reservoir.

62 Abnormal Operation – Stalled-Fan Test

62.1 When tested as described in 62.3 and 62.4, an oven provided with a cooling fan the malfunction of which would not be apparent to the user shall not exceed the temperature rises specified in Table 59.1.

Exception No. 1: An oven need not comply with this requirement if the oven heating element is controlled so that it can be energized only when the air stream is present.

Exception No. 2: Initial temperature transients may exceed the temperature rises specified in Table 59.1 if the duration or extent of the transients:

a) Do not result in a risk of fire or electric shock;

b) Are of a duration of not more than 15 min; and

c) Do not exceed 110 percent of the applicable maximum temperature rise specified in Table 59.1.

62.2 With reference to Exception No. 2 to 62.1, if an initial temperature transient exceeds the maximum temperature rise specified in Table 59.1, a means, such as an indicator light or audible signal, shall be provided to alert the user that the oven is not operating normally during the bake mode. The means to alert the user shall comply with 62.5 and 62.6. See 84.2.7 and 84.2.8.

Exception: An alert means may be omitted if it is shown that during the bake mode of operation, malfunction of the fan results in the operation of a temperature-limiting control to open ungrounded conductors to the heating elements and to render the oven inoperable until the oven is serviced by a qualified serviceperson.

62.3 The test is to be conducted as described in the Temperature Test, Section 59, except that the cooling fan is to be stalled or de-energized when stabilized temperatures are obtained. The test is to be continued after the fan has been stalled or de-energized, and the maximum temperatures are to be recorded.

62.4 If, after the fan has been stalled or de-energized, the operation is interrupted by the operation of a temperature-limiting device, the maximum temperatures are to be recorded at that time. It may be necessary to restart the test from ambient temperature with the fan stalled or de-energized to determine whether the temperature limits are exceeded before the temperature-limiting device operates.

62.5 With regard to 62.2 and 96.1.2, if an indicator light is provided to alert the user that the appliance is not operating normally, the following conditions apply:

a) The light shall withstand, without burning out or failing to light, an endurance test consisting of 6000 cycles of 1 min on and 30 s off.

b) The light shall have a minimum rated life of 20,000 continuous hours at the operating voltage and shall be connected in a circuit in which the increased voltage incident to switching or any other operational characteristic of the appliance does not exceed 120 percent of the voltage recommended to provide the required life.

c) The light shall be visible under the conditions specified in 49.3.

d) If the light turns on as a result of a malfunction, the light shall remain on even though a temperature-regulating or -limiting control functions to reduce appliance temperatures.

e) The marking and instructions described in 84.2.7 and 87.13 shall be provided.

62.6 With regard to 62.2 and 96.1.2, if an audible signal is provided to alert the user that the appliance is not operating normally, the following conditions apply:

a) The signal shall withstand, without malfunction or breakdown, an endurance test consisting of 6000 cycles of 1 min on and 30 s off.

b) The signal shall withstand, without malfunction or breakdown, a durability test consisting of 72 h of continuous energization while in an ambient 10°C (18°F) higher than the maximum operating temperature of the device under normal operating conditions, but not less than 70°C (158°F).

c) The marking and instructions described in 84.2.8 and 87.13 shall be provided.

63 Broil Test

63.1 When an oven equipped with a broiling element is operated continuously under the conditions described in 63.2 there shall be no:

a) Emission of flame or molten metal;

b) Glowing or flaming of combustible material, either cheesecloth or wood, in proximity to the appliance as installed; or

c) Mechanical damage to wire or component insulation.

63.2 The oven is to be installed as described in 59.4.1.1 – 59.5.3.5 as applicable; the surfaces of the test enclosure above, to each side, and below the oven door are to be covered with two layers of cheesecloth, and the instructions provided with the appliance are to be followed with reference to the thermostat setting and the distance the door is to be opened. The oven is then to be operated continuously until the ultimate results have been determined. In most cases, operation for 7 – 8 h will be necessary in order to be sure that ultimate results have been observed.

64 Strain-Relief Test

64.1 The strain-relief means provided for a flexible cord shall be tested as described in 64.2. 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 internal connections.

64.2 The connections within the appliance are to be disconnected and a 35-lb (15.9-kg) weight is to be suspended for 1 min on the cord and supported by the appliance so that the strain-relief means will be stressed from any angle that the construction of the appliance permits.

65 Knockout Test

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

66 Dielectric Voltage-Withstand Test

66.1 When tested as described in 66.2 and 66.3, an appliance shall withstand without breakdown a test potential of:

a) 1000 V for an appliance rated 250 V or less; and

b) 1000 V plus twice the rated voltage for an appliance rated more than 250 V.

66.2 The test is to be conducted when the appliance is at the temperature attained during normal operating conditions as described in 59.2.1 – 59.5.3.5. The voltage is to be a 60-Hz essentially sinusoidal potential applied between live parts and exposed dead metal parts.

66.3 The appliance is to be tested by means of a 500 VA or larger capacity transformer the output voltage of which is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test level is reached, and is to be held at that level for 1 min. The increase in the applied potential is to be at a substantially uniform rate as rapid as is consistent with correct indication of its value by a voltmeter.

67 Overload Test

67.1 When a switch or other device that controls a motor is tested as described in 67.2, there shall be no electrical or mechanical malfunction of the device, undue pitting or burning of the contacts, and the fuse in the grounding connection shall not open.

Exception No. 1: This requirement does not apply to a device that has been investigated and found to be acceptable for the application.

Exception No. 2: This requirement does not apply to a device that is interlocked so that it will never have to break the locked-rotor motor current.

67.2 The rotor of the motor is to be locked in position, and exposed dead metal parts of the appliance are to be connected to ground through a 3-A plug fuse. The appliance is to be connected to a grounded supply circuit of rated frequency and the test voltage specified in 56.4. The connection is to be such that any single-pole, current-interrupting device will be located in the ungrounded conductor of the supply circuit. If the appliance is intended for use on direct current, or on direct current as well as alternating current, exposed dead metal parts are to be connected so as to be positive with respect to a single-pole, current-interrupting control device. The overload test is to consist of 50 cycles of operation, making and breaking the locked-rotor current of the motor. The device is to be operated at a rate of not more than 10 cycles of operation per minute, except that a faster rate of operation may be employed if agreeable to those concerned.

68 Endurance Test

68.1 Temperature controls

68.1.1 An automatic control for temperature regulation that has not been investigated for the application shall make and break the maximum rated current at rated voltage for at least 100,000 cycles.

Exception: The endurance test may consist of 30,000 cycles of operation if the control is employed in conjunction with a temperature-limiting control that functions when the regulating control is defeated during the Abnormal-Operation Test, Sections 72 and 96, and that has been tested in accordance with 68.1.2 or 68.1.3, as applicable.

68.1.2 An automatically reset temperature-limiting control shall be subjected to an endurance test consisting of 100,000 cycles of operation while making and breaking the maximum rated current at rated voltage. The control shall comply with the calibration requirements for temperature-limiting controls.

68.1.3 A manually reset temperature-limiting control shall be subjected to an endurance test consisting of 1000 cycles under load and 5000 cycles without load. The control shall comply with the calibration requirements for temperature-limiting controls.

68.1.4 Solid-state controls shall comply with the applicable requirements in the Standard for Temperature-Indicating and -Regulating Equipment, UL 873. 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.

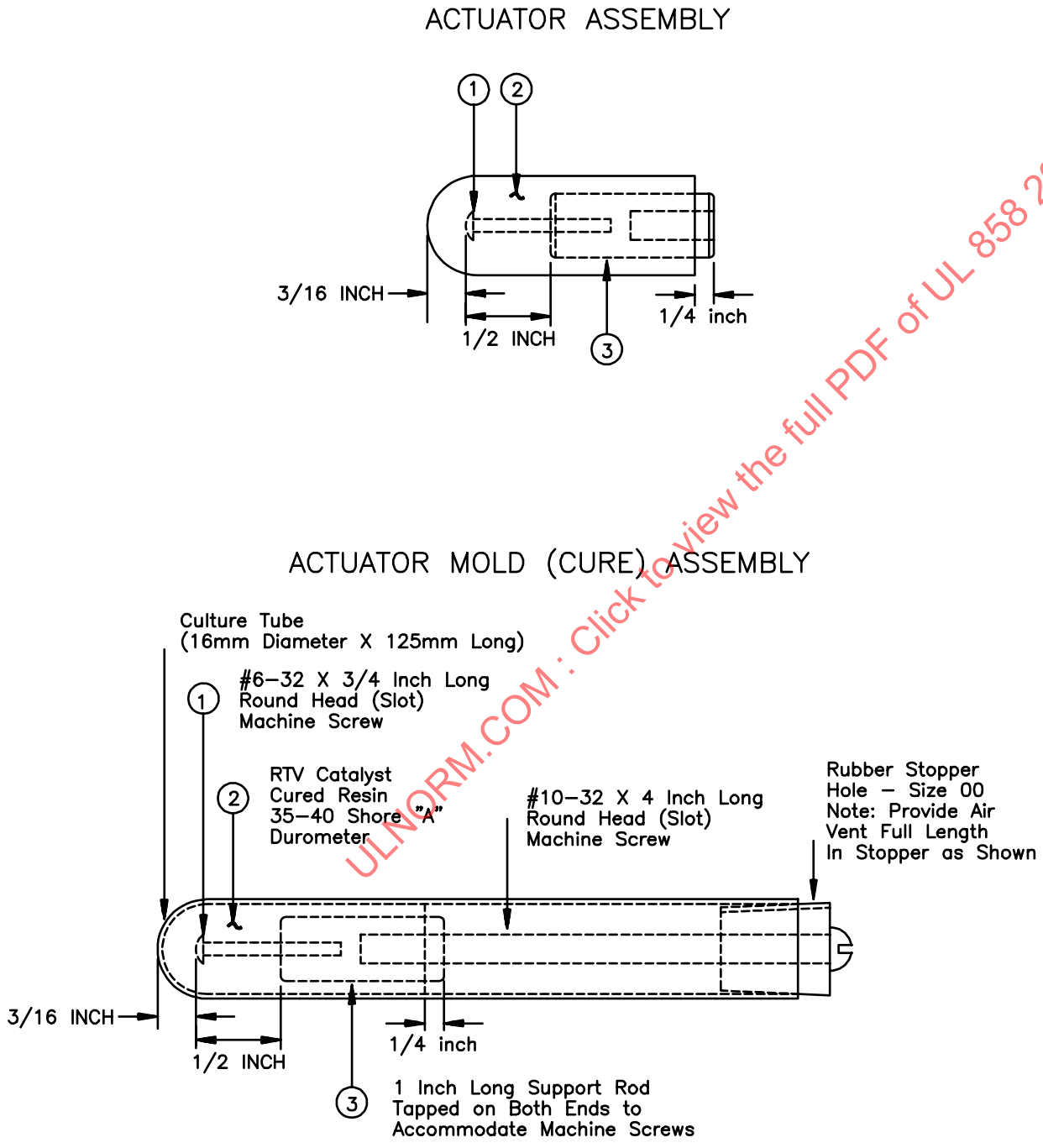
68.2 Data entry components

68.2.1 A data entry component employing a movable-type switching means and used to comply with a requirement in this standard or with the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, (that is, two step on, and the like as well as any one step off function) is to be tested at rated ambient using a mechanical probe such as that shown in Figure 68.1 or equivalent as an

actuator for 100,000 cycles at the rate of not more than 6 cycles per minute while connected to the actual load current controlled. The rate of operations may be more than 6 cycles per minute if agreeable to those concerned.

Figure 68.1

Probe for endurance test



S3501

68.3 Movable connections

68.3.1 If the normal operation of a movable part of an appliance – for example, a movable unit intended to function either as a deep-well cooker or as a surface unit or a movable surface assembly – affects mechanically the electrical wiring or other live parts, the appliance is to be tested as described in 68.3.2. There shall be no electrical or mechanical malfunction of the movable part or wiring and, after the test, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1.

68.3.2 A mechanical arrangement is to be employed to operate the movable member in the intended manner at the rate of approximately 12 cycles of operation per minute; and the movable member is to be operated so that during each cycle it will reach the actual limits of travel in both directions. The endurance test is to consist of 10,000 cycles of operation, but the number of cycles is able to be reduced if it appears that it does not represent the usage that would occur during the normal life of the appliance. The test is to be conducted with maximum normal current flowing in the movable connections, unless the construction is obviously such that a person is able to be burned if he attempts to move the part while it is energized.

68.4 Heating elements

68.4.1 A movable surface heating element with attached leads shall, after completion of the normal temperature test, operate for 1000 cycles in the intended manner as described in 68.4.2. There shall be no electrical or mechanical malfunction and, after the test, it shall comply with the dielectric voltage-withstand requirements in 66.1.

68.4.2 A mechanical arrangement is to be employed that will move the element to the actual limits of travel in both directions during each cycle. The rate of operation is to be approximately 12 cycles per minute.

69 Transient Surge Test for Solid-State Controls

69.1 The protective functions of a solid-state control and the appliance shall not be adversely affected by the Transient Surge Test described in the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, and there shall be no physical damage or risk of fire or electric shock or the control shall shut down the appliance without loss of the protective functions.

69.2 In addition, following each test, an appliance employing a self-cleaning feature shall be operated through a self-cleaning cycle. As a result, the time versus oven temperature relationship shall not exceed the values specified in 100.5, or the appliance shall comply with the fire and explosion requirements as indicated in 100.6.

70 Electromagnetic Susceptibility Tests for Solid-State Controls

70.1 The protective functions of a solid-state control and the appliance shall not be adversely affected by the Electromagnetic Susceptibility Tests described in the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, and there shall be no physical damage or risk of fire or electric shock or the control shall shut down the appliance without loss of the protective functions.

70.2 In addition, following each test, an appliance employing a self-cleaning feature shall be operated through a self-cleaning cycle. As a result, the time versus oven temperature relationship shall not exceed the amounts specified in 100.5, or the appliance shall comply with the fire and explosion requirements as indicated in 100.6.

71 Cleaning Tests

71.1 Spray cleaning solid state controls

71.1.1 A sample of an appliance employing a solid-state control shall operate in a manner that does not result in a risk of fire, electric shock, or injury to persons and the protective functions of the control shall not be adversely affected after being subjected to the test described in 71.1.2.

71.1.2 The control is to be mounted in the appliance as intended. The control panel is then to be well sprayed in an area that could cause wetting of live parts of the control with a general-purpose liquid glass cleaner [a], from a manual spray bottle. One spray of 1 mL ±0.05 mL is to be applied for each 0.5 ft^2 (0.05 m^2) of area of the control panel but not more than three sprays applied to the control panel for each test. A period of 10 s is to pass and the control panel is to then be wiped clean with an absorbent paper towel. The test procedure is to be repeated on other parts of the control panel surface, as necessary. The test is to be repeated using a liquid all-purpose cleaner[b].

[a] Windex or the equivalent.

[b] Fantastik or the equivalent.

71.1.3 In addition, following each test, an appliance employing a self-cleaning feature shall be operated through a self-cleaning cycle. As a result, the time versus oven temperature relationship shall not exceed the amounts specified in 100.5, or the appliance shall comply with the fire and explosion requirements as indicated in 100.6.

71.2 Sponge washing test

71.2.1 Switches, latches, controls and control panels shall be constructed so that leakage current resulting from cleaning in and around them is not greater than 0.5 mA for products rated 120 V or less, and not greater than 5 mA for products rated greater than 120 V. This applies equally to electromechanical, electronic, membrane, capacitance, and mechanical switches.

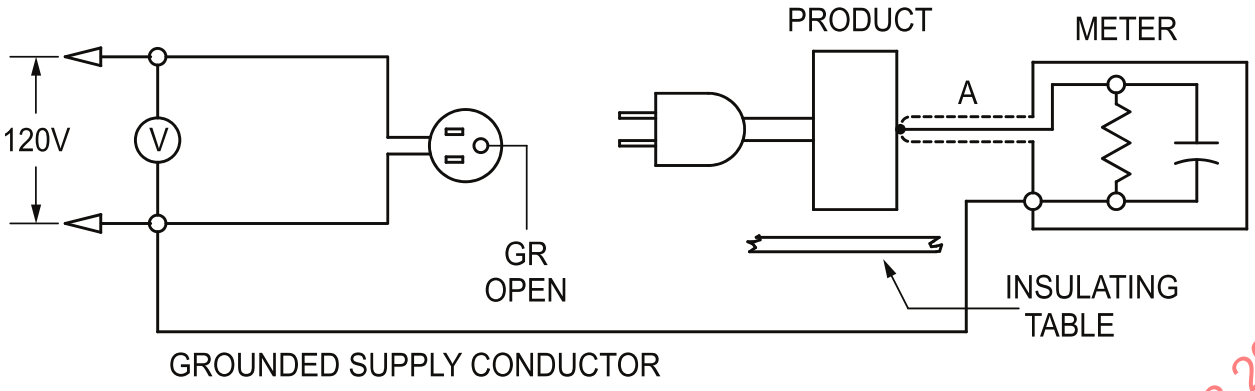
71.2.2 There shall be no evidence of arcing, short-circuiting or insulation breakdown nor shall there be unintended operation or change of power level of heating elements. In the case of touch-type controls, activation of keys, including power level settings, is acceptable provided that surface units do not turn on from the OFF position.

71.2.3 The range or cooktop is to be isolated from ground with the normal grounding means disconnected and is to be connected so that the component to be tested is in the ungrounded side of the supply. Control knobs, guards, panels, and the like, that are located in the area to be cleaned and that are removable without the use of tools, are to be removed. The test is to be conducted at a temperature of 77 ±9°F (25 ±5°C).

71.2.4 The measurement circuit for leakage current shall be as shown in Figure 71.1. The meter used for measurement of leakage current is to have the characteristics defined in section 55A.7 (a) – (c). The meter is to be connected between a metal backing on a cellulose sponge and the grounded conductor of the power supply.

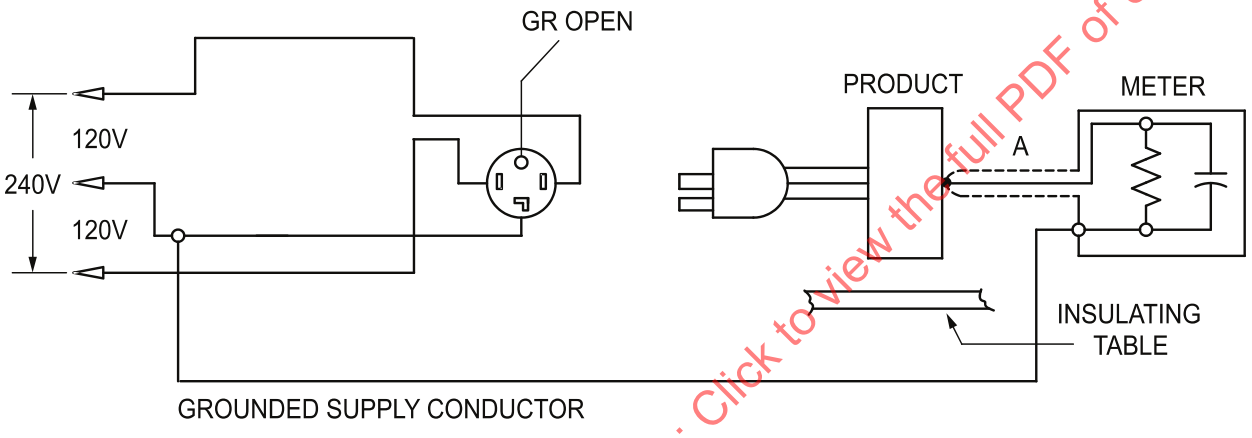
Figure 71.1

Sponge Washing Test Setup



su1849

Appliance intended for connection to a 120 V power supply.



su1850

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

A – Sponge with metal backing

Note: If the product contains a conductor which connects neutral and ground, it must be removed.

71.2.5 The sponge is to be at least 1-5/8 by 3 by 5 in (41.3 by 76.2 by 127.0 mm), capable of retaining a minimum of 2.6 oz (75 g) of solution, and is to have a metal backing on one of the 3 by 5 in (76.2 by 127.0 mm) faces.

71.2.6 The sponge is to be saturated in a solution consisting of 2 tsp (10 mL) of sodium bicarbonate and 0.2 oz (4.5 g) of chip soap or liquid hand soap[c], in 1 qt (0.95 L) of water at approximately 77°F (25°C). After saturation, the sponge is to be weighed to ensure that at least 75 g have been absorbed. The saturated sponge is to be wiped six times with a pressure of at least 2 lb (8.9 N) applied to the metal-backed side, over the control panel or other area being tested. The sponge shall be wiped directly over low-profile switches (such as rocker switches). If removal of knobs has left exposed control shafts, the sponge should be wiped so that the side of the sponge contacts the shafts. The speed of the wipe shall not exceed 15 in (381 mm) per second. The sponge shall be resaturated in the test cleaning solution after the third wipe. During the test, the technician is to be properly insulated.

[c] Ivory brand or the equivalent.

71.2.7 The test is to be conducted with manually-operable switch contacts, integral to the cooktop or range, in the open and closed positions. An equal number of wipes shall be applied at each position of the switch or control such that the total is six (three wipes at each position for 2-position switch; two wipes at each position for 3-position switch). A variable position switch should be tested with two wipes each at off, high and low settings. The product shall be observed for 5 minutes following the final wipe for compliance with section 71.2.2.

72 Abnormal-Operation Test

72.1 General

72.1.1 An appliance shall be tested as described in 72.1.2 – 72.2.2. As a result of the test:

a) There shall be no emission of flame or molten metal from the appliance;

b) The temperature of surfaces of the test enclosure that are not visible after installation of the appliance does not exceed 175°C (357°F) (see 72.1.2) or there is no scorching of the cheesecloth located between the appliance and the test enclosure;

c) There shall be no ignition of cheesecloth located on the test enclosure surfaces visible after installation of the appliance;

d) There shall be no visible damage to wire or component insulation;

e) The 3-A fuse connected between the exposed dead metal parts and ground shall not open; and

f) The appliance shall comply with the dielectric withstand requirements in 66.1. The dielectric voltage-withstand test is to be conducted following each abnormal mode of operation, commencing within 5 s after the appliance is de-energized.

Exception No. 1: In lieu of conducting the dielectric voltage-withstand test immediately following each test, the insulation resistance shall be measured immediately following each test and monitored until the appliance cools to normal operating temperatures. At no time shall the insulation resistance be less than 50,000 Ω. Following each test and with the appliance at normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. See 72.1.3.

Exception No. 2: In lieu of conducting the dielectric voltage-withstand test immediately following each test, the leakage current between accessible dead metal parts and ground through a 500 Ω resistor shall be measured immediately following each test and monitored until the appliance cools

to normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. The leakage current shall not exceed 5 mA.

72.1.2 With respect to 72.1.1(b), the temperature of surfaces of the enclosure that are not visible after installation may exceed 175°C (357°F) provided:

a) The temperature does not exceed 200°C (392°F); and

b) The heat-producing portions of the appliance are de-energized by a thermal cutoff, a manual-reset temperature limit control, a fuse, or a similar device requiring a nonuser service operation to restore the appliance to an operable condition.

72.1.3 With respect to Exception No. 1 of 72.1.1(f), the insulation resistance shall be measured with a dc voltage of approximately 250 V applied between exposed dead metal parts of the appliance and the appliance supply conductors, with a voltmeter connected in series with the dc voltage source and the supply conductors. The dc line voltage shall be measured using a separate ac-dc voltmeter. See Figure 72.1. The insulation resistance shall be calculated using the following circuit equation:

$$R_i = \left(\frac{V_1 - V_s}{V_s} \right) R_s$$

In which:

V_1 is the dc line voltage (reading given on ac-dc voltmeter),

V_s is the voltage across series voltmeter (reading given on series voltmeter),

R_s is the Resistance of series voltmeter[a], and

R_i is the Insulation resistance of test sample.

[a] *Note: R_s is the M_s V_m*

In which:

M_s is the deflection sensitivity of the series voltmeter in ohms/volt, and

V_m is the maximum voltage which can be read on the scale being used.

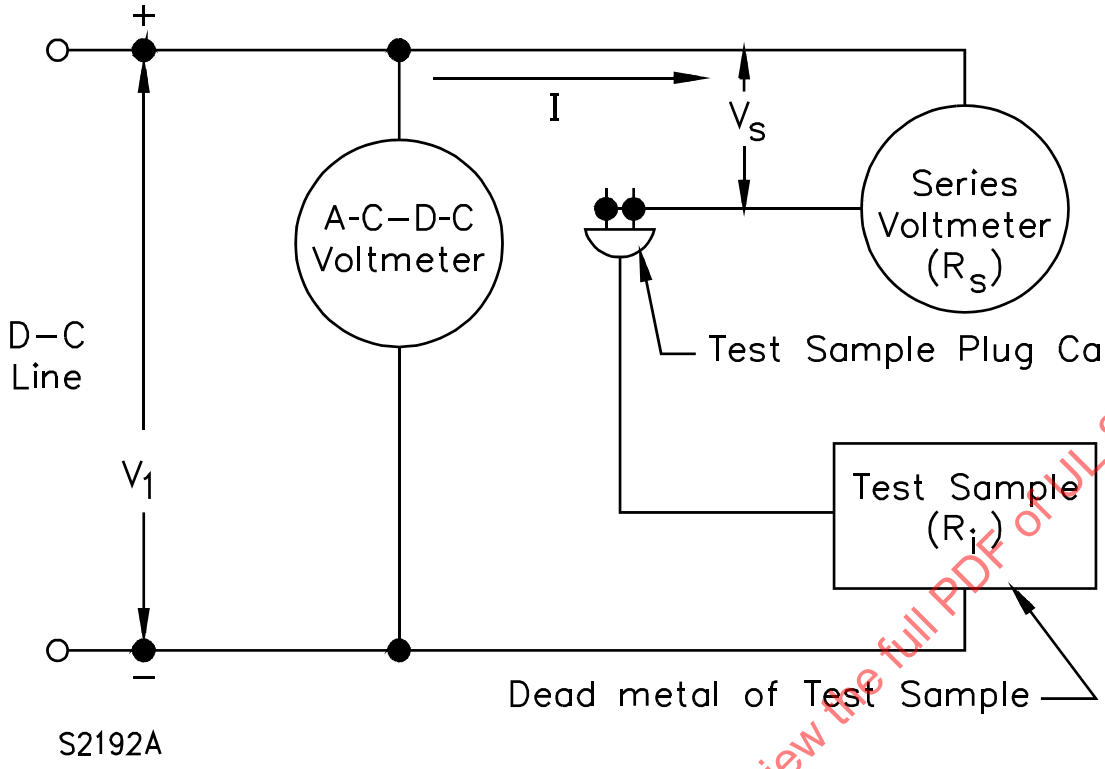
Exception: Self-contained laboratory grade instrumentation that produces equivalent results may be used in place of the two-voltmeter circuit shown in Figure 72.1.

72.1.4 The appliance is to be installed in accordance with 59.4.1.1 – 59.5.3.5 and Figure 59.3 – Figure 59.8 and the surfaces of the test enclosure are to be completely covered with two layers of cheesecloth secured as tightly as practicable to the enclosure surface. The cheesecloth is to be as described in 54.1. Exposed dead metal parts are to be connected to ground through a 3-A fuse.

Exception: The test specified in 72.1.7 may be conducted with the appliance installed with clearances to the test enclosure as specified in the manufacturer's instructions if the appliance is marked as specified in 83.10.

Figure 72.1

Two-voltmeter method of measuring insulation resistance



72.1.5 The appliance is to be operated continuously in each mode of operation as described in 72.1.5 (a) – (d) until the ultimate results have been obtained. In most cases, operation in each mode for 7 – 8 h will be necessary to obtain ultimate results.

a) In the broil mode with:

1) Broil temperature-regulating control short-circuited;

2) The broiler pan, if furnished with the oven, placed at or just below the center of the oven; and

3) The door closed.

b) Same as 72.1.5(a) except the test is to be conducted with the door open to either:

1) The broil-stop position;

2) The position recommended by the manufacturer; or

3) 4 in (102 mm) as measured at the open edge if items (1) and (2) are not provided. If necessary, the door is to be blocked in this open position.

c) In the preheat mode with the oven temperature-regulating thermostat short-circuited.

d) In the bake mode with the oven temperature-regulating thermostat short-circuited.

72.1.6 For the test described in 72.1.4 and 72.1.5, if an appliance is provided with two or more ovens, only one oven is to be operated at a time.

72.1.7 For an appliance employing surface units, the surface unit that imposes the most severe conditions is to be operated at maximum heat. The surface unit control is to be defeated or modified, if necessary, to obtain full-wattage, maximum-heat energization of the surface unit. The surface unit is to be operated in this manner twice – once with the unit uncovered and once with a stove plate as described in 59.3.2.3 and 59.3.2.4. During this test all other heating elements are to be de-energized.

72.1.7.1 For an appliance employing induction cooktops surface units, the test in 72.1.7 shall be conducted. It is not necessary to operate the surface unit uncovered during this testing.

72.1.8 For the tests described in 72.1.4 – 72.1.7, the temperature-regulating control (or operating control and / or control circuits that have been classified as Function Class A in Table SB5.1) is to be defeated by short-circuiting the control at its output(s). If a cooktop surface unit or an oven is provided with more than one temperature-regulating control, each control is to be defeated, one at a time, as separate tests. In such cases, all other independent temperature-regulating control(s) that are associated with the surface unit or oven are to be set to their maximum user-adjustable setting and are allowed to function as intended.

72.1.9 Except as noted in 72.1.11, a temperature-regulating control that is provided with multiple sets of switching contacts or outputs is to have all such sets of contacts or outputs short-circuited simultaneously prior to starting the test.

72.1.10 A single-pole double-throw device is to be short-circuited by connecting the common contact terminal to either the device's normally-open contact terminal or the normally-closed contact terminal, whichever results in maximum heating conditions.

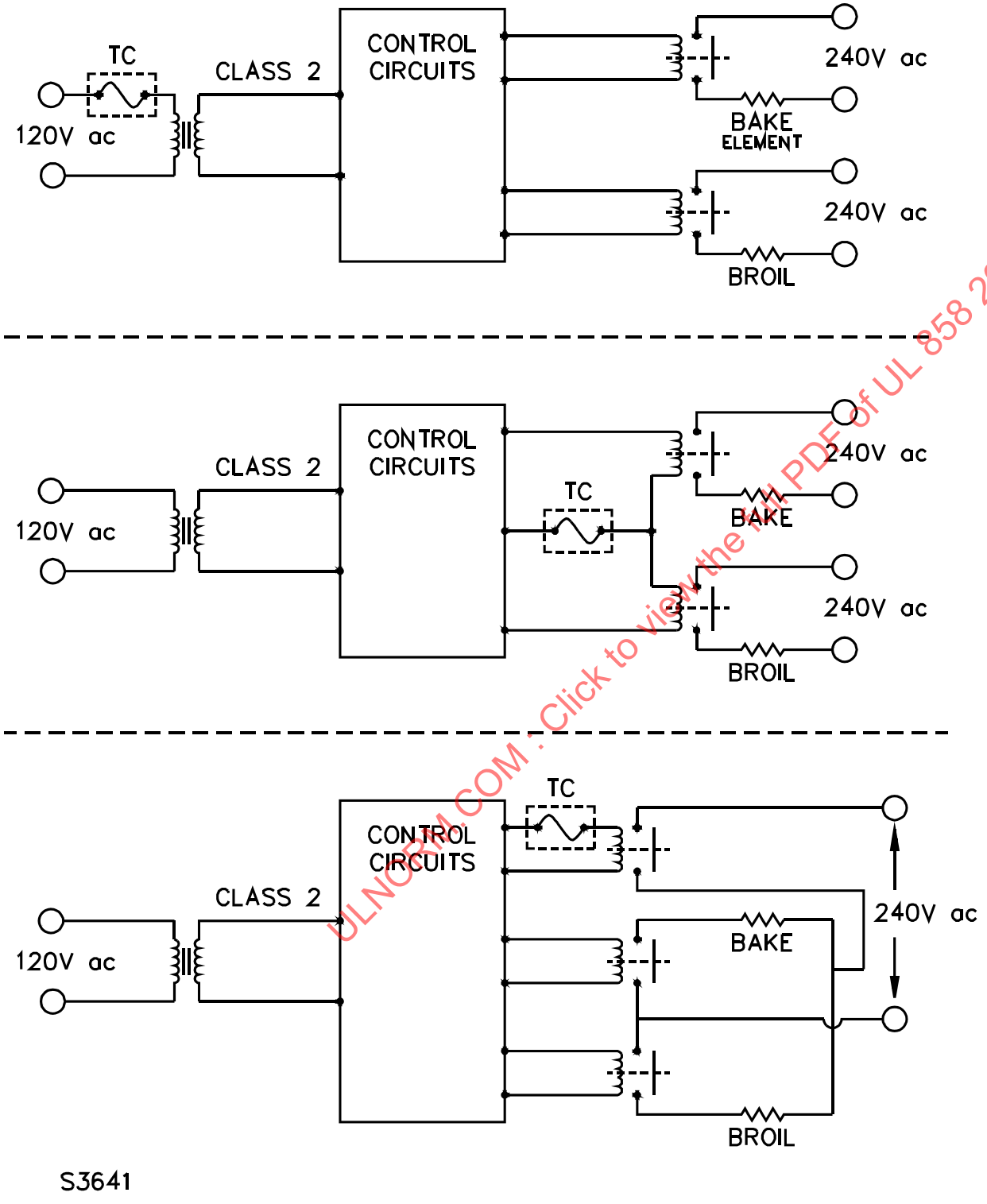
72.1.11 A temperature-limiting control or a temperature-limiting function of a control that has been found to comply with the requirements for such devices is to be allowed to remain functional during the tests specified in 72.1.4 – 72.1.7.

72.2 Temperature-limiting devices in pilot-duty configurations

72.2.1 An appliance that is provided with a thermal cutoff or a manual reset temperature-limiting thermostat connected in a pilot duty configuration in series with the coil of one or more temperature-regulating control output relays shall be tested as described in 72.2.2 in addition to the tests specified in 72.1.4 – 72.1.10. The appliance shall comply with the requirements specified in 72.1.1. For the tests described in 72.1.5 – 72.1.10, ultimate results are considered to be attained when the thermal cutoff or manual reset thermostat de-energizes the coils of relays that control the applicable heating elements. For the tests described in 72.2.2, ultimate results are considered to be attained after operation of the appliance in each mode for 7 h unless a manual-reset temperature-limiting control or thermal cutoff functions to directly interrupt heating element current before 7 h are accumulated. See Figure 72.2 for typical pilot-duty configurations.

Figure 72.2

Typical pilot-duty configurations of temperature-limiting circuits



TC = thermal cutoff or manual-reset temperature-limiting thermostat

72.2.2 An appliance that is constructed as described in 72.2.1 is to be subjected to additional abnormal operation tests by short-circuiting each involved output relay, one at a time as separate tests, until ultimate results are attained. During these additional tests, the circuits controlling the output relays are adjusted to their maximum user-adjustable temperature setting and these circuits are otherwise to be allowed to function as intended.

72.3 Abnormal operation test for warming elements

72.3.1 An appliance provided with a warming element actuated by a single operation as described in the Exception to 47.1 shall be tested as described in 72.4.1 – 72.5.3. As a result of the tests:

a) There shall not be emission of flame or molten metal;

b) There shall not be ignition of the cheesecloth or terry cloth; and

c) The temperature on the center of the surface of the warming element below the cloth shall not exceed 347°F (175°C).

72.4 Appliance configuration

72.4.1 The appliance shall be installed, operated and configured as described in Temperature Test, Section 59, representing the worst-case installation with respect to the warming element. If a single worst-case configuration cannot be determined, the test shall be repeated in any or all configurations recommended by the manufacturer. Only the warming element shall be activated for the test.

72.4.2 The cheesecloth used for the tests is to be bleached cotton cloth running 14-15 yd^2/lb (26-28 m^2/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 cm, 13 threads in one direction and 11 threads in the other direction).

72.4.3 The terry cloth used for the tests is to be white, l00 percent untreated cotton terry cloth having a pile weave and a nominal weight of 8 oz/yd^2 (270 g/m^2). The terry cloth is to be conditioned in a controlled atmosphere maintained at a temperature of 25°C and a relative humidity of not more than 25 percent for 24 h prior to the tests.

72.5 Test duration and operating conditions

72.5.1 Unless ultimate results and thermal equilibrium are attained in less time, the tests are to be continued for at least 1 h. If during or at the end of the tests there is an indication of an impending condition of fire (for example, the generation of smoke, discoloration of the test cloth, or similar condition), the test is to be continued until ultimate results are attained, but no longer than 7 h.

72.5.2 The warming element is to be covered with a single layer of cheesecloth cut to match the shape of the heating portion of the element being tested. The element is to be operated at maximum heat. All other surface units are to be deenergized. The test is then to be repeated with four layers of cheesecloth cut to match the heating portion of the element being tested. The test is to be repeated with cheesecloth covering respectively, three fourths of the element, one half of the element, and one quarter of the element.

72.5.3 The test in 72.5.2 is to be repeated with a single layer of terry cloth and again with four layers of terry cloth.

72.6 Tests for elements exposed to oil-laden air, oven vapors, moisture and grease

72.6.1 General

72.6.1.1 A heater as specified in the Exception to 6.4.1 shall be subjected to the tests specified in 72.6.2 – 72.6.5. In addition to this, an element employing an insulation system that has moisture-absorption characteristics as specified in 72.6.2 is to be subjected to the tests specified in 72.6.6.

72.6.1.2 A material with a moisture absorption value greater than 1.62 percent as determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A, the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, and the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, used as an insulation material between film-coated wires, between uninsulated live parts of opposite polarity, or between uninsulated live parts and dead or grounded metal parts shall comply with 72.6.1.3.

72.6.1.3 As a result of the tests specified in 72.6.4 and 72.6.5:

a) There shall not be noticeable change or deterioration of the element insulation with respect to accessibility, mechanical strength, or the like;

b) There shall not be dielectric breakdown or arc-over as a result of the Dielectric Voltage-Withstand Test, Section 66;

c) The insulation resistance of the element shall comply with 13.1.2. The insulation resistance of the element shall not be less than 50,000 ohms between live parts and interconnecting dead metal parts. Charring or discolouration of the insulation is acceptable.

d) The removal force for the element shall not be less than 50 percent of the original average removal force when 5 various locations of the securing means are tested.

72.6.2 Oil conditioning

72.6.2.1 The testing described in 72.6.2.2 is to be done with the element installed in the normal, downward facing position in an oven or chamber and the element continuously energized at its rated voltage for the periods specified. The addition of a smoke elimination system is acceptable.

72.6.2.2 The mesh cover of three samples are to be sprayed evenly with 5ml of Canola (rapeseed) oil, using a fine mist spray. The heaters are then to be continuously energized for 20 minutes. At the end of 20 minutes, the power is to be switched off for 2 minutes and the heater re-sprayed with 5 mL of Canola oil and the power restored. The heater is to remain energized for a further 20 minutes. At the end of the conditioning each sample shall comply with the requirements in 72.6.1.3.

72.6.3 Grease conditioning

72.6.3.1 Prior to conducting the test described in 72.6.3.2, the samples are to be preconditioned for 40 hours at a temperature of 25ºC ±3ºC (77ºF ±5.4ºF) and a relative humidity not greater than 50 percent.

72.6.3.2 For three heater samples the mesh barriers are to be completely coated with a minimum 1/8-in (3.2 mm) thick layer of rendered cooking lard and conditioned (heater in the normal downward facing orientation) for 168 hours (7 days) in a forced-draft air-circulating oven or chamber maintained at a temperature of 150ºC ±5ºC (238ºF ±10ºF). The use of a smoke elimination system is acceptable. After conditioning, each sample shall be installed as described in 72.6.2.1 and operated at maximum rated voltage for at least 20 minutes. At the end of the conditioning each sample shall comply with the requirements specified in 72.6.1.3.

72.6.4 Grease and humidity conditioning

72.6.4.1 Three samples of an element are to be conditioned for 48 hours in air having a relative humidity of 88 ±2 percent at a temperature of 32ºC ±2ºC (89. 6ºF ±3.6ºF). After the humidity conditioning, each sample is to be subjected to the grease conditioning specified in 72.6.3.2.

72.6.5 Oven and humidity conditioning

72.6.5.1 Three samples of an element shall be conditioned for 7 hours in a forced-draft air-circulating oven or chamber maintained at a temperature of 150ºC ±5ºC (238ºF ±10ºF). The use of a smoke elimination system is acceptable. At the end of 7 hours, the samples are to be removed from the oven or chamber and conditioned for 48 hours in air having a relative humidity of 88 ±2 percent and a temperature of 32ºC ±2ºC (89.6ºF ±3.6ºF). The cycle is then to be repeated. At the end of the second conditioning cycle, each sample shall comply with the requirements specified in 72.6.1.3.

72.6.6 Element coil-bond strength tests

72.6.6.1 General

72.6.6.1.1 After being subjected to the conditioning in 72.6.6.2 – 72.6.6.4, the removal force for an element that is secured by staples, pins, pressing, moulding or similar means shall not be less than 50 percent of the original average removal force in 5 various locations of the securing means.

72.6.6.2 Usage test

72.6.6.2.1 Three samples of the heater are to be energized at rated voltage. The element is to be cycled for 6,000 cycles at the rate of 6 cycles per hour of 5 minutes "on" and 5 minutes "off". After the conditioning, the element shall comply with Spacing, Section 26, and Dielectric Voltage-Withstand Test, Section 66.

72.6.6.3 Cold test

72.6.6.3.1 Three samples of the heater are to be conditioned for 24 hours in a chamber maintained at 0 ±2ºC (32 ±3.6ºF). After conditioning, the samples shall not show evidence of adverse effects to the bond between the element coil and the base material, or visual signs of cracking, chipping, or other distortion of the substrate material. In addition, the element shall comply with Dielectric Voltage-Withstand Test, Section 66.

72.6.6.4 Cycling test

72.6.6.4.1 Three samples of the heater are to be subjected to three cycles of conditioning consisting of the following

a) 24 hours operation at 1.15 times the rated wattage,

b) 96 hours at 35 ±2ºC (95 ±3.6ºF), 90 percent relative humidity, and

c) 8 hours at 0 ±2ºC (32 ±3.6ºF).

72.6.6.4.2 After three cycles of the conditioning described in 72.6.6.4.1, the heaters shall comply with Dielectric Voltage-Withstand Test, Section 66.

73 Component Failure Test

73.1 The requirements specified in 73.2 – 73.4 are applicable to appliances employing electronic oven temperature-regulating controls if, at the manufacturer's request, the test level of a critical component is reduced in accordance with the Failure Mode and Effect Analysis requirements in the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A.

73.2 The test level of the component under consideration shall be reduced if, as a result of the test specified in 73.4:

a) There is no emission of flame or molten metal, nor ignition of cheesecloth;

b) The temperature of surfaces of the test enclosure that are not visible after installation of the appliance does not exceed 175°C (see 73.3) or there is no scorching of cheesecloth located between the appliance or the test enclosure;

c) There is no visible damage to wire or component insulation;

d) The 3-A fuse connected between exposed dead metal parts of the appliance and ground does not open; and

e) The appliance shall comply with the dielectric withstand requirements in 66.1. The dielectric voltage-withstand test is to be conducted following each abnormal mode of operation, commencing within 5 s after the appliance is de-energized.

Exception No. 1: In place of conducting the dielectric voltage-withstand test immediately following each test, the insulation resistance may be measured immediately following each test and monitored until the appliance cools to normal operating temperatures. At no time shall the insulation resistance be less than 50,000 Ω. Following each test and with the appliance at normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. See 72.1.2.

Exception No. 2: In place of conducting the dielectric voltage-withstand test immediately following each test, the leakage current between accessible dead metal parts and ground through a 500 Ω resistor may be measured immediately following each test and monitored until the appliance cools to normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. The leakage current shall not exceed 5 mA.

73.3 With respect to 73.2(b), the temperature of surfaces of the enclosure that are not visible after installation may exceed 175°C, provided:

a) The temperature does not exceed 200°C; and

b) The heat-producing portions of the appliance are de-energized by a thermal cutoff, manual-reset temperature limit control, fuse, or similar device requiring a nonuser service operation to restore the appliance to an operable condition.

73.4 The surfaces of the test enclosure are to be covered with cheesecloth and the appliance provided with a 3-A fuse as described in 72.1.4. The appliance is to be installed, connected, and operated as described in 59.3.2.1 – 59.5.2.7, except that:

a) The electronic control component under consideration shall be defeated in accordance with the Failure Mode and Effect Analysis requirements in UL 858A; and

b) All other oven temperature-regulating and -limiting controls are to be defeated so as to result in maximum heating conditions.

74 Thermal Shock Test

74.1 The cooking surface of a glass/ceramic-top appliance shall not crack or break when tested as described in 74.2.

74.2 The largest surface unit is to be operated for 1/2 h at its maximum heat setting. Then, 500 cc of water at room temperature is to be poured over the hottest area of the cooking surface.

75 Resistance to Moisture Tests

75.1 Spillage on horizontally mounted controls

75.1.1 An appliance having controls mounted in the horizontal cooking surface as determined by 6.4.2 is to be subjected to the spill test described in 75.1.2 to simulate conditions that might occur during actual use. There shall be no evidence of arcing, short-circuiting, insulation breakdown, or unintended operation. After the test, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1.

75.1.2 For the spill test, a solution of 500 cc (18 fl. oz) of water containing 1/4 g (0.009 oz) of ordinary table salt is to be poured at random over the knobs of the controls while the appliance is connected to the power-supply source with all controls in the on position. Each control is then to be operated through its full range and this operation is to be repeated after a 5-min interval. Within 5 min but not less than 1 min after the repeated series of operations, the appliance is to be tested for compliance with the Dielectric Voltage-Withstand Test, Section 66.

75.2 Door switch flooding test

75.2.1 A door-operated switch mounted in the front oven frame shall be subjected to the test described in 75.2.2 to simulate conditions that might occur during normal cleaning of the oven. There shall be no evidence of arcing, short-circuiting, insulation breakdown, or unintended operation. After the test, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1.

Exception: An appliance employing a single-pole switch connected in the grounded conductor in accordance with 25.1.3 is not to be subjected to the dielectric voltage-withstand test in 66.1.

75.2.2 For the test mentioned in 75.2.1, the solution described in 75.1.2 is to be directed into the face of the switch. This may be done by using a funnel, 1/4 in (6.4 mm) inside diameter, with a spout angled 30 degrees from the horizontal. Following this, the appliance is to be tested for compliance with the dielectric voltage-withstand requirements in 66.1.

75.3 Spillage on sealed cooktops

75.3.1 With reference to 6.4.4, with the appliance as-received and at room temperature, 1-1/2 L (53 fl. oz) of water is to be poured steadily over the cooktop. When the appliance is supplied with switches or controls in or adjacent to the cooking surface, the water is also to be poured over the switch area. The appliance shall comply with Dielectric Voltage-Withstand Test, Section 66, with the appliance remaining at room temperature.

Exception: A dielectric voltage-withstand test is not required to be conducted when there is no moisture present on live parts or internal wiring as determined by a visual examination.

75.4 Aging of cooktop seals and gaskets

75.4.1 With reference to 6.4.4, a sample of the appliance is to be subjected to the test sequence described in 75.4.3. Following the repeat of part (c) and with the appliance at room temperature, the appliance shall comply with Dielectric Voltage-Withstand Test, Section 66.

Exception No. 1: A dielectric voltage-withstand test need not be conducted if there is no moisture present on live parts or internal wiring as determined by a visual examination.

Exception No. 2: This test is not required if the appliance complies with Spillage on Sealed Cooktops, Section 75.3, and Spillage on Horizontally Mounted Controls, Section 75.1, if applicable, is conducted on a sample that has been modified to simulate a worst-case deterioration of any and all seals and gaskets. Worst-case deterioration may be simulated by removing approximately 50 percent of the sealing or gasketing material from the appliance to result in an opening between the sealed surfaces while maintaining relative positions of the sealed surfaces.

Exception No. 3: This test is not required when:

a) All seals and gaskets comply with the applicable requirements in the Standard for Gaskets and Seals, UL 157. See 75.4.2;

b) The seal or gasket material has a temperature rating acceptable for the application; and

c) The appliance complies with Spillage on Horizontal Mounted Controls, Section 75.1, and Spillage on Sealed Cooktop, Section 75.3, as applicable, when tested with the seal or gasket installed as intended.

75.4.2 With reference to Exception No. 3(a) of 75.4.1, a seal or gasket material shall comply with the requirements for the following properties as specified in the Standard for Gaskets and Seals, UL 157:

a) Minimum tensile strength and elongation after oven aging;

b) Maximum compression set – This property is applicable to elastomers and cellular materials that are subject to flexing or other movement following factory assembly; and

c) Maximum tensile set – This property is applicable to elastomers that are subject to stretching following factory assembly.

75.4.3 The test sequence is to be as follows:

a) The appliance is to be connected to a supply at the rated voltage with the surface unit controls at maximum settings and operated until thermal equilibrium is attained. The appliance is then to be de-energized and 1 L (35 fl. oz) of tap water at 15°C (59°F) maximum is to be poured steadily onto the cooking surface. The appliance is then to be subjected to the test described in (b).

b) With the controls set to their maximum heat settings, the appliance is to be reconnected to the supply and operated for a total of 240 h. During this time the appliance is be de-energized and allowed to cool to room temperature five times at regular intervals. At the end of the 240-h period, while the appliance is in its heated condition, 1 L of tap water at 15°C maximum is to be poured steadily onto the cooking surface. The appliance is then to be subjected to the test described in (c).

c) The appliance is to be cooled to room temperature and then connected to the supply, with the controls set at their maximum heat setting, and operated until thermal equilibrium is attained. While at thermal equilibrium 1 L of tap water at 15°C maximum is to be poured steadily onto the cooking surface.

d) Repeat (c) until each has been conducted twice.

75.5 Spillage on vents, slots, or openings

75.5.1 An appliance having vents, slots, or openings on or near the horizontal cooking surface as referenced in 6.4.5 is to be subjected to the spill test in 75.5.2 to simulate conditions that might occur during actual use. There shall be no evidence of arcing, short-circuiting, insulation breakdown, or unintended operation. After the test, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1.

75.5.2 Using the solution described in 75.1.2, pour the salt-water solution down any series of openings (vent, slot, gap, groove, crevice, etc.) that could receive water from a spill at a steady rate while steadily moving back and forth along the length of the opening. Each control is then to be operated through its full range and this operation is to be repeated after a 5 min interval. Within 5 min but no less than 1 min after the repeated series of operations, the appliance is to be tested for compliance with Dielectric Voltage-Withstand Test, Section 66.

75.6 Spillage on under counter appliances

75.6.1 An appliance intended for under counter installation as referenced in 6.4.6 is to be subjected to the spill test in 75.6.2 to simulate conditions that may occur in actual use. There shall be no evidence of arcing, short- circuiting, insulation breakdown, or unintended operation. After the test, the appliance shall comply with the dielectric voltage-withstand requirement in 66.1.

75.6.2 Using the solution described in 75.1.2 and with the product installed per 59.5.2, pour the salt-water solution along the back edge and top of the control panel at a steady rate while moving back and forth along the length of the panel. Each control is then to be run through various modes of operations so that all components (fans, switches, relays, etc.) have been activated. Within 5 min but no less than 1 min after the series of operations, the appliance is to be tested for compliance with the Dielectric Voltage-Withstand Test, Section 66.

76 Impact Test

76.1 With reference to 6.1.9, the impact is to be produced by allowing a steel sphere, 2 inches (50.8 mm) in diameter and weighing 1.18 lb (535 g), to fall through a vertical distance of 25-1/2 inches (648 mm). The test is to be conducted with the glass at room temperature.

76.2 Each glass/ceramic panel of a glass/ceramic-top appliance that constitutes a part of the electrical enclosure shall withstand without cracking or exposing live parts when subjected to the tests described in 76.3 and 76.4.

Exception: Breakage or cracking of the panel as a result of the test is acceptable if the leakage current, when measured as described in 76.5 and 76.6, does not exceed 5.0 mA.

76.3 With reference to 76.2, each glass/ceramic panel is to be subjected to the impact produced by dropping a steel sphere, 2 inches (50.8 mm) in diameter and weighing 1.18 lb (535 g), through a distance of 20-1/4 inches (514 mm). The test is to be conducted with the panel at room temperature.

76.4 Following the test described in 76.3, glass/ceramic panel is to be subjected to ten impacts produced by dropping a 3.96-lb (1.8-kg) weight through a distance of 6 in (152 mm). The weight is to be shaped as a cooking utensil, is to have a flat bottom of copper or aluminum, and is to have a diameter of 4-1/4 to 5-1/8 in (108 to 130 mm) with a corner radius of 3/8 in (9.5 mm). Each panel is to be subjected to ten impacts, and the impacts are to be equally distributed over the panel. The weight is to be dropped so that it strikes the panel as flatly as possible. The test is to be conducted with the panel at room temperature.

76.5 With reference to the Exception to 76.2, to determine whether a broken or cracked panel is acceptable, a solution of 500 cc of water containing 1/4 g of ordinary table salt is to be spilled over the broken or cracked area of the panel. A layer of metallic foil is then to be placed over the panel. The foil is to be covered with a 1-in (25-mm) thick layer of 1 lb-per-ft^3 (16 kg-per-m^3) glass fiber insulation. A 10-in (254-mm) diameter pan filled with sufficient water to make it weigh 10 lb (4.54 kg) is then to be placed on the insulation directly over the broken or cracked area. The leakage current is then to be measured in accordance with 76.6.

76.6 The leakage current between the metallic foil and live parts of the appliance is to be measured as soon after the water-salt solution has been poured on the panel as is possible. For the test, the appliance frame is to be isolated from the leakage current test circuit; and the appliance is not to be connected to the power supply. The test potential for the leakage current circuit is to be the potential that would normally exist to ground.

77 Structural (Load-Bearing) Adhesives Tests

77.1 General

77.1.1 After being subjected to the conditioning in 77.2 – 77.8, there shall not be visual signs of cracking, chipping, or other deterioration between the two adhered parts at room temperature. In addition, the average bond strength shall not be less than the value of the weight that is supported by the adhesive.

77.2 Effect of temperature

77.2.1 Five samples of the materials to be secured are to be bonded together with the candidate adhesive. The samples are to then be conditioned for 1000 h in a circulating-air oven at 10°C (18°F) above the maximum stabilized temperature measured for the Temperature Test, Section 59.

77.3 Effect of humidity

77.3.1 Five samples of the materials to be secured are to be bonded together with the candidate adhesive. The samples are to then be conditioned for 7 days at a temperature of 60 ±1°C (140 ±1.8°F) with 95 – 100 percent relative humidity.

77.4 Effect of cold

77.4.1 Five samples of the materials to be secured are to be bonded together with the candidate adhesive. The samples are to then be conditioned for 24 h in a chamber maintained at 0 ±1°C (32 ±1.8°F).

77.5 Effect of cycling

77.5.1 Five samples of the materials to be secured are to be bonded together with the candidate adhesive. The samples are to then be subjected to three complete cycles consisting of the following:

1) 24 h at the rated use temperature,

2) 96 h at 35 ±2°C (95 ±3.6°F), 90 percent relative humidity, and

3) 8 h at 0 ±2°C (32 ±3.6°F).

77.6 Effect of environmental conditions 1

77.6.1 Three samples of the materials to be secured are to be bonded together with the candidate adhesive. The samples are to then be immersed for 7 days in a solution of 50 mL of commercially available household dishwashing detergent per liter of water at 90°C (194°F).

77.7 Effect of environmental conditions 2

77.7.1 Three samples of the materials to be secured are to be bonded together with the candidate adhesive. The samples are to then be immersed for 7 days in a solution of 50 mL of 5 ±1% sodium hypochlorite with calcium cabonate per liter of water at 90°C (194°F). Commercially available chlorine bleach with calcium cabonate for household use is equivalent.

77.8 End-product evaluation

77.8.1 A sample of the complete appliance is to be subjected to 1750 h of continuous operation with a total weight representing four times the normal weight exerted on the bonded part or parts. The weight is to be distributed evenly over the surface of the bonded part or parts and is to be in the direction that tends to separate the bond during normal use. During the test, the appliance is to be installed as in 59.4.1.1 – 59.5.3.5 and Figure 59.3 – Figure 59.8 and operated as described in 59.3.2.1 – 59.3.8.2.

77A Abnormal Operation – Nichrome Wire Test

77A.1 If required per 10.24.1(b), an electrical connection shall be tested as specified in 77A.1.1 – 77A.11. Each connection shall be evaluated using one connector sample. Multiple connections may be independently evaluated within the same appliance if they are located such that they do not influence the outcome or evaluation of the test. As a result of the test, there shall be no evidence of ignition of the cheesecloth referenced in 77A.3 as indicated by broken threads of the cheesecloth. Browning of the cheesecloth is acceptable provided that all individual threads are unbroken. Cheesecloth fibers may become brittle after exposed to heat. Care must be taken to prevent breakage of fibers during inspection. Fibers broken during inspection are not considered as a non-compliance.

77A.1.1 The test shall be considered inconclusive and then repeated if there is evidence of:

a) Fracture or shorting of the nichrome wire prior to completion of the test, or

b) A shift in the position of the nichrome wire sufficient to alter the severity of the test.

77A.2 This test intentionally attempts to cause a fire. Appropriate safety precautions to prevent the spread of fire should be taken. The test location shall have sufficient fresh air to sustain the flame. This test shall be conducted at an elevation of less than 2,000 ft (609.6 m) above sea level.

77A.3 A floor-supported appliance shall be supported on a non-conductive surface. The top, sides, front and back of appliance shall be completely covered by single-layer cheesecloth panels. A mechanical means, such as small pieces of metal foil adhesive tape, shall be used to secure the cheesecloth panels so there are no gaps between the panels. A single layer of cheesecloth, slightly larger than the appliance bottom surface, shall cover the supporting surface. If agreeable to those concerned, cheesecloth may be placed only in the area of the anticipated breach.

77A.4 Wall-mounted and counter-mounted appliances shall be placed in enclosures as shown in Temperature Test – Wall-mounted Ovens and Counter-mounted Cooking Units, Section 59.5, except the base for wall-mounted products shall be solid, and the enclosure may be constructed from non-combustible material such as calcium silicate board or cement board if preferred. The surfaces of the test enclosure are to be completely covered with two layers of cheesecloth secured as tightly as practicable to

the enclosure surface. A single layer of cheesecloth shall be held in close contact with exposed surfaces of the product.

77A.5 Counter-supported ranges shall be supported by 3/8 inch thick minimum plywood or non-combustible material such as calcium silicate board or cement board on the sides and rear of the appliance. Enclosure walls shall be placed as close as possible to the sides and rear of the product with the side walls remaining parallel. The surfaces of the test enclosure are to be completely covered with two layers of cheesecloth secured as tightly as practicable to the enclosure surface. A single layer of cheesecloth shall be held in close contact with exposed surfaces of the product. The floor beneath the product shall be covered with a single layer of cheesecloth.

77A.6 All labels that are applied by the manufacturer shall be applied to the intended surfaces of the test appliance. Printing on the labels is not required. The manufacturer shall place the wiring diagram in the test appliance as intended.

77A.7 The appliance shall be de-energized during the test unless equipped with a protective control or device. The connection under evaluation shall be electrically isolated from the appliance circuitry during the test. If the appliance is energized during the test, a duplicate connection that is electrically isolated from live parts shall be evaluated. Thermocouples shall be placed around the part (but not in direct contact) such that when ignition occurs, an increase in temperature can be detected. When appropriate, windows made of glass, or other clear non-combustible material may be used in the product to allow viewing of the component being tested. Windows shall be sealed to prevent extraneous drafts or air leaks. Windows shall be located in areas not likely to be involved in or influence flame propagation. Video cameras may be employed to assist in verification of ignition. A constant current power supply shall be used and current shall be monitored for evidence of shorting or resistance wire breaks during testing.

77A.8 An appliance control or device employed to provide protection from risk of fire shall be evaluated as a protective control and may be used to de-energize the nichrome wire if found to actuate during the test.

77A.9 Nichrome wire [80% Nickel, 20% Chrome, 22 AWG, in accordance with ASTM 344], shall be applied to a connector or switching contact such that the adjacent non-metallic combustible materials will be ignited during the test.

77A.10 In the application of the nichrome wire to the part under test, the nichrome wire may be inserted into the part, or the wire may be externally wrapped around the part under test. The intent is to achieve complete combustion of the part under test and/or adjacent materials.

a) When inserting the coil into the part under test, a single strand of nichrome wire with a minimum length of 4.0 in (100 mm) shall be formed into a coil with a diameter and length that approximates the connection under evaluation. The coil shall be inserted in place of the connection under evaluation. In the case of a multi-pin connector, a single terminal pin shall be removed from the connector such that the coil can be inserted in the worst case location (typically the lowest position). If worst case position is not obvious, then multiple positions must be evaluated.

b) When externally wrapping a connector or uninsulated terminal, use minimum 2.0 in (50 mm) of nichrome wire to achieve a minimum of three evenly spaced wraps along the length of the connector or uninsulated terminal.

c) Uninsulated terminals shall be wrapped with a non-flammable tape or sleeve prior to wrapping with nichrome wire to prevent shorting out portions of the nichrome wire.

d) In the case of switching devices, a coil of nichrome wire shall be placed inside the device in the position of the contacts and appropriately supported to prevent movement during the test.

Insulated wire leads shall be used to supply power to the nichrome wire and shall be supported and strain-relieved to prevent the nichrome wire from shifting during testing. With reference to (a) and (d), the preferred method of wrapping a coil is wrapping nichrome wire around the threads of a No. 6-18 wood screw with a root diameter of 0.094 in (2.4 mm) and a thread per inch (25.4 mm) count of 18.

77A.11 The nichrome wire shall be energized such that current in the circuit is immediately increased to 11 A and shall be held constant for the duration of the test. If no ignition is detected within 20 minutes, the current shall be removed from the nichrome wire. If ignition is detected, the current shall be held constant until burning of the non-metallic combustible material ceases naturally or there is ignition of the cheesecloth. If ignition of the cheesecloth occurs, the fire shall be extinguished as soon as possible. If the nichrome wire fractures prematurely, the test shall be repeated.

77A.12 *Deleted*

MANUFACTURING AND PRODUCTION TESTS

78 Dielectric Voltage-Withstand Test

78.1 Each product shall withstand without electrical breakdown, as a routine production-line test, the application of an ac potential at a frequency within the range of 40 – 70 Hz or a dc potential between the primary wiring, including connected components, and accessible dead metal parts that are likely to become energized, and between primary wiring and accessible low voltage (42.4 Vpeak or less) metal parts, including terminals.

78.2 The production-line test shall be in accordance with either Condition A or Condition B of Table 78.1. The full test potential is to be applied for the full time specified in Table 78.1. The test potential may be applied gradually until the full test potential is attained; however, for the second test the full test potential shall be applied at the beginning of the test.

Table 78.1
Production-line test potential

Product rating	Condition A			Condition B		
	Minimum test potential		Time, s	Minimum test potential		Time, s
	V dc[c]	V ac		V dc[c]	V ac	
250 V or less without a motor rated more than 1/2 hp (373 W output)	1400	1000	60	1700	1200	1
250 V or less with a motor rated more than 1/2 hp	1400 + 2.8V[a]	1000 + 2V[a]	60	1700 + 3.4V[a]	1200 + 2.4V[a]	1
251 – 600 V	1400 + 2.8V[b]	1000 + 2V[b]	60	1700 + 3.4V[b]	1200 + 2.4V[b]	1
600 V or less and product applied directly to persons	1400 + 2.8V[a]	1000 + 2V[a]	60	1700 + 3.4V[a]	1200 + 2.4V[a]	1
250 V or less and product applied, in a wet or moist condition, directly to persons	3500	3600	60	4200	3000	1

[a] Maximum marked voltage but not less than 120 V if the maximum marked voltage is within the range 105 – 120 V, and not less than 240 V if the maximum marked voltage is within the range 210 – 240 V.

[b] Maximum marked voltage.

[c] Peak dc voltage

78.3 The product may be in a heated or unheated condition for the test.

78.4 The test shall be conducted when the product is complete (fully assembled). It is not intended that the product be unwired, modified, or disassembled for the test.

Exception No. 1: A part such as a snap cover or a friction-fit knob that would interfere with conducting the test need not be in place.

Exception No. 2: The test may be performed conducted before final assembly if the test represents that for the completed product.

78.5 A product employing a solid-state component that is not relied upon to reduce a risk of electric shock and that can be damaged by the dielectric potential may be tested before the component is electrically connected provided that a random sampling of each day's production is tested at the potential specified in Table 78.1. The circuitry may be rearranged for the purpose of the test to reduce the likelihood of solid-state component damage while retaining representative dielectric stress of the circuit.

78.6 The test equipment shall include a means of indicating the test potential, an audible or visual indication of breakdown, and either a manually reset device to restore the equipment after electrical breakdown or an automatic feature that rejects any unacceptable unit. If an ac test potential is applied, the test equipment shall also include a transformer having an essentially sinusoidal output.

78.7 If the output of the test equipment transformer is less than 500 VA, the equipment shall include a voltmeter in the output circuit to indicate the test potential directly.

78.8 If the output of the test equipment transformer is 500 VA or more, the test potential may be indicated (1) by a voltmeter in the primary circuit or in a tertiary winding circuit; (2) by a selector switch marked to indicate the test potential; or (3), in the case of equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manually reset switch has been reset following a dielectric breakdown.

78.9 Test equipment other than that described in 78.6 – 78.8 may be used if found to accomplish the intended factory control.

78.10 During the test, the primary switch is to be in the on position, both sides of the primary circuit of the product are to be connected together and to one terminal of the test equipment, and the second test equipment terminal is to be connected to the accessible dead metal.

Exception No. 1: A product (resistive, high-impedance winding, or the like) having circuitry not subject to excessive secondary voltage buildup in case of electrical breakdown during the test may be tested (1) with a single-pole primary switch, if used, in the off position, or (2) with only one side of the primary circuit connected to the test equipment when the primary switch is in the on position or when a primary switch is not used.

Exception No. 2: The primary switch is not required to be in the on position if the testing means applies full test potential between the primary wiring and dead metal parts with the switch not in the on position.

79 Grounding Continuity Test

79.1 A routine production-line test shall be conducted to determine that grounding continuity exists between the grounding blade of an attachment plug; or the grounding means provided where the wiring system is to be connected; and an accessible dead metal part of the appliance that is likely to become energized. The test is to be conducted on each appliance of the following types:

a) An appliance with a factory-connected power-supply cord having a grounding means, such as a neutral or grounding lead.

b) An appliance with instructions indicating that a power-supply cord kit may be used.

c) An appliance provided with a power-supply cord kit.

79.2 Any indicating device, such as an ohmmeter, a battery-and-buzzer combination, or the like, may be used to determine compliance with the requirement in 79.1.

RATING

80 General

80.1 An appliance shall be rated in amperes or watts, and also in volts. The rating shall include the number of phases, if polyphase; and it shall include the frequency – expressed in one of the following terms: hertz, Hz, cycles-per-second, cps, cycles/second, or c/s – if necessary because of relay coils or other control devices. The range of a voltage rating shall not be more than 20 V.

80.2 If normal operation of an appliance, including the load of all accessories, causes an unbalanced condition to occur in the supply-circuit conductors other than the neutral – that is, in the outside legs of a nominal 125/250 V supply circuit – such that branch-circuit overcurrent protection is likely to be affected, the rating of the appliance shall be computed using the maximum current flowing in any leg. See 56.2.

80.3 With reference to 80.2, to determine if the overcurrent protection is able to be affected, the following steps are to be taken:

a) Determine the maximum power input. See 56.2. Calculate the maximum current using the test voltage specified in 56.4.

b) Determine the maximum current in any supply-circuit conductor other than the neutral. See 56.2.

c) Determine the size of the branch-circuit overcurrent protector in accordance with the National Electrical Code, ANSI/NFPA 70, for each step. If the branch-circuit overcurrent protector for Step B is greater than for Step A, use the input of Step B in determining whether the appliance complies with 56.1.

80.4 The currents calculated in 80.3 are to be rounded off to the nearest integer.

80.5 In addition to the rating required by 80.1, a wall-mounted oven or counter-mounted cooking unit provided with supplementary terminals as described in 9.2.3.20 – 9.2.3.22 shall be additionally rated in amperes or watts indicating the maximum rating for the parallel-connected units.

MARKING

81 General

81.1 All required marking shall be plain, legible, and except as noted otherwise, permanently affixed to the appliance.

81.2 A required marking shall not be on a removable part of an appliance, such as a drawer.

81.3 A cautionary marking shall contrast with its background, be easily readable, and be readily visible from the user's position or from the position in which a specific risk would be encountered.

81.4 In a cautionary marking, the words "CAUTION," "WARNING," or "DANGER" shall be in letters not less than 3/32 in (2.4 mm) high.

82 Visible During Installation and Inspection

82.1 The marking required by 82.2 – 82.21 shall be readily visible during installation and during inspection of the supply-wiring connections.

82.2 A wall-mounted oven or a counter-mounted cooking unit provided with supplementary terminals as described in 9.2.3.20 – 9.2.3.22 shall be permanently marked to indicate the model or catalog number of each unit with which it may be associated. A cross-reference marking shall be provided on the associated unit. It shall also be marked to indicate that there are two points for inspection of wiring terminals. The marking shall be located so that it will be readily visible at the point of parallel connection. Also see 82.21.

82.3 Each individual heating element of an appliance that is of interchangeable design or intended to be readily removable for cleaning or servicing shall be marked with:

a) Its electrical rating in volts and amperes, or in volts and watts; or

b) The manufacturer's part number.

82.4 An appliance equipped with a link and having terminals or leads in accordance with 16.2.1 and 16.2.4 shall be marked with the word "WARNING" and the following statement or the equivalent: "Risk of Electric Shock, frame grounded to neutral of appliance through a link. Grounding through the neutral conductor is prohibited for new branch-circuit installations (1996 NEC); mobile homes; and recreational vehicles, or in an area where local codes prohibit grounding through the neutral conductor. For installations where grounding through the neutral conductor is prohibited:

a) Disconnect the link from the neutral;

b) Use grounding terminal or lead to ground unit; and

c) Connect neutral terminal or lead to branch circuit neutral in usual manner (when the appliance is to be connected by means of a cord kit, use 4-conductor cord for this purpose)."

Where the link is not visible at the wiring terminals or leads, the appliance shall be marked to specify the location of the link.

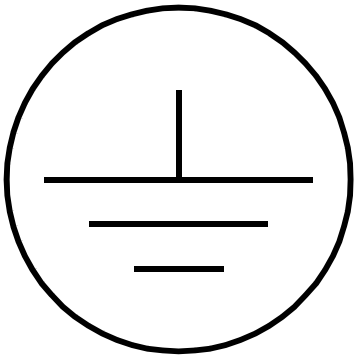
82.5 Other than noted in 82.6, an appliance equipped with a link in accordance with 16.2.1 and 16.2.4 and provided with a 3-conductor cord or cable assembly shall be marked with the word "WARNING" and the following statement or the equivalent: "Risk of Electric Shock, frame grounded to neutral of appliance through a link. Grounding through the neutral conductor is prohibited for new branch-circuit installations (1996 NEC); mobile homes; and recreational vehicles, or in an area where local codes prohibit grounding through the neutral conductor. When installed where it is not permitted to ground through the neutral, the 3-conductor cord or cable assembly must be replaced by a 4-conductor cord or cable assembly. See manufacturer's instructions." See 86.11 also.

82.6 An appliance as described in the Exception to 16.1.1 shall be marked with the word "WARNING" and the following statement or the equivalent: "Frame grounded to neutral of appliance through a link. This range not for use in mobile homes or in areas where local codes do not permit grounding through neutral."

82.7 A pressure wire connector intended for connection of an equipment-grounding conductor shall be identified by being marked "G," "GR," "GND," "Ground," "Grounding," the grounding symbol illustrated in Figure 82.1, a similar marking, or by a marking on the wiring diagram provided on the appliance.

Figure 82.1

Grounding symbol



IEC417, Symbol 5019

82.8 The markings mentioned in 82.4 and 82.5 are not required to be permanent – removable tags meet the intent of the requirement.

82.9 A wall-mounted oven or counter-mounted cooking unit that is factory-connected in accordance with the Exception to 16.2.1 shall have a tag attached to the end of the lead assembly that is marked with the word "WARNING" and the following statement or the equivalent: "Frame grounded by connection of grounding lead to neutral lead. If used in a mobile home or if local codes do not permit grounding through neutral, open connection and use grounding lead to ground unit in accordance with local codes. Connect neutral lead to branch-circuit neutral conductor in usual manner."

82.10 An appliance that is intended to be connected to the power supply only by means of permanent wiring brought into the appliance shall be marked with the word "WARNING" and the following statement or the equivalent: "To reduce the risk of electric shock and fire, do not use a flexible power-supply cord with this appliance."

82.11 A single-oven eye-level range intended for mounting directly over any specific appliance shall be marked with a code number or some similar designation to indicate the appliance over which it may be mounted.

82.12 If a spacing of more than the minimum value that will accommodate the trims is necessary to reduce the likelihood of excessive temperatures when a wall-mounted oven is installed adjacent to an identical oven as described in 59.5.2.6, the oven shall be marked to indicate the minimum separation that must exist between it and the identical oven when installed. If ovens are intended for installation side by side, the indicated minimum distance is to be that between vertical centerlines through the fronts of the ovens; and if ovens are intended for installation one above the other, the indicated distance is to be that between the horizontal centerlines through the fronts of the ovens.

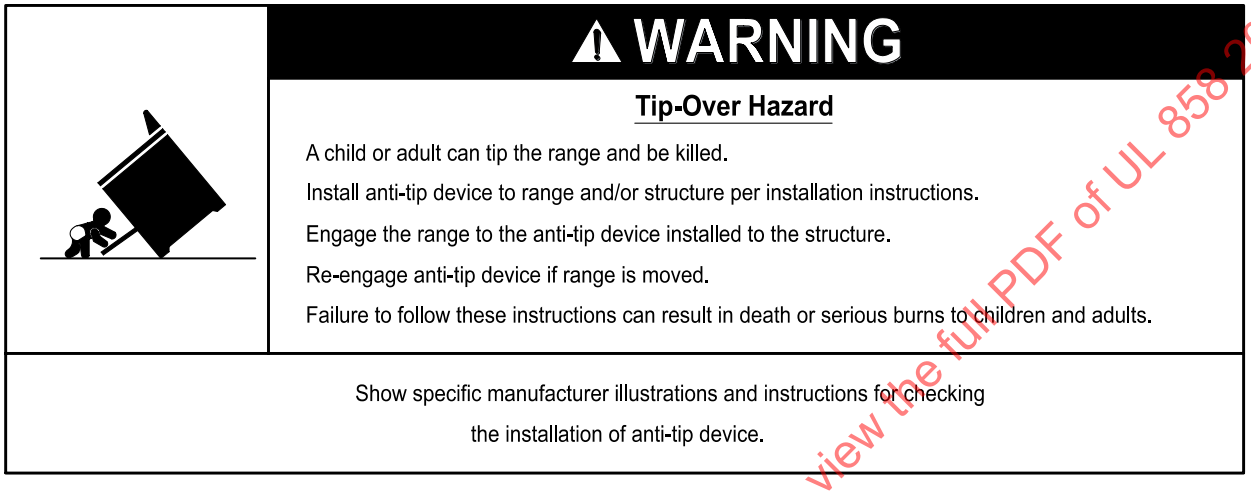
82.13 An electrical accessory intended for field installation in or on an appliance shall be marked with the manufacturer's name, with a catalog number or the equivalent, with the type of household cooking equipment with which it is intended to be used – for example, range or wall-mounted oven – and with the name of the manufacturer of that appliance. The associated appliance shall be marked to indicate the catalog number or equivalent designation of such an accessory and the name of the manufacturer of that accessory.

82.14 With reference to 82.13, instructions for installing the accessory shall be provided on or with the accessory. A statement shall be included in the instructions warning the user that the appliance must be disconnected from the source of supply before attempting the installation, and that the accessory is intended for use only with an appliance that is marked to indicate such use.

82.15 An appliance employing devices to reduce the risk of tipping of the appliance shall be marked with text and illustration as shown in Figure 82.2. An equivalent marking may be used provided the word "WARNING" appears on the marking.

Figure 82.2

Range stability marking– visible to installer



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82.16 If more than the minimum spacing that will accommodate the trims is necessary to reduce the likelihood of excessive temperature when a counter-mounted cooking unit is installed adjacent to an identical cooking unit as described in 59.5.3.4, the cooking unit shall be marked to indicate the minimum separation that must exist between it and an identical cooking unit when installed. If cooking units are intended for installation end to end, the indicated minimum distance is to be that between centerlines parallel to the ends of the units; and if the cooking units are intended for installation side to side, the indicated minimum distance is to be that between centerlines parallel to the sides of the units.

82.17 With reference to 15.1, if an appliance is provided with a lamp rated more than 150 V, the appliance shall be marked to indicate that it is intended for use only where 250 V incandescent lamps are used for general household lighting.

82.18 An appliance having field-wiring terminals shall be marked "Use Copper or Aluminum Conductors." This marking shall be independent of any marking on the terminals and is allowed to be on a wiring diagram.

Exception: This marking may be omitted if the appliance complies with 9.2.2.2 and is marked "Do Not Use Aluminum Conductors with this Appliance. Use Copper Conductors Only."

82.19 With reference to 82.18, an abbreviation designating copper or aluminum shall be "CU" or "AL."

82.20 An appliance intended for use on alternating current only or on direct current only shall be so marked. A 2-wire appliance intended for use only on a 3-wire, 120/240 V ac system shall be marked "Connect only to a 3-wire, 120/240-volt power supply; the neutral conductor is not required for the operation of the appliance. The potential at the power supply electrical connections shall be 150-volts-to-ground or less." A 2-wire appliance intended for connection to a maximum 240 V to ground ac system shall be marked for a 240 V rating.

82.21 A wall-mounted oven or counter-mounted cooking unit provided with supplementary terminals as described in 9.2.3.20 – 9.2.3.22, and leads as described in the Exception to 9.2.1.1, shall be marked to indicate that there are two points for inspection of wiring terminals. This marking need not be permanent.

82.22 An appliance intended to be built-in and attached to the cabinet structure, rated 120 V, 1.75 kW (14.6 A) or less and employing a flexible cord shall be provided with the following marking: "Connect to Individual Branch Circuit Only."

83 Visible After Installation

83.1 The marking required by 83.5 – 83.11 shall be readily visible after the appliance is installed as intended.

83.2 A marking on the back of an appliance is not acceptable because of the difficulty in seeing the marking after the appliance is installed.

83.3 A marking that is not visible without moving a wall-mounted oven or a counter-mounted cooking unit from its mounting installation is not acceptable.

83.4 A marking that is not visible unless a part on the appliance is moved or removed is acceptable, if the part can be moved or removed without the use of a tool.

83.5 An appliance shall be marked with:

a) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified – hereinafter referred to as manufacturer's name;

b) A distinctive catalog number or the equivalent; and

c) The electrical rating. Also see 86.17.

83.6 A counter-mounted cooking unit intended for mounting directly above a wall-mounted oven shall be marked with the model or catalog number of the oven or ovens with which it may be so assembled or combined. A cross-reference marking shall be provided on the associated oven or ovens.

83.7 For a counter-mounted cooking unit that is not completely assembled when shipped from the factory – see 7.6 – the top surface shall be marked with the manufacturer's name, and the catalog number or the equivalent; and the remainder of the unit shall be marked in accordance with 83.5. Instructions for assembling and installing the unit shall be provided on or with the unit.

83.8 A ventilating hood shall be marked to call attention to the need for:

a) Frequent cleaning of all grease from the fan itself and from all other grease-laden surfaces; and

b) Frequent removal and cleaning or replacement of any filter unit provided.

This marking shall be in letters not less than 3/16 in (4.8 mm) high.

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

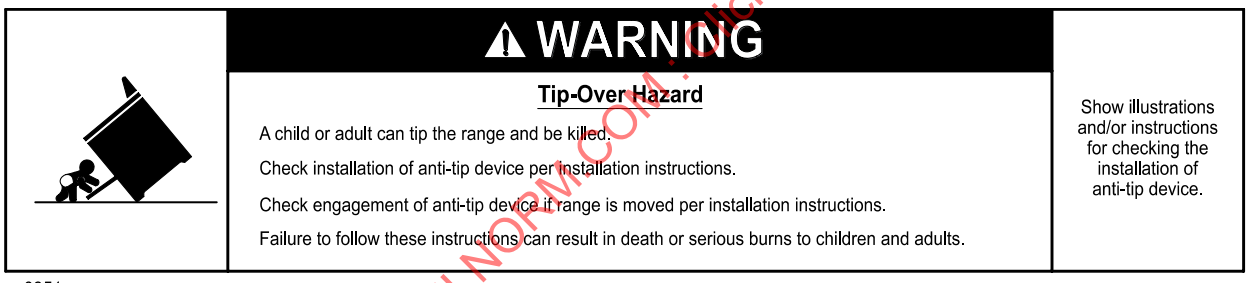
83.10 An appliance that is tested as provided in 59.3.7.4, or in the Exception to 72.1.4, shall be marked with the word "WARNING" and the following or equivalent wording: "To reduce the risk of ignition of surrounding combustible materials, install ___ inches from left sidewall, ___ inches from right sidewall, and ___ inches from rear wall. Install in accordance with manufacturer's instructions." The dimensions in the marking are to be those specified by the manufacturer.

83.11 An appliance that is tested as provided in the Exception to 59.5.3.1 shall be marked with the word "WARNING" and the following or equivalent wording: "If installing between two parallel side walls or cabinets, the walls or cabinets should be spaced at least ___ inches apart to reduce the risk of ignition of surrounding combustible materials." The spacing specified in the marking shall be no less than the distance between sidewalls when tested in accordance with Temperature Test, Section 59.

83.12 An appliance employing devices to reduce the risk of tipping of the appliance shall be marked with the text and illustration as shown in Figure 83.1. An equivalent marking may be used provided the word “WARNING” appears on the marking. The marking may be visible after opening an oven door.

Figure 83.1

Range stability marking – visible from front



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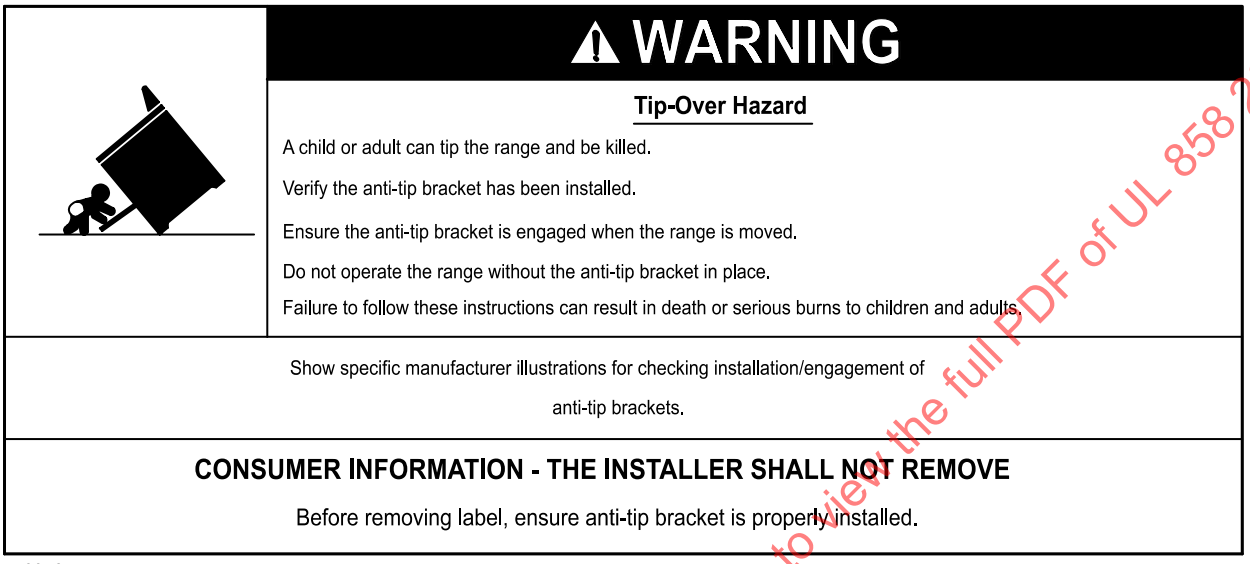
83.13 An appliance employing devices to reduce the risk of tipping of the appliance shall be marked with a consumer removable label with an area of at least 36 square inches. The label shall state that the range should not be operated without the anti-tip device installed and include information and illustration as shown in Figure 83.2. An equivalent marking may be used provided the word “WARNING” appears on the marking. The label shall state "CONSUMER INFORMATION – THE INSTALLER SHALL NOT REMOVE" and “Before removing label, ensure anti-tip device is properly installed.” The label shall be visible after the appliance is installed with any doors closed.

Figure 83.2

Range stability marking – consumer removable label



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84 Visible to the User

84.1 During servicing

84.1.1 The marking required by 84.1.2 – 84.1.5 shall be readily visible to the user during servicing.

84.1.2 An appliance marked in accordance with 82.17 shall also be marked: "Replace lamp with 250-volt lamp only."

84.1.3 A counter-mounted cooking unit that opens an ordinary – non-time-delay – fuse when tested in accordance with the Exception to 57.1, shall be marked: "If connected to a circuit protected by fuses, use time-delay fuses with this appliance," or with the equivalent.

84.1.4 The following information shall be marked both on the plug-in module and on its shipping carton:

a) The manufacturer's name, trademark or other descriptive marking by which the organization responsible for the product can be identified;

b) The catalog number or the equivalent; and

c) The electrical rating.

84.1.5 An appliance intended to be used with a plug-in module shall be marked to indicate the catalog designation of the intended module and the manufacturer of the module.

84.2 During use

84.2.1 The markings required by 84.2.2 – 84.2.8 shall be readily visible to the user during operation of the appliance.

84.2.2 If a reduced setting of the thermostat is necessary for proper operation while a rotating spit is being used, the maximum thermostat setting for such use shall be plainly indicated by the words "rotary roasting," "spit broiling," or an equivalent wording on or adjacent to the thermostat. This marking may indicate a range of settings lower than the maximum.

84.2.3 With reference to 59.3.2.6, if a specific kind or type of pan is required to be used with an appliance, the appliance shall be clearly marked or the accompanying instruction booklet shall carry a statement similar to the following: "CAUTION – To obtain proper heating use only the pans provided with this appliance."

84.2.4 An appliance that employs an indicator light in accordance with 25.2.2 and 25.2.4 shall be provided with a permanent marking, located adjacent to the light, that identifies the function of the light. The marking shall consist of the word "WARNING" and the following or the equivalent: "Oven is malfunctioning in self-cleaning mode, turn off or disconnect from power supply. See instruction manual before operating."

84.2.5 An appliance that employs an audible signal in accordance with 25.2.2 and 25.2.4 shall be provided with a permanent marking, located in an area readily visible to the user during the operation of the appliance. The marking shall consist of the word "WARNING" and the following or the equivalent: "If alarm signal (for example, a bell or buzzer) sounds, oven is malfunctioning in self-cleaning mode. Turn off or disconnect from power supply and see instruction manual before operating."

84.2.6 An appliance that is provided with a trouble indication in accordance with the requirements for Electrical Supervision of the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, shall be marked in a location readily visible to the user during operation of the appliance with the word "CAUTION" and the following or equivalent: "Alarm signals a component failure. Have appliance repaired by a qualified serviceman before using." If a visual signal is used to supplement an audible signal in accordance with UL 858A, the appliance shall be provided with a permanent marking, in a location adjacent to the signal readily visible to the user during operation of the appliance, that identifies the function of the light and consists of the word "CAUTION" and the following or equivalent: "Light signals a component failure. Have appliance repaired by a qualified serviceman before using." These two markings, if both apply, may be combined into a single marking.

84.2.7 An appliance that employs an indicator light in accordance with 62.2 and 96.1.2 shall be provided with a permanent marking, located adjacent to the light, that identifies the function of the light. The marking shall consist of the word "WARNING" and the following or the equivalent: "Appliance is malfunctioning, turn off or disconnect from power supply. See instruction manual before operating."

84.2.8 An appliance that employs an audible signal in accordance with 62.2 and 96.1.2 shall be provided with a permanent marking, located in an area readily visible to the user during the operation of the appliance. The marking shall consist of the word "WARNING" and the following or the equivalent: "If alarm

signal (for example, a bell or buzzer) sounds, appliance is malfunctioning. Turn off or disconnect from power supply and see instruction manual before operating."

84.2.9 For an appliance provided with casters, the marking required by 84.2.10 shall be located in an area readily visible to the user when preparing to move the appliance by unlocking the casters.

84.2.10 For an appliance provided with casters, there shall be a marking in addition to 84.2.1 – 84.2.8. The marking shall consist of the word "WARNING" and the following or the equivalent: "To reduce the risk of burns, do not move this appliance while hot. To reduce the risk of injury due to tipping of the appliance, verify the reinstallation of this appliance into the anti-tip device provided after returning the appliance to the original installed position."

INSTRUCTIONS

85 General

85.1 An appliance shall be provided with legible instructions pertaining to:

a) Installation as specified in Section 86; and

b) A risk of fire, electric shock, or injury to persons associated with use of the appliance as specified in Section 87; and

c) Operation as specified in Section 87.

85.2 The instructions and warning statements required by Sections 86 through 87 shall be provided as printed material and shall be repeated in any electronic media instructions provided. All other instructions may be provided in electronic read-only media format only, such as CD-ROM.

85.3 The printed instruction material referenced in 85.2 shall contain detailed instructions of how to obtain a printed copy of the material contained in electronic format.

86 Installation Instructions

86.1 An appliance shall be provided with installation instructions in accordance with 86.2 – 86.17. The installation instructions shall be packaged or otherwise kept together and shall be marked with the following or its equivalent: "Important – Save for the local electrical inspector's use."

Exception: The marking may be omitted if the installation instructions are permanently attached to the appliance in a location that is readily visible during installation and inspection.

86.2 For an eye-level range, a drawing and legend similar to Figure 59.4 shall be provided giving the minimum spacings that must be maintained between the appliance and adjacent cabinetry.

86.3 The installation instructions provided with a range or counter-mounted cooking unit shall include the following or its equivalent: "To eliminate the risk of burns or fire by reaching over heated surface units, cabinet storage space located above the surface units should be avoided. If cabinet storage is to be provided, the risk can be reduced by installing a range hood that projects horizontally a minimum of 5 inches beyond the bottom of the cabinets."

86.4 For a counter level range or a counter-mounted cooking unit, a drawing and legend similar to Figure 59.3 and Figure 59.7, respectively, shall be provided giving the minimum spacings that must be maintained between the appliance cooking surface and the horizontal surface above the cooking top. Except as noted in 86.5, the legend accompanying the drawing shall be: "A = 30 inches minimum

clearance between the top of the cooking surface and the bottom of an unprotected wood or metal cabinet;" or "A = 24 inches minimum when bottom of wood or metal cabinet is protected by not less than 1/4-inch-thick flame-retardant millboard covered with not less than No. 28 MSG sheet steel, 0.015-inch-thick stainless steel, 0.024-inch-thick aluminum, or 0.020-inch-thick copper."

86.5 If an electrically heated warming tray is provided on the back guard of a counter level range, the dimension in Figure 59.3 shall be 30 in (762 mm) and the appropriate legend described in 86.4 shall be used.

86.6 For a combination electric-solid fuel range, a drawing and legend shall be provided giving the required air space, if any, at the electrical end as specified in 59.4.5.1 and the minimum spacings at the nonelectrical end as specified in Table 59.2.

86.7 A wall-mounted oven shall be provided with instructions specifying the proper method of installation.

86.8 An appliance provided with a duct system as described in 23.4 shall be provided with explicit instructions specifying:

a) How the appliance should be vented; and

b) That the exhaust air should not be vented into a wall, a ceiling, or a concealed space of a building.

86.9 With reference to the requirement in 86.8, the instructions may be included in the installation instruction book, or marked on the appliance in a location that will be visible during installation.

86.10 If the appliance installation instructions indicate that the appliance is not prohibited from being connected by means of a power-supply cord kit, the instructions shall indicate that only a power-supply cord kit rated ____ volts, ____ amperes and marked for use with ranges shall be used. The specified ampere rating for the cord shall be 30, 40, or 50 A, in accordance with Table 86.1. The instructions shall also specify the number of conductors (3 or 4) and the type of terminations (tinned leads, closed-loop terminals, open-end spade lugs with upturned ends, or similar terminations) that the cord kit is to employ, as appropriate for the appliance supply terminals, and that only a 4-conductor cord is to be used when the appliance is installed where grounding through the neutral conductor is prohibited, such as:

a) New branch-circuit installations (1996 NEC),

b) Mobile homes,

c) Recreational vehicles, or

d) In an area where local codes prohibit grounding through the netural.

86.11 With reference to 82.5, explicit instructions for changing from a 3-conductor cord or cable assembly to a 4-conductor cord or cable assembly when the appliance is to be used in a location where grounding through the neutral conductor is prohibited. Grounding through the neutral conductor is prohibited for new branch-circuit installations (1996 NEC); mobile homes; and recreational vehicles, or an area where local codes prohibit grounding through the neutral conductor and shall be provided with each appliance marked with the warning specified in 82.5. With regard to cord replacement, other than specified in 86.12, the instructions shall:

a) Indicate that only a 4-conductor power-supply cord kit rated ____ volts, ____ amperes and marked for use with ranges shall be used; and

b) Specify the type of terminations (tinned leads, closed-loop terminals, open-end spade lugs with upturned ends, or similar terminations) that the cord kit is to employ, as appropriate for the appliance supply terminals.

The specified ampere rating for the cord shall be 30, 40, or 50 A, in accordance with Table 86.1.

Table 86.1
Specified power-supply-cord kit rating

Range rating, W		Wall- or counter-mounted cooking unit rating, W		Specified rating of power-supply-cord kit, A
120/240 V 3-wire	120/208 V 3-wire	120/240 V 3-wire	120/280 V 3-wire	
0 – 8,749	0 – 7,800	0 – 7,200	0 – 6,240	30
8,750 – 16,500	7,801 – 12,500	7,201– 9,600	6,241 – 8,320	40 or 50[a]
16,501 – 22,500	12,501 – 18,500	9,601 – 12,000	8,321– 10,400	50

[a] See 86.15.

86.12 For an appliance equipped with a factory-connected flexible cord or cable that leaves the appliance enclosure through an opening sized in accordance with the Exception to 9.3.1.13, the cord replacement instructions specified in 86.11 shall identify the specific cord kit that is to be used. The identification shall include the name of the cord-kit manufacturer and a distinctive catalog or part number.

86.13 With reference to 38.3.4(d), the instructions for an appliance employing devices intended to reduce the risk of tipping the appliance shall include the word "WARNING" and the following or the equivalent:

a) "A child or adult can tip the range and be killed."

b) "Install the anti-tip device to the structure and/or the range [indicate the two or more possible locations]."

c) "Engage the range to the anti-tip device by [state how for the two or more possible locations]."

d) "Re-engage the anti-tip device if the range is moved."

e) "See installation instructions for details."

f) "Failure to do so can result in death or serious burns to children or adults."

86.14 Instructions shall include a warning specifying how to check installation of the anti-tip device. The warning shall be on the first or second page of the installation instructions and in the section of the installation instructions describing the installation of the anti-tip device.

86.15 With respect to note a of Table 86.1, the installation instructions provided with a range rated 8,750 – 16,500 W at 120/240 V or 7,801 – 12,500 W at 120/208 V and a wall- or counter-mounted cooking unit rated 7,201 – 9,600 W at 120/240 V or 6,241 – 8,320 W at 120/208 V may specify the use of a cord kit rated either 40 A or 50 A. If the instructions specify the use of a cord kit rated 50 A, the instructions shall also specify that only 50 A rated cord kits that are marked for use with nominal 1-3/8 in (34.93 mm) diameter connection openings may be used.

86.16 The installation instructions for an appliance that is tested as provided in 59.3.7.4, in the Exception to 59.5.3.1, and in the Exception to 72.1.4, shall indicate the minimum required clearances to adjacent surfaces, consistent with the minimum clearances specified in the marking described in 83.10.

86.17 The installation instructions or instruction manual shall include information identifying the location of the nameplate label required by 83.5. Such identification shall be located with or adjacent to the instructions for electrical connections and shall also include a drawing or other pictorial identification of the location of the label.

Exception: Providing the location of the nameplate label required by 83.5 on a separate instruction sheet to be included with the installation instructions or instruction manual meets the intent of this requirement.

86.18 A cord-connected cooking appliance complying with exceptions to 55A.1 and 55A.2 shall have instructions that contain the following statement. “Caution: Risk of Electric Shock. If the cord or plug becomes damaged, disconnect the appliance from the power supply and replace only with a cord or plug of the same type.”

87 User Instructions

87.1 Each appliance shall be provided with an instruction manual that shall specifically warn the user of potential risks of fire, electric shock, or injury to persons, and state the precautions that should be taken to reduce those risks. These instructions shall be separated in format from other instructions, and shall appear before the operating instructions in the manual.

87.2 Letters in the instructions required by 87.1 shall not be less than 1/12 in (2.1 mm) high in the text and in illustrations. The instructions shall have a heading such as "IMPORTANT INSTRUCTION" in letters not less than 3/16 in (4.8 mm) high.

87.3 The important instructions in the manual shall include the appropriate instructions in (a), or the equivalent; and the appropriate instructions in (b) – (h), as applicable, or the equivalent.

a) ALL APPLIANCES:

1) Proper Installation – Be sure your appliance is properly installed and grounded by a qualified technician.

2) Never Use Your Appliance for Warming or Heating the Room.

3) Do Not Leave Children Alone – Children should not be left alone or unattended in area where appliance is in use. They should never be allowed to sit or stand on any part of the appliance.

4) Wear Proper Apparel – Loose-fitting or hanging garments should never be worn while using the appliance.

5) User Servicing – Do not repair or replace any part of the appliance unless specifically recommended in the manual. All other servicing should be referred to a qualified technician.

6) Storage in or on Appliance – Flammable materials should not be stored in an oven or near surface units.

7) Do Not Use Water on Grease Fires – Smother fire or flame or use dry chemical or foam-type extinguisher.

8) Use Only Dry Potholders – Moist or damp potholders on hot surfaces may result in burns from steam. Do not let potholder touch hot heating elements. Do not use a towel or other bulky cloth.

b) SURFACE COOKING UNITS:

1) Use Proper Pan Size – This appliance is equipped with one or more surface units of different size. Select utensils having flat bottoms large enough to cover the surface unit heating element. The use of undersized utensils will expose a portion of the heating element to direct contact and may result in ignition of clothing. Proper relationship of utensil to burner will also improve efficiency.

2) Never Leave Surface Units Unattended at High Heat Settings – Boilover causes smoking and greasy spillovers that may ignite.

3) Make Sure Reflector Pans or Drip Bowls Are in Place – Absence of these pans or bowls during cooking may subject wiring or components underneath to damage.

4) Protective Liners – Do not use aluminum foil to line surface unit drip bowls or oven bottoms, except as suggested in the manual. Improper installation of these liners may result in a risk of electric shock, or fire.

5) Glazed Cooking Utensils – Only certain types of glass, glass/ceramic, ceramic, earthenware, or other glazed utensils are suitable for range-top service without breaking due to the sudden change in temperature.

6) Utensil Handles Should Be Turned Inward and Not Extend Over Adjacent Surface Units – To reduce the risk of burns, ignition of flammable materials, and spillage due to unintentional contact with the utensil, the handle of a utensil should be positioned so that it is turned inward, and does not extend over adjacent surface units.

7) Do Not Soak Removable Heating Elements – Heating elements should never be immersed in water.

c) OVENS:

1) Use Care When Opening Door – Let hot air or steam escape before removing or replacing food.

2) Do Not Heat Unopened Food Containers – Build-up of pressure may cause container to burst and result in injury.

3) Keep Oven Vent Ducts Unobstructed.

4) Placement of Oven Racks – Always place oven racks in desired location while oven is cool. If rack must be moved while oven is hot, do not let potholder contact hot heating element in oven.

d) SELF-CLEANING OVENS:

1) Do Not Clean Door Gasket – The door gasket is essential for a good seal. Care should be taken not to rub, damage, or move the gasket.

2) Do not use a protective coating to line the oven and do not use commercial oven cleaner unless Certified for use in a self-cleaning oven.

3) Clean Only Parts Listed in Manual.

4) Before Self-Cleaning the Oven – Remove broiler pan and other utensils.

e) GLASS/CERAMIC COOKING SURFACES:

1) Do Not Cook on Broken Cook-Top – If cook-top should break, cleaning solutions and spillovers may penetrate the broken cook-top and create a risk of electric shock. Contact a qualified technician immediately.

2) Clean Cook-Top With Caution – If a wet sponge or cloth is used to wipe spills on a hot cooking area, be careful to avoid steam burn. Some cleaners can produce noxious fumes if applied to a hot surface.

f) VENTILATING HOODS:

1) Clean Ventilating Hoods Frequently – Grease should not be allowed to accumulate on hood or filter.

2) When flaming foods under the hood, turn the fan on.

g) DEEP FAT FRYERS:

1) Use extreme caution when moving the grease kettle or disposing of hot grease.

h) INDUCTION COOKTOP SURFACE UNITS:

1) Do not place metallic objects such as knives, forks, spoons and lids on the cooktop surface since they can get hot.

87.4 Any of the instructions provided as part of the marking on an appliance need not be included in the instruction manual.

87.5 The instruction manual provided with a range or counter-mounted cooking unit shall include the word "CAUTION" and the following or the equivalent: "Do not store items of interest to children in cabinets above a range or on the backguard of a range – children climbing on the range to reach items could be seriously injured."

87.6 The instruction manual provided with an appliance employing a surface unit shall include the following or its equivalent: "DO NOT TOUCH SURFACE UNITS OR AREAS NEAR UNITS – Surface units may be hot even though they are dark in color. Areas near surface units may become hot enough to cause burns. During and after use, do not touch, or let clothing or other flammable materials contact surface units or areas near units until they have had sufficient time to cool. Among these areas are (identification of areas – for example, the cook-top and surfaces facing the cook-top)." See 87.10.

87.7 The instruction manual provided with an appliance employing an oven shall include the following or its equivalent: "DO NOT TOUCH HEATING ELEMENTS OR INTERIOR SURFACES OF OVEN – Heating elements may be hot even though they are dark in color. Interior surfaces of an oven become hot enough to cause burns. During and after use, do not touch, or let clothing or other flammable materials contact heating elements or interior surfaces of oven until they have had sufficient time to cool. Other surfaces of the appliance may become hot enough to cause burns – among these surfaces are (identification of surfaces – for example, oven vent openings and surfaces near these openings, oven doors, and windows of oven doors)." See 87.10.

87.8 With reference to 38.3.4(e), the user instructions for an appliance employing devices intended to reduce the risk of tipping the appliance shall include the word "WARNING" and the following or its equivalent:

a) "A child or adult can tip the range and be killed. "

b) "Verify the anti-tip device has been properly installed and engaged [state how for the two or more possible locations]."

c) "Ensure the anti-tip device is re-engaged when the range is moved [state how for the two or more possible locations]. "

d) "Do not operate the range without the anti-tip device in place and engaged."

e) "Failure to do so can result in death or serious burns to children or adults."

Instructions shall be included specifying how to check installation of the anti-tip device. The warning shall be on the first or second page of the user information.

87.9 The instruction manual provided with an appliance provided with casters and a device to reduce the risk of tipping shall include the word "WARNING" and the following or the equivalent: "TO REDUCE THE RISK OF BURNS, DO NOT MOVE THIS APPLIANCE WHILE HOT. THIS APPLIANCE IS PROVIDED WITH CASTERS TO FACILITATE MOVEMENT. TO REDUCE THE RISK OF INJURY DUE TO TIPPING OF THE APPLIANCE, VERIFY THE REINSTALLATION OF THIS APPLIANCE INTO THE ANTI-TIP DEVICE PROVIDED, AND LOCK THE CASTERS AFTER RETURNING THE APPLIANCE TO THE ORIGINAL INSTALLED POSITION."

87.10 For an appliance that employs a surface unit and an oven, the instructions specified in 87.6 and 87.7 may be combined.

87.11 The "Important Instruction" section of the instruction manual for an appliance that employs an indicator light or an audible signal in accordance with 25.2.2, 25.2.4, and 25.2.5 shall include the following statement or the equivalent: "In the event the self-cleaning mode malfunction light goes on, or the audible signal (for example, a bell or buzzer) sounds, oven is malfunctioning in the self-cleaning mode. Turn off or disconnect appliance from power supply and have serviced by a qualified technician."

87.12 An appliance that is provided with a trouble indication in accordance with the requirements for Electrical Supervision of the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, shall be provided with instructions specifying what the user is to do in the event of activation of the trouble indication (for example, "Disconnect power supply and call qualified serviceman").

87.13 The "Important Instruction" section of the instruction manual for an appliance that employs an indicator light or an audible signal in accordance with 62.2 and 96.1.2 shall include the following statement or the equivalent: "If the malfunction light goes on, or if the audible signal (for example, a bell or buzzer) sounds, appliance is malfunctioning. Turn off or disconnect appliance from power supply and have serviced by a qualified technician."

87.14 An appliance intended to be built-in and attached to the cabinet structure, rated 120 V, 1.75 kW (14.6 A) or less and employing a flexible cord shall be provided with the following instructions. These instructions shall be located in the same section of the Instruction Manual as the Power Supply/Grounding connection instructions. “Do not use an extension cord to connect this appliance. If the power supply cord is too short, have a qualified electrician or serviceman install an outlet near the appliance.”

87.15 An appliance intended to be built-in, attached to the cabinet structure and is rated 120 V, 1.75 kW (14.6 A) or less shall be provided with the following instruction, or equivalent: “This Oven is intended to be built-in to a cabinet structure only and is not intended for attachment to the building structure.” This instruction is to be located in the Installation Section that identifies the cabinetry that is required for the installation. In addition, this instruction shall be more prominent than the general installation instructions.

87.16 For smart enabled electric ranges that allow remote operation in accordance with any portion of Section SA3, an additional statement shall be provided. "Remote Operation – This appliance is configurable to allow remote operation at any time. Do not store any flammable materials or temperature sensitive items inside, on top or near surface units of the appliance."

CONTINUOUS-CLEANING OVENS

88 General

88.1 Scope

88.1.1 The requirements in 88.2.1 and 88.3.1 cover continuous-cleaning ovens. These requirements supplement and, in some cases, amend the requirements in Sections 2 – 87.

88.2 Construction

88.2.1 Any material used in the coating on an oven interior, liner, door, and the like shall not be toxic at the oven temperatures that may exist.

88.3 Performance

88.3.1 If the manufacturer's instructions state that an oven temperature more than 246°C (475°F) is to be used for cleaning, the temperature test described in Temperature Test, Section 59 shall be conducted with the oven set at the maximum temperature recommended by the manufacturer.

SELF-CLEANING OVENS

GENERAL

89 Scope

89.1 The requirements in Sections 90 – 110 cover self-cleaning ovens:

a) Operating at temperatures of 380 – 548°C (716 – 1018°F);

b) Having an oven volume not exceeding 6.0 ft^3 or 10,368 in^3 (0.1699 m^3) as determined in accordance with the Procedures for the Determination and Expression of the Volume of Household Microwave and Conventional Ovens, ANSI/AHAM OV-1; and

c) That are intended to be vented into the room where the oven is installed.

89.2 An oven that is vented externally shall comply with the requirements in Sections 2 – 87 and 90 – 110 as applicable, and shall be investigated with respect to grease build-up, gas mixtures, temperatures, and the like in vents.

89.3 The requirements in Sections 90 – 110 supplement and, in some cases, amend the requirements in Sections 2 – 87.

CONSTRUCTION

90 Materials

90.1 Oven coating

90.1.1 Any material used in the coating on an oven interior, liner, door, and the like shall not be toxic at the oven temperatures that may exist.

90.2 Smoke eliminators

90.2.1 A smoke eliminator shall be constructed of such material that the performance will not be adversely affected by thermal aging, grease, products of combustion, and the like, and shall be mechanically secured in place.

Exception: The requirement does not apply if the oven performs acceptably when subjected to the tests at the oven vent described in Sections 90 – 106 with and without the smoke eliminator.

90.3 Oven vent tubes and smoke diverters

90.3.1 If the absence or displacement of an oven vent tube or a smoke diverter may result in excessive temperatures or accumulation of grease on electrical components or wiring, the vent tube or smoke diverter shall be:

a) Of such material (see 90.3.2) that performance will not be adversely affected by thermal aging, exposure to grease, products of combustion, and the like; and

b) Mechanically secured in place or constructed so that proper replacement is obvious to the user.

90.3.2 With reference to 90.2.1 and 90.3.1, steel and aluminum are considered acceptable materials. The use of other materials may necessitate an investigation to determine whether they are acceptable.

91 Oven Door Latch/Interlock Assembly

91.1 A self-cleaning oven shall be designed or constructed so that the oven door must be closed and latched before a temperature of 316°C (600°F) can be attained, unless latching is done automatically when the locking temperature is reached.

91.2 An oven-door interlock shall operate before the cleaning cycle temperature exceeds 316°C (600°F), and the oven door shall remain locked at any temperature above 316°C under any condition, such as loss of power, malfunction or breakdown of components, and the like. See 94.2.3.

Exception: The maximum temperature at which an oven-door interlock operates may exceed 316°C if the oven complies with the requirements in Elevated Interlock Operating Temperature Tests, Section 109.

91.3 An oven-door interlock shall not operate to prohibit access to the oven during normal bake or broil operations.

91.4 An oven-door interlock shall be constructed and designed so that it cannot be defeated, except in one or more of the following ways:

a) Using tools that would normally be employed only by servicemen;

b) Altering the electrical connections of the interlock circuit; or

c) Damaging or dismantling the appliance.

91.5 A self-cleaning oven shall be constructed so that the user must perform at least two distinct operations to initiate a self-cleaning cycle. Examples of such operations are operating a door latch, setting a timer, setting a thermostat, and setting a selector switch.

Exception: If an oven-door latch is released during a self-cleaning cycle before the oven-door interlock has operated, two operations are not required to restart the self-cleaning cycle.

91.6 With reference to 91.5, for a self-cleaning oven using a solid-state control(s) in which the two distinct operations necessary to initiate a self-cleaning cycle are both of the touch-pad type, the control shall comply with the requirements in 47.4 except for the 30 s requirement.

91.7 A self-cleaning oven shall be designed so that the self-cleaning cycle can be interrupted at any time by a single operation – for example, reversing one of the operations mentioned in 91.5.

91.8 Solid-state control(s) used in a self-cleaning oven shall comply with the applicable requirements of the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A.

91.9 Oven door lock thermostats and other devices that respond to temperature shall comply with the applicable requirements in the Standard for Temperature-Indicating and -Regulating Equipment, UL 873. 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.

92 Seals and Gaskets

92.1 An oven-door seal or oven-frame seal necessary to contain burning or flammable vapors within the oven during the self-cleaning operation shall be of such material and so secured in place that the performance of the seal will not be adversely affected by thermal aging, exposure to grease, products of combustion, or commercial oven cleaners.

92.2 An example of a material that is acceptable for the application mentioned in 92.1 is glass fiber. The use of other materials may necessitate an investigation to determine whether they are acceptable.

PERFORMANCE

93 General

93.1 The tests described in Sections 94 – 108 are to be conducted with the appliance installed in a test enclosure as described in 59.4.1.1 – 59.5.3.5, and connected to a power supply in accordance with Input Test, Section 56.

93.2 Solid-state temperature door lock controls shall comply with the applicable requirements of the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A.

94 Temperature Test

94.1 General

94.1.1 For the temperature tests described in 94.2.1 – 94.2.4 and Sections 95 and 96, the timer is to be continuously set and reset until temperatures are stabilized. If the circuitry is such that consecutive cycles cannot be run until the oven has cooled, the timer is to be reset as soon as possible.

94.2 Normal temperature

94.2.1 A self-cleaning oven shall be tested as described in 94.2.2 and 94.2.3 and shall not reach a temperature at any point high enough to cause a risk of fire, to damage any material used, or to exceed the temperature rises specified in Table 59.1.

94.2.2 The self-cleaning oven or ovens are to be operated in the self-cleaning cycle. The surface units of the appliance are not to be operated during the test. If two self-cleaning ovens are provided and are

interlocked so that only one oven can be cleaned at a time, one oven is to be operated to stabilization and maximum temperatures are to be measured as described in 59.2.1 – 59.2.7. As soon as possible, the second oven is to be operated and maximum temperatures again measured.

94.2.3 During the temperature test described in 94.2.2, time-temperature rise data is to be recorded for future reference, and the temperatures at which the oven door interlocks operate – lock and unlock – are to be recorded. See 91.2.

94.2.4 If the oven-door interlock employs a solenoid, the test described in Latch-Solenoid Temperature Test, Section 94 is to be performed following the test described in 94.2.2.

95 Latch-Solenoid Temperature Test

95.1 When tested as described in 95.2 and 95.3, the maximum temperature rises of a solenoid of an oven-door-interlock system shall not exceed the applicable values in Table 59.1.

Exception: A solenoid that cannot remain on for 1 s or more need not be subjected to the test.

95.2 At the end of the temperature test described in 94.2.2, a solenoid that operates to release the oven-door interlock when the oven cools to a temperature below the locking temperature, is to be subjected to 10 cycles of operation – 1 s on and 4 s off – at that temperature, and the maximum temperatures of the solenoid are to be recorded after the tenth cycle of operation.

95.3 If the interlock circuit is designed so that the solenoid will remain on at the completion of the self-cleaning cycle to indicate completion of the self-cleaning operation, the solenoid is to be allowed to operate in the on position until maximum temperatures are recorded.

96 Abnormal Operation Test

96.1 Stalled fan

96.1.1 When tested as described in 96.1.3 and 96.1.4, a self-cleaning oven provided with a cooling fan shall not exceed the temperature rises specified in Table 59.1.

Exception: Initial temperature transients may exceed the temperature rises specified in Table 59.1 if the duration or extent of the transients:

a) Do not result in a risk of fire or electric shock;

b) Are of a duration of not more than 15 min; and

c) Do not exceed 110 percent of the applicable maximum temperature rise specified in Table 59.1.

96.1.2 With reference to the Exception to 96.1.1, if an initial temperature transient exceeds the temperature rise specified in Table 59.1, a means, such as an indicator light or audible signal, shall be provided to alert the user that the oven is not operating normally during the self-cleaning mode of operation. The means to alert the user shall comply with 62.5 and 62.6.

Exception: An alert means may be omitted if it is shown that during the self-cleaning mode of operation, malfunction of the fan results in the operation of a temperature-limiting control to open the ungrounded conductors to the heating elements and to render the oven inoperable until the oven is serviced by a qualified serviceperson.

96.1.3 The test mentioned in 96.1.1 is to be conducted as described in 94.2.2, except that the cooling fan is to be stalled or de-energized when stabilized temperatures are obtained. The test is to be continued after the fan has been stalled or de-energized, and the maximum temperatures are to be recorded.

96.1.4 If, after the fan has been stalled or de-energized, the cleaning cycle is interrupted by the operation of a temperature-limiting device, the maximum temperatures are to be recorded at that time. It may be necessary to restart the test from ambient temperature with the fan stalled or de-energized to determine whether the temperature limits are exceeded before the normal self-cleaning cycle is completed or before the temperature-limiting device operates.

96.2 Drip bowls

96.2.1 A range employing a self-cleaning oven and provided with surface-unit drip bowls that can be removed without affecting the normal support of the surface units shall not become a risk of fire or electric shock when operated continuously under the conditions described in 96.2.2 and 96.2.3.

96.2.2 With reference to 96.2.1, the surface-unit drip bowls are to be removed, the surface units are to be operated as described in 59.3.2.1 – 59.3.2.9, and the self-cleaning oven is to be operated in the self-cleaning cycle. The range is to be operated in this manner until ultimate results have been determined. In most cases, continuous operation for 7 – 8 h will be necessary to determine that the ultimate results have been observed.

96.2.3 A range or oven is considered to comply with the requirements in 96.2.1 if:

a) There is no emission of flame or molten metal;

b) There is no glowing or flaming of combustible material – either cheesecloth or wood – in proximity to the range or oven as installed;

c) The temperature of the test enclosure as measured by thermocouples shall not exceed 175°C (357°F) (see 96.2.4) or there is no scorching of the cheesecloth located between the appliance and the test enclosure;

d) There is no visible damage to the insulation of wire or components; and

e) The appliance complies with the dielectric voltage-withstand requirements in 66.1. The dielectric test shall be conducted following the test, commencing within 5 s after the appliance is de-energized.

Exception No. 1: In place of conducting the dielectric voltage-withstand test immediately following the test, the insulation resistance may be measured immediately following the test and monitored until the appliance cools to normal operating temperatures. At no time shall the insulation resistance be less than 50,000 Ω. Following the test and with the appliance at normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. See 96.2.5.

Exception No. 2: In place of conducting the dielectric voltage-withstand test immediately following each test, the leakage current between accessible dead metal parts and ground through a 500 Ω resistor may be measured immediately following each test and monitored until the appliance cools to normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. The leakage current shall not exceed 5 mA.

96.2.4 With respect to 96.2.3(c), the temperature of surfaces of the enclosure that are not visible after installation may exceed 175°C (357°F) provided:

a) The temperature does not exceed 200°C (392°F); and

b) The heat-producing portions of the appliance are de-energized by a thermal cutoff, a manual-reset temperature limit control, a fuse, or a similar device requiring a nonuser service operation to restore the appliance to an operable condition.

96.2.5 With respect to Exception No. 1 of 96.2.3(e), the insulation resistance shall be measured with a dc voltage of approximately 250 V applied between exposed dead metal parts of the appliance and the appliance supply conductors, with a voltmeter connected in series with the dc voltage source and the supply conductors. The dc line voltage shall be measured using a separate ac-dc voltmeter. See Figure 72.1. The insulation resistance shall be calculated using the following circuit equation:

$$R_i = \left(\frac{V_1 - V_s}{V_s} \right) R_s$$

In which:

V_1 is the dc line voltage (reading given on ac-dc voltmeter),

V_s is the voltage across series voltmeter (reading given on series voltmeter),

R_s is the resistance of series voltmeter[a], and

R_i is the insulation resistance of test sample.

[a] *Note: R_s is the M_s V_m*

In which:

M_s is the deflection sensitivity of the series voltmeter in ohms/volt, and

V_m is the maximum voltage which can be read on the scale being used.

96.3 Shorted thermostat

96.3.1 An appliance employing a self-cleaning oven shall be operated continuously under the conditions described in 96.3.2. The appliance shall comply with requirements in 96.2.3 and, in addition, there shall be no scorching of cheesecloth located between the appliance and the test enclosure nor ignition of cheesecloth located on test enclosure surfaces visible after installation of the appliance.

96.3.2 The appliance is to be installed in accordance with 59.4.1.1 – 59.5.3.5 and Figure 59.3 – Figure 59.8, and the surfaces of the test enclosure are to be completely covered with two layers of cheesecloth secured as tightly as practicable to the enclosure surface. The cheesecloth is to be as described in 54.1. Exposed dead metal parts are to be connected to ground through a 3-A fuse. The self-cleaning oven is to be operated in the self-clean mode with the oven temperature-regulating control short-circuited and with all other oven controls, if any, set to result in the most severe conditions until ultimate results have been obtained. In most cases, operation for 7 – 8 h will be necessary to obtain ultimate results. If an appliance is provided with two or more ovens, only one oven is to be operated at a time.

96.3.3 A single-pole double-throw device is to be short-circuited by connecting the common contact terminal to either the device's normally-open contact terminal or the normally-closed contact terminal, whichever results in maximum heating conditions.

97 Component Failure Test

97.1 The test described in 97.2 – 97.4 are applicable to appliances employing electronic self-cleaning oven temperature-regulating controls if, at the manufacturer's request, the test level of a critical component is reduced in accordance with the Failure Mode and Effect Analysis requirements in the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A.

97.2 The test level of the component under considerations shall be reduced if, as a result of the test specified in 97.4:

a) There is no emission of flame or molten metal, nor glowing or flaming of combustible material – cheesecloth or wood;

b) The temperature of surfaces of the test enclosure that are not visible after installation of the appliance does not exceed 175°C (see 97.3), or there is no scorching of cheesecloth located between the appliance and the test enclosure;

c) There is no visible damage to wire or component insulation;

d) The 3-A fuse connected between exposed dead metal parts of the appliance and ground does not open; and

e) The appliance shall comply with the dielectric withstand requirements in 66.1. The dielectric voltage-withstand test is to be conducted following each abnormal mode of operation, commencing within 5 s after the appliance is de-energized.

Exception No. 1: In place of conducting the dielectric voltage-withstand test immediately following each test, the insulation resistance may be measured immediately following each test and monitored until the appliance cools to normal operating temperatures. At no time shall the insulation resistance be less than 50,000 Ω. Following each test and with the appliance at normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. See 96.2.4.

Exception No. 2: In place of conducting the dielectric voltage-withstand test immediately following each test, the leakage current between accessible dead metal parts and ground through a 500 Ω resistor may be measured immediately following each test and monitored until the appliance cools to normal operating temperatures, the appliance shall comply with the dielectric voltage-withstand requirements in 66.1. The leakage current shall not exceed 5 mA.

97.3 With respect to 97.2(b), the temperature of surfaces of the enclosure that are not visible after installation may exceed 175°C (357°F), provided:

a) The temperature does not exceed 200°C (392°F); and

b) The heat-producing portions of the appliance are de-energized by a thermal cutoff, manual-reset temperature limit control, fuse or similar device requiring a nonuser service operation to restore the appliance to an operable condition.

97.4 The surfaces of the test enclosure are to be covered with cheesecloth and the appliance provided with a 3-A fuse as described in 96.3.2. The appliance is to be installed, connected, and operated as described in 94.1.1 – 94.2.4, except that:

a) The electronic control component under consideration shall be defeated in accordance with the Failure Mode and Effect Analysis requirements in the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A; and

b) All other oven temperature-regulating and -limiting controls are to be defeated so as to result in maximum heating conditions.

98 Oven-Door Latch Endurance Test

98.1 General

98.1.1 Components of an oven door latch or lock mechanism shall complete the tests specified in 98.2 without any malfunction that results in:

a) A change in the gap between the oven door and the frame; or

b) Allowing the oven door to be opened at a temperature higher than that at which the oven door interlock or mechanism is intended to operated. See 91.1 and 91.2 for acceptable operating conditions.

Exception: A change in the gap between the oven door and the frame may occur if the product continues to comply with the Fire and Explosion Within Oven Test, Section 104.

98.2 Test procedure

98.2.1 Mechanical parts and electro-mechanical parts of an oven door latch or lock mechanism that do not switch current, such as linkages, springs, levers, solenoids, motors and the like, that cycle only during self-cleaning operation, shall withstand 6,000 cycles of operation at normal load at the temperature specified in 98.2.4. Parts that operate during cooking or other appliance operating modes, such as bi-metal devices, shall withstand 100,000 cycles of operation at normal load at the temperature specified in 98.2.4.

98.2.2 Oven door lock thermostats and switching component of an oven door latch or lock system that cycle electrically (make or break current) during self-cleaning operation and that carry current or cycle without electrical load during cooking or other operating modes shall withstand 6,000 cycles of operation at normal electrical load, plus an additional 94,000 cycles at no load. Oven door lock thermostats and switching components that may cycle electrically one or more times during cooking or other appliance operating modes shall withstand 100,000 cycles of operation at normal electrical load.

98.2.3 Prior to being subjected to the endurance test specified in 98.2.2, each switching component shall:

a) Be aged for 250 h while conducting maximum normal current and placed in a test oven adjusted to maintain a temperature not less than the maximum ambient temperature to which the device is exposed during self-cleaning operation, followed by

b) An Overload Test consisting of 50 cycles of operation while making and breaking 150 percent of normal current at normal voltage in a test oven adjusted to maintain a temperature not less than the maximum ambient temperature to which the device is exposed during self-cleaning operation.

If the Endurance Test temperature is not less than the minimum temperature specified for the 250-h aging test, aging may be omitted if the total time elapsed during the 50-cycle Overload Test and the Endurance Test is at least 250 h.

98.2.4 The Endurance Test specified in 98.2.1 and 98.2.2 is to be conducted with the mechanism or system installed in a sample of the appliance and operating such that the ambient temperature at the components under test is no less than the maximum normal temperature to which the components are subjected when they actuate the lock, unlock, or unlatch the oven door. Alternately, the mechanism or system may be tested while in a test chamber that is adjusted to maintain the same ambient temperature,

or, at the manufacturer's option, at the maximum ambient temperature adjacent to the component that is recorded during the tests as specified in the Temperature Test, Section 59 or Abnormal Operation – Stalled-Fan Test, Section 62.

98.2.5 For purposes of the tests specified in 98.2.1 and 98.2.2, the maximum normal temperature to which components are subjected when they actuate to lock or latch the oven door is determined by operating the appliance in the self-clean mode as specified in Temperature Test, Section 94, with the appliance initially at room ambient temperature. The maximum temperature to which they are subjected when they actuate to unlock or unlatch the oven door is the temperature at the time when the door can first be unlatched and opened during cooldown.

99 Window Impact Tests

99.1 The window assembly of an oven door shall be subjected to three impact tests, as described in 99.2 – 99.7, using a new door assembly for each test.

99.2 The first impact test is to be conducted as described in 99.3 and if:

a) At least one panel remains intact after the impact, the test described in 94.2.2 is to be repeated to determine whether the effects of heat will cause the panel to break. If the panel breaks or the air flow in the oven is changed as a result of the test described in 94.2.2, the tests described in Sections 100 – 108 are to be repeated to determine whether a risk of fire or explosion exists.

b) All panels break as a result of the impact, the tests described in Sections 100 – 108 are to be repeated to determine whether a risk of fire or explosion exists.

99.3 For the test mentioned in 99.2, the impact test is to be conducted on the inside glass panel of the window assembly with the oven door mounted on the oven as intended, with the door open, and with the sliding shield or shutter in the position normally used for baking. The panel is to be subjected to a single impact as described in 99.4.

99.4 The impact mentioned in 99.2 is to be produced by a smooth, solid steel sphere, 3-1/4 in (82.5 mm) in diameter and weighing approximately 5 lb (2.27 kg). The sphere is to fall or to swing as a pendulum through a vertical distance of 5 ft (1.52 m) to produce the required impact.

99.5 The second impact test is to be conducted on the outside glass panel of the window assembly with the oven door mounted on the oven as intended, with the door closed, and with the sliding shield or shutter in the self-cleaning position. The panel is to be subjected to a single impact as described in 99.6. After the impact, the panel is to be intact.

99.6 The impact mentioned in 99.5 is to be produced using a smooth solid steel sphere, 2 in (50.8 mm) in diameter and weighing approximately 1.18 lb (535 g). The sphere is to be allowed to fall or to swing as a pendulum through a vertical distance of 25-7/16 in (646 mm).

99.7 The third impact test is to be conducted as described in 99.5 and 99.6, except that the sphere is to fall or swing through a vertical distance of 51 in (1.29 m) before impact. Cracking or breaking of the panel as a result of the impact is acceptable if the air flow in the oven does not change. If the air flow in the oven is changed, the tests described in Sections 100 – 108 are to be repeated to determine whether a risk of fire or explosion exists.

100 General

100.1 An appliance shall be tested as described in Sections 101 – 109. There shall be no appreciable accumulation of greasy residue on the interior wiring, electrical components, or internal or external ducts; nor applicable dispersion of visible sooty particles into the room.

100.2 Tests are not required for self-cleaning of surface-unit drip bowls.

100.3 The tests described in Sections 101 – 109 are to be started with the oven temperature at 38°C (100°F) or less.

100.4 If alternate temperature controls are employed in an appliance, the fire and explosion tests specified in 100.6 are to be repeated using an alternate control if the control affects the time-temperature relationship during the self-cleaning cycle as determined by 100.5. When time-temperature rise data is recorded for comparison purposes, the ambient temperature shall be within ±10°C (±18°F) of the ambient temperature during the test which the time-temperatrue rise data is to be compared.

100.5 With respect to 100.4, if the time versus temperature relationship in the oven changes by the following amounts, consideration is to be given to repeating the fire and explosion tests as required in 100.6.

a) The peak maximum oven cavity air temperature differs from the original test value by more than ±5 percent measured in degrees Fahrenheit;

b) The rise time from room temperature to 454°C (850°F) or the maximum oven cavity air temperature, whichever is lower, decreases by more than 7 min, or increases by more than 15 min; or

c) The rise time from 316°C (600°F) to 454°C (850°F) or the maximum oven cavity air temperature, whichever is lower, decreases by more than 5 min, or increases by more than 10 min.

100.6 If the maximum oven cavity air temperature increases or the rise time decreases beyond the specifications in 100.5, then the Vent Gases and Vapors Tests, Section 106, are to be repeated. If the maximum oven cavity air temperature decreases or the rise time increases beyond the specifications in 100.5, then the Emission of Carbon Monoxide Tests, Section 105, are to be repeated.

100.7 A self-cleaning oven having a solid-state control that has not been investigated and found to comply with the applicable requirements of the Standard for Safety-Related Solid-State Controls for Household Electric Ranges, UL 858A, is to be subjected to a time-temperature determination both with and without the solid-state control in the circuit. If the two conditions do not comply with the requirements in 100.5, the fire and explosion tests specified in 100.6 are to be repeated both with and without the control in the circuit. In addition, if any malfunction of the control, when considering the failure of any combination of control components, results in a time versus temperature curve that does not comply with the requirements in 100.5 when compared to the two time versus temperature curves indicated above, the fire and explosion tests specified in 100.6 are to be repeated with the control malfunctioning.

101 Test Electrodes

101.1 The discharge electrodes to be used for the tests described in Sections 102 – 108 are to have a 1/4-in (6.4-mm) spark-gap; and are to be connected to the secondary of a transformer rated 110 V, 60-Hz primary and 23 mA, 10,000 V secondary. A 0.01-µF capacitor is to be connected across the secondary of the transformer. The electrodes are to be insulated for 10,000 V, and the insulation is to be acceptable for the temperatures within the oven during the self-cleaning cycle. When installed in the oven, the electrodes are to be adjustable over the upper half of the oven.

102 Test Samples

102.1 The test samples to be used for the tests in Sections 103 – 108 are to incorporate the following provisions to facilitate testing:

a) External means for defeating the oven-door interlock at self-cleaning temperatures.

b) Electrodes, as described in 101.1, entering the oven vertically at the center of its top interior surface.

c) An opening into the interior of the oven to accommodate a 1/2-in standard pipe nipple. This opening for connection of pressure-measuring equipment is to be located in the upper and back one-third of the left side of the oven when facing the oven cavity, except that for an appliance having storage drawers, areas, or the like, on the left side, the opening may be provided in the upper and back one-third of the right side of the oven.

d) If the appliance has a smoke eliminator provided with a supplementary heating element that is not electrically interlocked with the self-cleaning cycle, external means to open the circuit to the heating element.

102.2 The test samples are to be provided with complete operating instructions, oven racks, and two broiler pans.

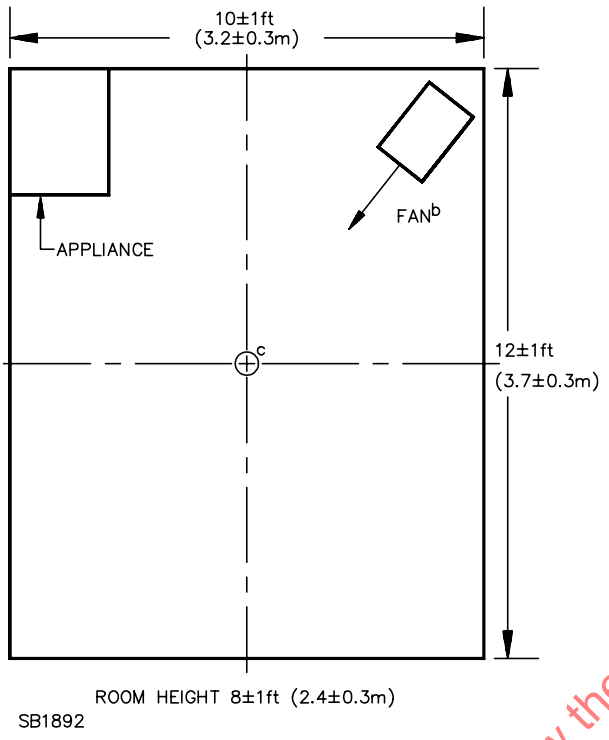
103 Installation of Test Sample

103.1 The test sample to be used for the tests in Sections 104 – 109 is to be installed as described in General, Section 93 in one corner of a test room. See Figure 103.1. The test room is to be provided with a door that can be closed tightly. The room is also to be provided with lighting and windows for observation during the tests. For the Emission of Carbon Monoxide test, Section 105, the room is to be provided with a fan to gently circulate the air within the room, and facilities for measuring carbon monoxide during the tests. For the tests specified in Sections 105 – 109, the product is to be installed in a test enclosure as described in 59.4.1.1 – 59.5.3.5. The test room is not to be vented during the test. The room is to have a volume of approximately 1000 ft^3 (28.3 m^3).

Exception: For the Fire and Explosion Within Oven test, Section 104, the appliance need not be installed in a test enclosure and the test room is to have ventilation or volume as described in 104.3.

Figure 103.1

Layout of test room[a]



[a] The room dimensions are to be within the limits specified and the total volume is to be approximately 1000 ft^3 (28.3 m^3).

[b] The fan is to be located near the floor with the airstream directed toward the upper corner.

[c] The room air sample and temperature are to be taken 60 in (1.5 m) above the center of the floor.

104 Fire and Explosion Within Oven

104.1 When tested as described in 104.2 – 104.7, pressure developed within the oven shall not result in breakage or permanent deformation of the oven cavity, including the oven door; and no intermittent or continuous flame shall be emitted from the oven. If cheesecloth is used as an indication of flame in accordance with 104.2, there shall not be ignition of the cheesecloth.

104.2 If, when the appliance is tested without cheesecloth, there is an indication of flames or burning vapors being emitted from the oven, the test is to be repeated with cheesecloth affixed to the area surrounding the oven door to determine if flame is emitted from the oven. Alternatively, at the manufacturer's request, the test shall be conducted initially with cheesecloth affixed to the appliance. The cheesecloth is to cover the areas surrounding all edges of the door so as to cover the intersection between the oven door, door seal, and the portion of the appliance chassis that mates with the door. The cheesecloth is to also cover any other openings leading to the oven cavity. Openings in the outside surface of the appliance that do not lead to the oven cavity need not be covered with cheesecloth. The cheesecloth is to be tightly affixed to the product using adhesive-backed tape or similar means. Care is to be exercised when cheesecloth is located over or near ventilation openings to avoid restricting the normal flow of air to the extent that the results of the test are affected.

104.3 The test room is to be:

a) Of sufficient volume so that smoke generated during the test does not obscure the appliance under test from view, or

b) Provided with an exhaust fan, blower, or vent that removes smoke-laden air from the test room at a rate that allows the appliance under test to be viewed through the observation window and the test results determined. Such ventilation is not to result in negative air pressure within the test room or otherwise affect the results of the test.

104.4 Two oz (56.7 g) of peanut oil are to be placed in a clean broiler pan. The pan is to be placed approximately in the center of the oven. The electrodes are to be located so that the spark-gap is approximately at the level of the top edge of the broiler pan. The oven door is to be closed and the oven is then to be operated continuously in the self-cleaning cycle.

104.5 Periodic attempts are to be made to ignite the gases or vapors that result from thermal decomposition of the peanut oil. Beginning at 316°C (600°F), attempts at ignition are to be made each time the temperature rises 14°C (25°F), or each time 2 – 3 min elapse, whichever occurs first.

104.6 The test described in 104.4 and 104.5 are to be repeated, except that 6 oz (170 g) of butter are to be placed in the broiler pan.

104.7 The test described in 104.4 and 104.5 are to be repeated, except that 8 oz (227 g) of raw beef suet in small pieces are to be scattered across the entire bottom of a clean broiler pan.

105 Emission of Carbon Monoxide

105.1 When tested as described in 105.2 – 105.6, there shall be no emission outside the oven of:

a) Intermittent or continuous flames; or

b) Hazardous levels of carbon monoxide. See 105.2 and 105.6.

105.2 The carbon monoxide level within the test room during the test shall not exceed 0.015 percent (150 ppm) time weighted average for a total of 1 h with a peak concentration not exceeding 0.05 percent (500 ppm).

105.3 For ovens having a volume not exceeding 3.0 ft^3 (0.0850 m^3), 5.0 ft^3 (0.1416 m^3), and 6.0 ft^3 (0.1699 m^3) shall be tested with the amount of beef gravy/vegetable oil shortening mixture as noted in Table 105.1. The beef gravy is to be canned, noncondensed, prepared gravy or the equivalent.

Table 105.1
Conditioning load amounts

Max oven volume	Total beef gravy/ Shortening mixture	Beef gravy amount	Vegetable oil shortening amount
3 cubic feet or 5184 in^3 (0.0850 m^3)	4 oz (113g)	2-4/5 oz (79g)	1-1/5 oz (34g)
5 cubic feet or 8640 in^3 (0.1416 m^3)	5 oz (142g)	3-1/3 oz (95g)	1-2/3 oz (47g)
6 cubic feet or 10368 in^3 (0.1699 m^3)	6 oz (170g)	4-1/4 oz (120g)	1-3/4 oz (50g)

105.4 The beef gravy/vegetable oil shortening mixture is to be applied with a brush to the two side walls and the back wall of the oven. The oven is to be preconditioned for one 3-h bake cycle with the oven set at the maximum temperature. The 3-h period is to be timed while the oven is operating.

105.5 Following the preconditioning described in 105.4, the oven is to be operated continuously in the self-cleaning cycle under the following conditions:

a) Oven door closed.

b) Test room doors and windows closed.

c) Test room fan operating to provide slight air circulation.

d) Test room lights on.

e) Test room carbon monoxide instrumentation operating.

f) Sampling lines positioned 60 in (1.5 m) above the floor in the center of the room for withdrawal of room air samples for carbon monoxide measurements during the test.

g) A smoke eliminator heater that is not electrically interlocked with the oven self-cleaning cycle is not to be energized.

105.6 Periodically during the self-cleaning cycle, the carbon monoxide concentration within the test room and the ambient temperatures in the oven and test room are to be recorded. The carbon monoxide level is to be continuously monitored during the test.

106 Vent Gases and Vapors

106.1 When tested as described in 106.2 – 106.8:

a) There shall not be continuous burning of gases or vapors emitted from the oven vent; and

b) There shall be sufficient emission of smoke or vapor to produce an alarm effect. See 106.2.

106.2 The alarm effect mentioned in 106.1 is the emission of sufficient smoke, gas or vapor during the self-cleaning cycle to be judged visually alarming to the user, or to induce very noticeable irritation to the eyes, or inhalation irritation to any person within the closed test room.

106.3 With reference to 106.1(b), if no alarm effect is obtained during the test, the conditioning load is to be increased until an alarm effect is produced. However, the increased load shall not cause continuous burning as mentioned in 106.1(a).

106.4 For ovens having a volume not exceeding 3.0 ft^3 (0.0850 m^3), 5.0 ft^3 (0.1416 m^3), and 6.0 ft^3 (0.1699 m^3) shall be tested with the amount of beef gravy/vegetable oil shortening mixture as noted in Table 105.1.

106.5 The oven is to be preconditioned for three consecutive baking cycles with the thermostat set at the maximum baking temperature with an amount of beef gravy/shortening mixture as shown in Table 106.1. The mixture shall be applied to the oven walls prior to the first and second baking cycles. The duration of each baking cycle is to be 1-1/2 h, measured from the time the oven is turned on. The oven temperature is to be cooled to 38°C (100°F) or less between each baking cycle by turning the oven off and opening the oven door.

Table 106.1
Preconditioning Load Amounts

Max oven volume	Beef gravy / Shortening mixture
3 cubic feet or 5184 in^3 (0.0850 m^3)	2 oz (59g)
5 cubic feet or 8640 in^3 (0.1416 m^3)	2-1/2 oz (74g)
6 cubic feet or 10368 in^3 (0.1699 m^3)	3 oz (89g)

106.6 Following the preconditioning described in 106.5, the oven is to be operated continuously in the self-cleaning cycle and periodic attempts are to be made to ignite the gases or vapors evolving from the oven vent or smoke diverter. The periodic attempts at ignition are to be made at 14°C (25°F) intervals above 316°C (600°F) or every 2 – 3 min, whichever occurs first.

106.7 The electrodes used to attempt to ignite the vapor are to be as described in 101.1. The electrodes are to be moved to various locations in and around the vent where gases or vapors enter the room.

106.8 If the oven has a smoke eliminator heater not electrically interlocked with the oven self-cleaning cycle, the test is to be conducted with the smoke-eliminator heater element both energized and de-energized.

107 Vertical Cool-Air-Mixing Duct

107.1 When tested as described in 107.2 and 107.3, there shall be no continuous burning of the gases or vapors around or within the vertical duct, and there shall be no evidence of greasy residue on wiring or electrical components within the wiring compartment.

107.2 Electrodes having a spark gap of approximately 1/8 in (3.2 mm) are to be located so that the spark cap is approximately 1/4 in (6.4 mm) below the plane of the open bottom of the vertical duct and in the approximate center of the opening. The electrodes are to be connected to the secondary of a transformer as described in 101.1. The test is to be conducted with the back of the oven in place but having a window installed so that the open bottom of the vertical duct may be observed during the test.

107.3 Eight oz (230 g) of raw beef suet are to be scattered in small pieces across the entire bottom of a clean broiler pan. The pan is to be placed approximately in the center of the oven, the door is to be closed and the oven is then to be operated continuously in the self-cleaning cycle. During the test, periodic attempts at ignition are to be made, beginning at 316°C (600°F), and each time the temperature rises 14°C (25°F) but at not more than 3 min intervals.

108 Self-Cleaning of Removable Companion Oven Panels

108.1 If the appliance is marked or accompanied by instructions that indicate that it can be used to clean removable oven panels from a companion oven, the test described in 108.2 – 108.5 shall be conducted.

108.2 When tested as described in 108.4 – 108.5, self-cleaning of removable companion oven panels:

a) Shall not result in continuous burning of gases or vapors emitted from the oven vent; and

b) Shall result in sufficient emission of smoke or vapor to produce an alarm effect. See 106.2.

108.3 With reference to 108.2(b), if no alarm effect is produced during the test, the conditioning load is to be increased until an alarm effect is produced. However, the increased load shall not cause continuous burning as mentioned in 108.2(a).

108.4 The removable panels of the companion oven are to be preconditioned in the companion oven by operating the oven for three consecutive baking cycles, as described in 106.5, with the mixture described in 106.4 applied to the removable panels.

108.5 After the removable panels have been preconditioned, they are to be placed in the clean self-cleaning oven. The self-cleaning oven is then to be operated continuously in the self-cleaning cycle, and periodic attempts at ignition are to be made as described in 106.6.