

UL 197

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Commercial Electric Cooking Appliances

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety for Commercial Electric Cooking Appliances, UL 197

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Revisions: This Standard contains revisions through and including April 10, 2000.

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The revisions dated January 4, 2000 include a reprinted title page (page1) for this Standard.

The revisions dated April 10, 2000 were issued for editorial corrections. In the set of revisions dated January 4, 2000, an error was introduced by the change of reference from UL 519 to UL 2111, this was corrected with the revisions dated April 10, 2000. Also, these revisions are being issued to correct an incorrect reference to UL 73, the correct reference is UL 2111.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if

the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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The Department of Defense (DoD) has adopted UL 197 on January 28, 1976 . The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

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

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover commercial electric cooking appliances rated 600 volts or less and intended for use in accordance with the National Electrical Code, NFPA-70.

1.2 These requirements cover coffee makers, conductive cookers, food warmers, fryers, griddles, steam kettles, steam cookers, nut warmers, popcorn machines, ranges, utensil warmers, and other appliances usually found in commercial kitchens, restaurants, or other business establishments where food is dispensed.

1.3 These requirements do not cover vending machines, cooking appliances intended for household use, commercial cooking appliances rated more than 600 volts, or microwave cooking appliances.

1.4 An appliance designed so that it can be mounted and supported at an outlet box, such as a food warmer, will be judged on the basis of compliance with the requirements in this standard and with the mounting and weight requirements for electric lighting fixtures.

1.5 An appliance that also utilizes heat produced by a means other than electrical, for example, coal, gas, or oil, is also investigated with respect to such additional risk of fire.

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

1.6 revised April 10, 2000

2 Glossary

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

2.2 CONTINUOUS-DUTY MOTOR – A motor that, under any normal condition of use, can operate unattended and under load for 3 hours or more.

2.3 SAFETY CIRCUIT – A primary or secondary circuit that is relied upon to prevent a risk of fire, electric shock, or injury to persons; for example, an interlock circuit.

2.4 USER SERVICING – Any servicing that might be performed by personnel other than those who are trained to maintain the particular appliance. Some examples of user servicing are:

a) Attaching an accessory by means of an attachment plug and receptacle or by means of other separable connectors.

b) Resetting or replacing any protective device in an appliance, or its receptacle circuit that is likely to be overloaded by the user.

- c) Resetting a circuit breaker or replacing a fuse or a lamp that is accessible without the use of a tool.
- d) Making a routine operating adjustment necessary to adopt the appliance for a different intended function.
- e) Routine cleaning.

3 Components

3.1 Except as indicated in 3.2, a component of a product covered by this standard shall comply with the requirements for that component.

3.1 revised June 2, 1993

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

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

3.2 revised April 10, 2000

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

3.3 revised April 10, 2000

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

3.4 revised April 10, 2000

4 Units Of Measurement

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

4.1 revised April 10, 2000

CONSTRUCTION

5 Accessories

5.1 An appliance having provisions for the use of an electrical accessory intended to be attached in the field shall comply with the requirements in this standard, with or without an accessory installed.

5.2 Installation of an accessory by the user shall be by means of a receptacle and plug-in connector.

5.3 The installation of an accessory by service personnel shall be by means of receptacles, plug-in connectors, insulated wire connectors, or by connection to existing wiring terminals.

5.4 With reference to 5.3, an installation shall not require the cutting of wiring or the soldering of connections by the installer. Installations shall not require cutting, drilling, or welding in electrical enclosures and in other areas where such operations may damage electrical components and wiring within the enclosure.

5.5 A means for strain relief shall be provided for the wiring in the accessory if there is a possibility of transmitting stress to the terminal connections during installation.

5.6 All terminals and wiring intended to be field connected shall be identified on the accessory, on the appliance if connections are made between the accessory and the appliance, and on the wiring diagram.

5.7 The mounting location of the accessory shall be indicated on the appliance.

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

5.8 As part of the investigation, an accessory is to be trial installed to determine that the installation is feasible, the instructions are detailed and correct, and the use of the accessory does not introduce a risk of electric shock, fire, or injury to persons.

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6 Frames And Enclosures

6.1 General

6.1.1 An appliance shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without increasing the 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.

6.1.2 The enclosure of an appliance shall be of a material acceptable for the application and shall house all electrical parts, except a supply cord, that may present a risk of fire, electric shock, or injury to persons under any condition of use. An adjacent wall or adjacent equipment shall not be depended upon to complete an enclosure.

Exception: A panel that completes an enclosure may be omitted if the enclosure will be completed by another appliance in an adjacent or stacked installation. See 45.3.4 and 64.2.

6.1.3 Among the factors taken into consideration when an enclosure is being judged are its:

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

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

6.1.4 The minimum thickness of cast metal shall be in accordance with Table 6.1.

Exception: Thinner metal that has been found to be acceptable when the enclosure is judged by such factors as those mentioned in 6.1.3.

Table 6.1
Minimum acceptable thickness of cast metal

Metal	Minimum thickness, inch (mm)	
	At reinforced surfaces ^a	At unreinforced flat surfaces
Die-cast metal	3/64 (1.2)	5/64 (2.0)
Cast malleable iron	1/16 (1.6)	3/32 (2.4)
Other cast metal	3/32 (2.4)	1/8 (3.2)
^a Includes surfaces that are curved, ribbed, and the like or are otherwise of a shape or size to provide intended mechanical strength.		

6.1.5 In addition to being considered with reference to the factors mentioned in 6.1.3, an enclosure of sheet metal is judged with respect to its size and shape, the thickness of metal and its acceptability for the particular application. The use of sheet steel having a thickness less than 0.026 inch (0.66 mm) if uncoated or 0.029 inch (0.74 mm) if galvanized, or of nonferrous sheet metal having a thickness of less than 0.036 inch (0.91 mm) is not recommended except for a relatively small area or for a surface that is curved or otherwise reinforced.

6.1.5 revised November 4, 1993

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

Exception: Sheet steel not less than 0.026 inch (0.66 mm) thick if uncoated steel or not less than 0.029 inch (0.74 mm) thick if galvanized steel is acceptable if the area surrounding a knockout has a thickness of not less than 0.053 inch (1.35 mm).

6.2 Openings

6.2.1 An opening in the bottom of an appliance shall not be located below an electrical part unless a solid, noncombustible pan complying with Figure 6.1 is interposed between the electrical part and supporting surface. The pan is to have a rim, lip, or other raised edge that is in a horizontal plane and extends all the way around the pan. The bottom of the pan need not be flat or any regular shape and the transmission from the bottom to the rim, lip, and the like may have any convenient shape, but at every point directly below the electrical part, the floor of the pan is to be 1/8 inch (3.2 mm) or more below the plane of the rim, lip, and the like.

Exception No. 1: The requirement does not apply to components on the load side of an automatic switch in a pop-up toaster.

Exception No. 2: The use of a pan of noncombustible material under a motor is not required if:

- a) The motor has no openings below a horizontal plane through the center of the motor;*
- b) The structural parts of the motor or of the appliance provide the equivalent of the described barrier;*

c) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the appliance when the motor is energized under each of the following fault conditions:

1) Open main winding,

2) Open starting winding,

3) Starting switch short-circuited, and

4) For a permanent-split capacitor motor, capacitor short-circuited. The short circuit is to be applied before the motor is energized and the rotor is to be locked;

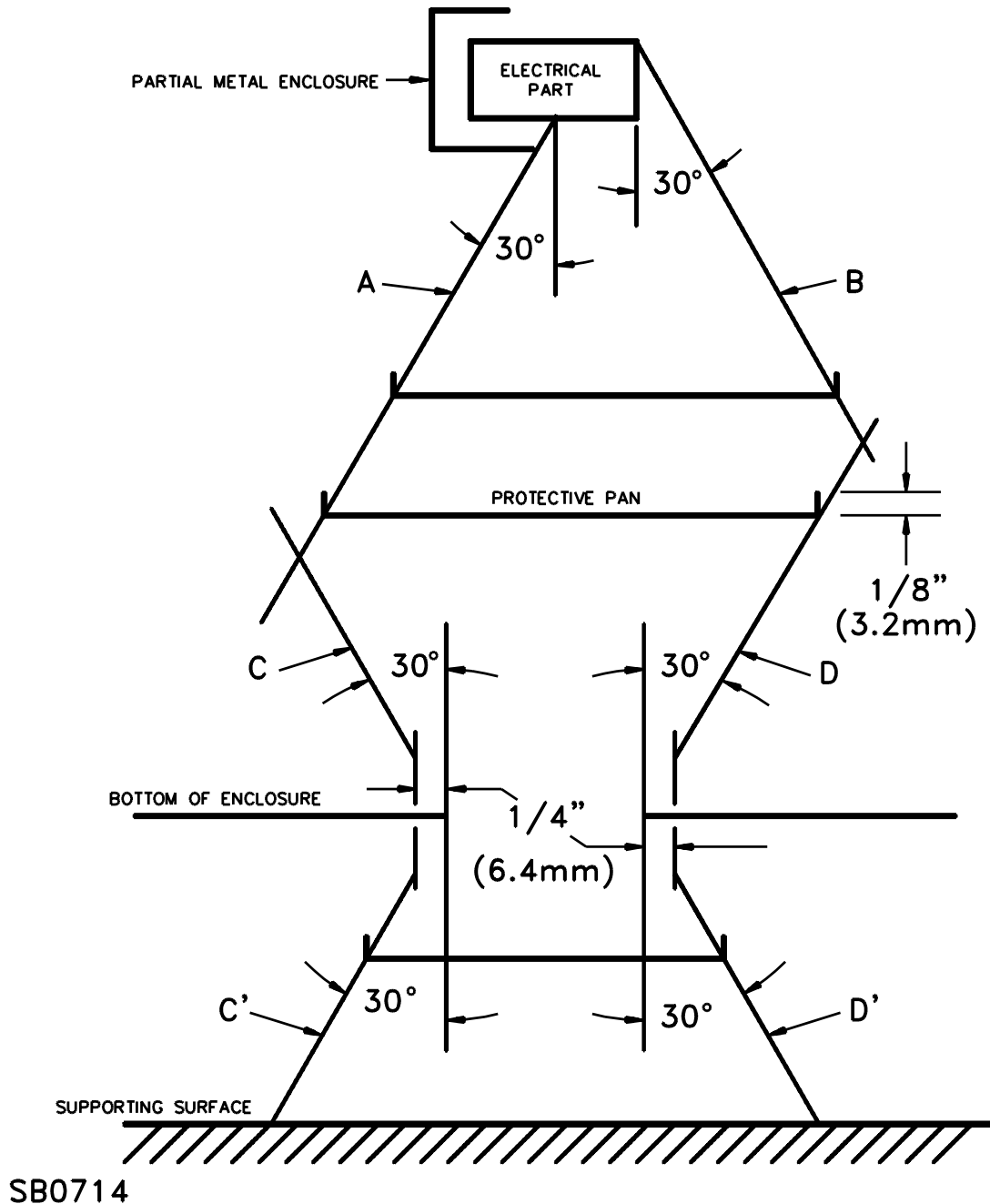
d) The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that will prevent the temperature of the motor windings from exceeding 125°C (257°F) at the maximum load under which the motor will run without causing the protector to cycle and from exceeding 150°C (302°F) with the rotor of the motor locked; or

e) The motor is impedance protected and the locked-rotor temperature of the motor winding is not more than 150°C (302°F) with the appliance otherwise operating as intended.

6.2.1 revised November 4, 1993

Figure 6.1
Minimum extent of baffle for opening in bottom of enclosure

Figure 6.1 revised February 18, 1998



A, B, C and D are projections that define a volume between an electrical part and an opening: C' and D' are projections that define a volume between an opening and the supporting surface. A protective pan in any horizontal plane between the part and the opening in the supporting surface must be larger than the area defined by projections A, B, C, and D, or projections C' and D', respectively. Three samples of protective pans are illustrated in the figure, two are above the opening and one is below it.

6.2.2 The structure of the part or of the appliance may provide the equivalent of the pan described in 6.2.1 if it complies with Figure 6.1. The raised edge may be incorporated in the opening.

6.2.3 An opening in a surface other than the bottom of an enclosure that contains electrical parts shall be provided with a baffle, such as the one illustrated in Figure 6.2, that will prevent the emission of flame, molten metal, burning insulation, or the like.

Exception: A baffle may be omitted from an enclosure that contains electrical parts other than an overcurrent-protective device such as a fuse or circuit breaker provided:

- a) The structure of the part provides the equivalent of a baffle,*
- b) The distance from the electrical part to the plane of the enclosure is greater than 12 inches (305 mm), or*
- c) No ventilating opening in a vertical wall is more than 3/8 inch (9.5 mm) wide, and the total area of such openings located less than 12 inches from the floor in any 1-foot-square area of the enclosure does not exceed 8 square inches (52 cm²).*

6.2.4 An opening in the side of an enclosure shall be so located and of such size that entry of foreign objects likely to create a risk of fire or electric shock is prevented and contact with internal parts by persons is prevented. See Accessibility of Live Parts, Section 7 and Enclosures and Guards, Section 31. Louvers may be used if shaped to deflect external falling objects outward. See Figure 6.3.

6.2.5 No opening or joint in the enclosure of an appliance shall be located where spillage from the cooking operation can enter the enclosure and affect the internal wiring or any other electrical component. A removable part, such as a grease pan, shall not be depended upon to provide such protection.

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Figure 6.2
Relationship of baffle and electrical part to prevent emission

Figure 6.2 revised February 18, 1998

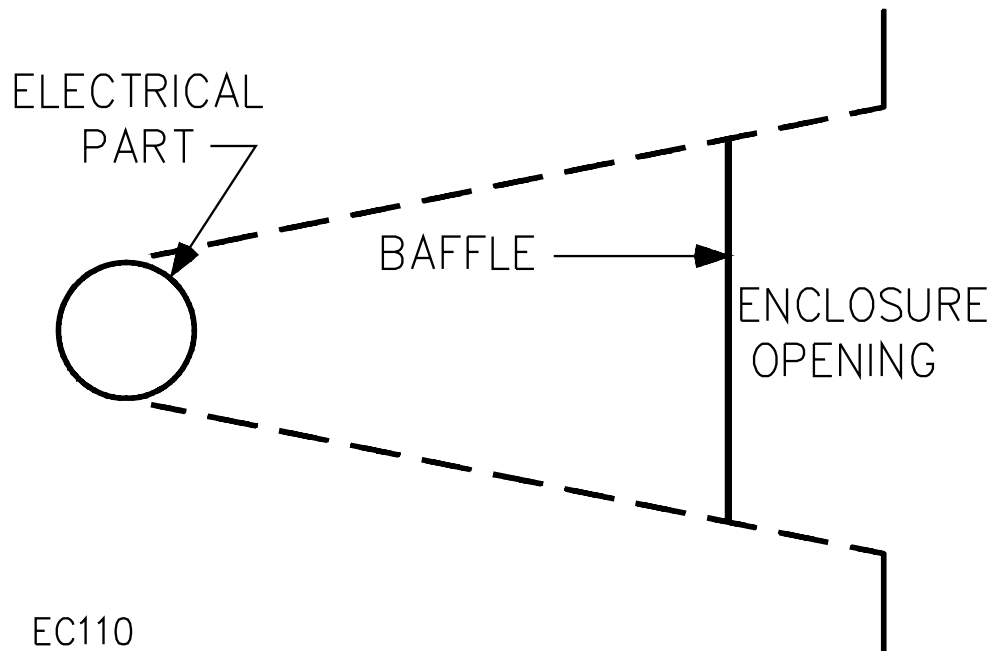
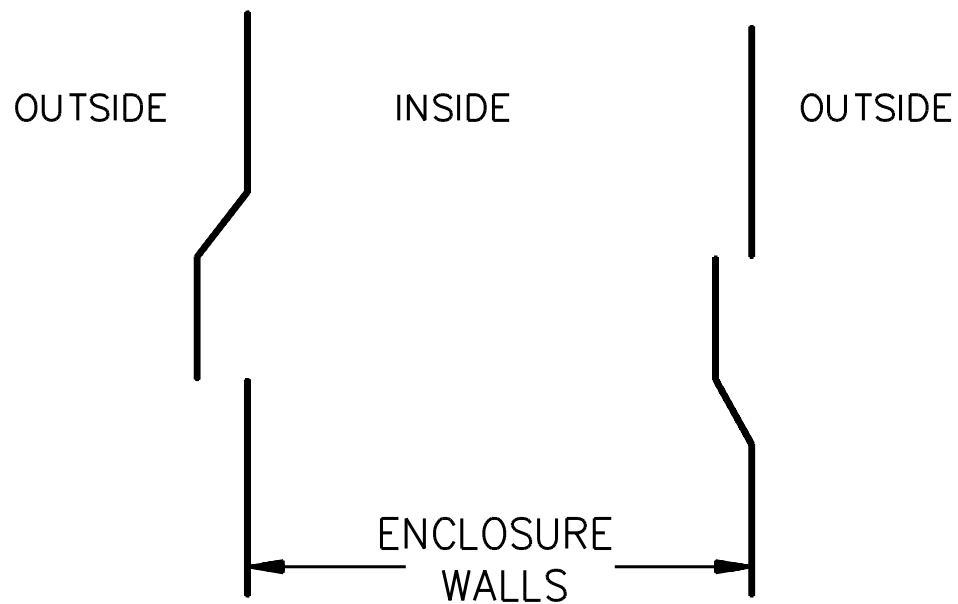


Figure 6.3
Louver designs

Figure 6.3 revised February 18, 1998



6.3 Grease troughs and pans

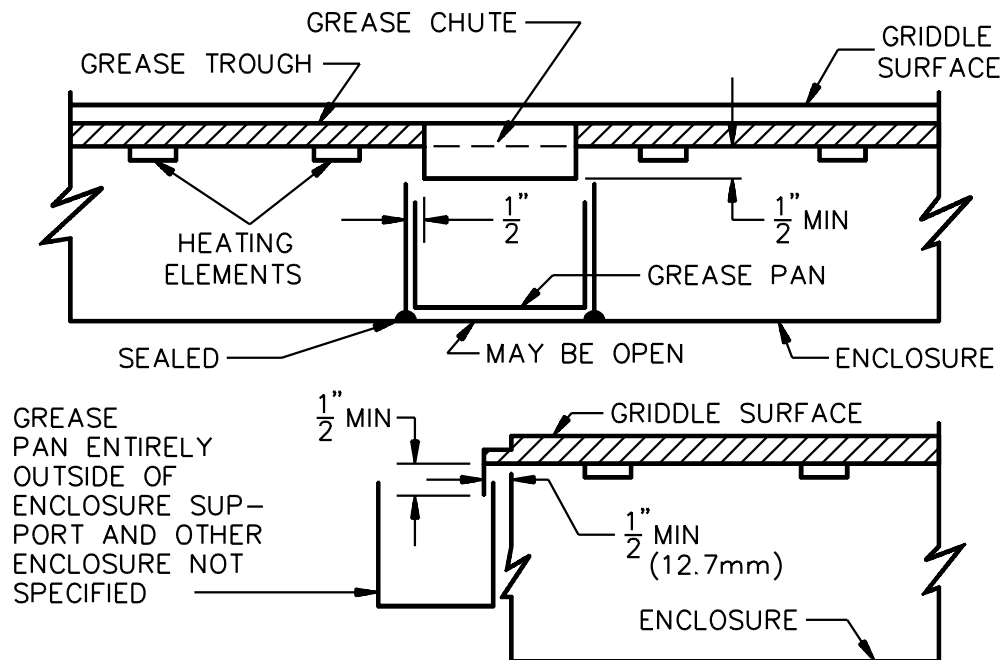
6.3.1 An appliance shall be constructed so that grease spillage is not likely to enter the enclosure and contact live parts or wiring.

6.3.2 An appliance, such as a grill, that has a flat, unenclosed cooking surface and that is intended to be used with grease or oil in the usual cooking operation shall be provided with a trough, grease-collecting pan, or the equivalent to reduce the likelihood of the accumulation of grease on walls, counters, and other nearby surfaces when the appliance is operated.

6.3.3 An opening in the trough of a griddle for drainage to a grease pan or receptacle shall have a drip edge at least 1/2 inch (12.7 mm) long. The opening for the pan or receptacle shall be enclosed on all sides to minimize entrance of grease to the interior of the appliance. Figure 6.4 illustrates some acceptable construction.

Figure 6.4
Grease chutes for griddles

Figure 6.4 revised February 18, 1998



SB0717

7 Accessibility Of Live Parts

7.1 General

7.1.1 The electrical parts of an appliance shall be located or enclosed so that persons are protected against unintentional contact with uninsulated live parts involving a risk of electric shock.

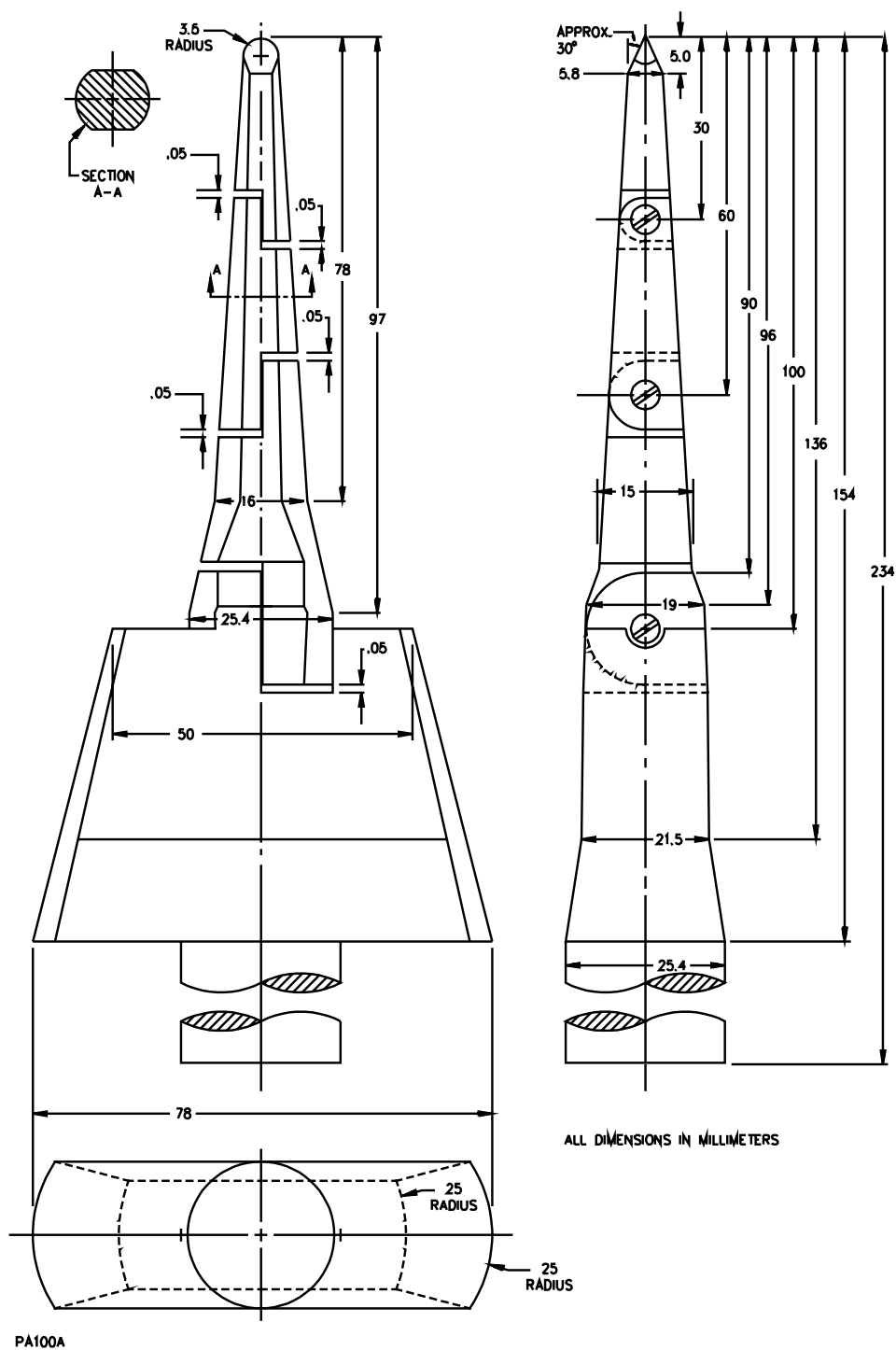
7.1.2 The risk of electric shock is considered to exist if the available open-circuit potential is more than 42.4 volts peak, and the available current through a 1500-ohm resistance is more than 5 milliamperes.

7.1.3 The following are not considered to be uninsulated live parts: a coil of a controller, a relay, a solenoid, and a transformer, if they are provided with insulating overwraps at least 1/32 inch (0.8 mm) thick; enclosed motor windings; insulated terminals and splices; and insulated wire.

7.1.4 An uninsulated live part, such as a terminal bus bar, and the like, but not including enameled wire, shall not be less than 1 inch (25.4 mm) from any opening in the enclosure of an appliance.

7.1.5 An opening that will not permit the entrance of a 3/4-inch (19.0 mm) diameter rod is acceptable, except as noted in 7.1.4, if a probe as illustrated in Figure 7.1 cannot be made to touch any uninsulated live part or enameled wire when inserted into the opening.

Figure 7.1
Accessibility probe



7.1.6 An opening that will permit entrance of 3/4-inch (19.0-mm) diameter rod is acceptable if there are no uninsulated live parts:

- a) Less than X inches (mm) from the perimeter of the opening, and
- b) Within the volume generated by projecting the perimeter X inches (mm) normal to its plane – X equals five times the diameter of the largest diameter rod that can be inserted through the opening, but not less than 4 inches (102 mm). See Figure 7.2.

7.1.7 An uninsulated live part shall not be located behind an opening that may be used to make an adjustment considered to be a function of user servicing if a 1/8-inch (3.2-mm) diameter straight rod can be made to touch the part when the rod is inserted through the opening and moved to all positions possible without producing an angle of more than 30 degrees between the rod and the line drawn between the center of the opening and the center of the face of the adjusting mechanism. The length of the rod beyond the opening is not to exceed the distance between the opening and the face of the adjusting mechanism by more than 3 inches (76 mm). See Figure 7.3.

Figure 7.2
Opening in enclosure
Proportions Exaggerated for Clarity
Figure 7.2 revised February 8, 1998

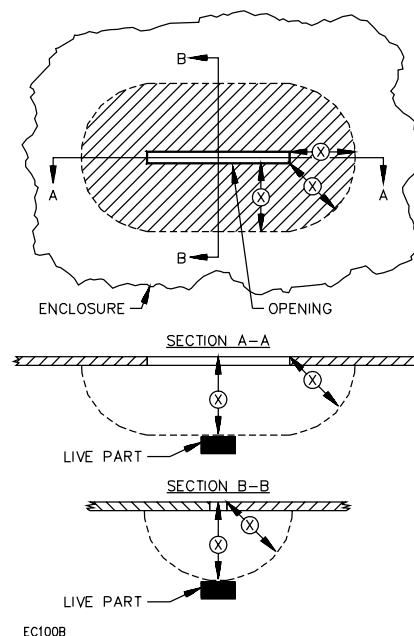
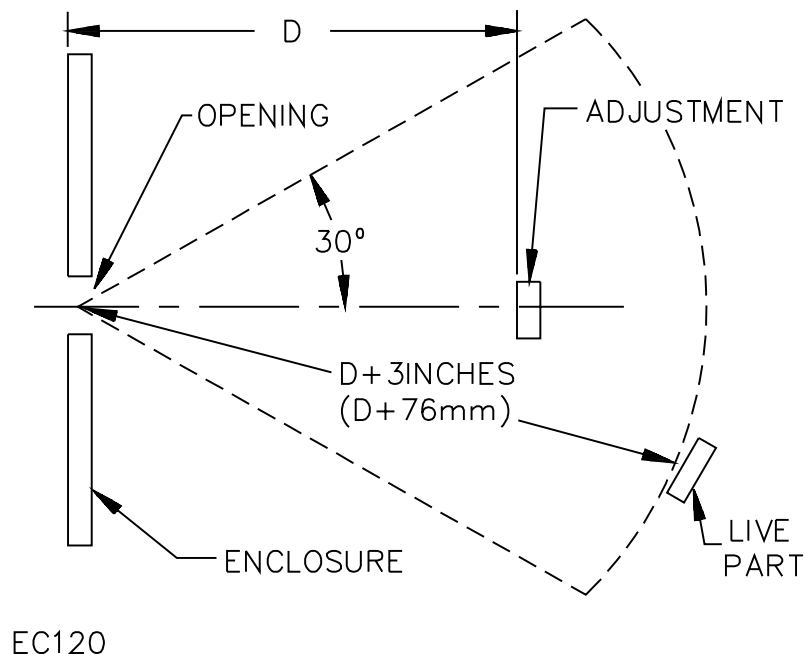


Figure 7.3
Accessibility of live part through adjustment opening



EC120

7.1.8 During the examination of an appliance in connection with the requirements in 7.1.5 – 7.1.7, a part of the outer enclosure that may be removed without the use of tools, or that must be opened or removed for user servicing, is to be disregarded – that is, it will not be assumed that the part in question affords protection against the risk of electric shock. A warning marking such as that specified in 62.13 is not considered to reduce the risk of electric shock.

Exception: The cover of a compartment that does not enclose user-serviceable parts and that is retained in the closed position by means of a keyed lock is to be retained in place while examining the appliance in accordance with 7.1.5 – 7.1.7 if the marking specified in 61.16 is on or adjacent to the cover.

7.1.9 A cover or enclosure of an open-wire element shall not be perforated or otherwise constructed so that complete protection against contact with the element is not provided.

7.1.10 A lamp, a quartz-enclosed heating element, or a similar component shall be installed or guarded so that it is not likely to be broken unintentionally by utensils, such as pans or trays, inserted in an oven or similar compartment.

7.1.11 Except as indicated in 7.1.12, the surface of a component as mentioned in 7.1.10 shall not be contacted when a 3/4-inch (19-mm) diameter rod, 3 inches (76 mm) long and supported vertically, is moved in any direction in a horizontally plane.

7.1.12 If more than one-half of the cylindrical or spherical surface of a lamp is recessed above the plane of the top of a compartment, the remaining lamp surface may be unguarded if no portion projects more than 3/4 inch (19 mm) below the top.

7.1.13 A lens, a shield, or a shade employed as the guard required by 7.1.10 shall not be supported by a lamp, a quartz-enclosed heating element, or a similar component, and shall be made of material that will not be adversely affected by the temperature encountered in normal operation.

7.1.14 The strength of a guard required by 7.1.10 is to be determined by a ball-impact test conducted with a smooth steel sphere having a diameter of 2 inches (50.8 mm) and weighing 1.18 pounds (535 g). If the component being tested can be struck from above, the sphere is to be allowed to fall vertically from rest to strike the component. Otherwise, the sphere is to be suspended by a cord and is to be allowed to fall from rest as a pendulum to strike the component. In either case, the vertical travel of the sphere is to be 51 inches (1.30 m).

7.1.15 A lamp, a quartz-enclosed heating element, or a similar component in a radiant-heat food warmer shall be recessed so that no part of the component extends below the guard or shade.

7.1.16 A lampholder – including one for a quartz-enclosed heating element – a fuseholder, and a circuit breaker shall be located so that a person replacing the lamp or fuse or resetting the circuit breaker cannot unintentionally touch an uninsulated live part.

7.1.17 The requirement in 7.1.16 does not apply to the screw shell or center contact of a screw shell lampholder or a fuseholder or to the clips of a fuseholder or a quartz-enclosed heating element that is associated with the component being replaced. See 62.13.

7.1.18 A fuseholder or a circuit breaker shall not be accessible from outside the appliance without opening a door or a cover.

Exception: The operating handle of a circuit breaker or the insulating cap of an extractor-type fuseholder may project outside the enclosure.

7.1.19 An appliance shall be designed so that fuses can be replaced and manually reset devices reset without removing an enclosure part other than a service cover or panel.

7.1.20 A cover for a compartment that encloses a fuse in a circuit that involves a risk of electric shock – see 7.1.2 – shall be retained in place by hinging, pivoting, sliding, or equivalent means.

7.1.21 The requirements in 7.1.19 and 7.1.20 do not apply to the cap of an extractor type fuseholder or to a cover that covers such a fuseholder cap.

7.1.21 revised January 4, 2000

7.1.22 A cover for a manually reset overload-protective device shall be retained in place by hinging, pivoting, sliding, or equivalent means if it is necessary to open the cover to reset the device and if such opening results in access to live parts. A cover retained by a chain is not considered an equivalent means.

7.1.23 A cover that is required to be hinged shall be provided with a spring latch or catch, spring hinge, or an equivalent means that does not require the use of a tool to hold it closed.

7.1.24 A door or cover giving direct access to a fuse shall shut closely against a 1/4-inch (6.4-mm) rabbet or the equivalent, or shall have either:

- a) Turned flanges for the full length of four edges, or
- b) Angle strips fastened to it.

A flange or an angle strip shall fit closely with the outside of the wall of the box proper and shall overlap the edges of the box not less than 1/2 inch (12.7 mm). A combination of flange and rabbet or other construction that provides equivalent protection is acceptable.

Exception: A door or cover that gives access to a fuse located in a secondary circuit that is not a safety circuit and is supplied from a Class 2 transformer.

7.1.25 A strip used to provide a rabbet and an angle strip fastened to the edges of a door shall be secured:

- a) At not less than two points,
- b) Not more than 1-1/2 inches (38.1 mm) from each end of each strip, and
- c) At points between these end fastenings not more than 6 inches (152 mm) apart.

7.2 Protection of service personnel

7.2.1 An uninsulated live part involving a risk of electric shock and a moving part within the enclosure that involves a risk of injury to persons shall be located, guarded, or enclosed to prevent unintentional contact by service personnel performing mechanical service functions that may have to be performed with the equipment energized.

7.2.1 revised November 4, 1993

7.2.2 Mechanical service functions that may have to be performed with the equipment energized include: adjusting a water-control valve; adjusting the setting of a temperature or a pressure control with or without marked dial settings; resetting a control trip mechanism; operating a manual switch; adjusting an air-flow damper. A factory-set-and-sealed control is not considered to be adjustable.

7.2.3 The requirements in 7.2.1 are not applicable to mechanical service functions that are not usually performed with the equipment energized. Such functions include opening a drain plug, adjusting or replacing a drive belt, and the like.

7.2.4 An adjustable or resettable electrical control or a manual switching device may be located or oriented with respect to uninsulated live parts so that manipulation of the mechanism for adjustment, resetting, or operation can be accomplished in the usual direction of access if uninsulated live parts or moving parts involving a risk of electric shock or injury to persons are:

- a) Not located in front – in the direction of access – of the mechanism, and
- b) Not located within 6 inches (152 mm) on any side or behind the mechanism, unless guarded.

7.2.5 An electrical control component that may require examination, adjustment, servicing, or maintenance while energized, not including measuring voltage, shall be located and mounted with respect to other components and with respect to grounded metal parts so that it is accessible for electrical service functions without subjecting the serviceman to the likelihood of electric shock from adjacent uninsulated live parts or to a risk of injury to persons from adjacent moving parts. See 7.2.9.

7.2.6 Accessibility and protection against the risk of electric shock and injury to persons may be obtained by mounting the control components in an assembly so that unimpeded access to each component is provided through an access cover or a panel in the outer cabinet and the cover of the control assembly enclosure by the following arrangement. See Figure 7.4.

- a) The components are located so that the farthest component in the assembly is not more than 15 inches (381 mm) from the plane of the access opening in the outer cabinet.
- b) Uninsulated live parts outside the control assembly projected clear space – except live parts within a control panel – and unguarded moving parts involving a risk of casualty are located not closer than 6 inches (152 mm) from any side of the access area. The projected clear space is considered to be bounded on the sides by the projection of the smallest rectangular perimeter surrounding the outside edge of the components or the control enclosure when provided. The access area is considered to be bounded on the sides by the projection of the smallest rectangular perimeter surrounding the outside edge of the components or the control enclosure when provided. The access area is considered to be bounded on the sides by the projection of the perimeter of the access opening in the outer cabinet to the closest rectangular perimeter surrounding the outside edge of the component or the control enclosure.
- c) The volume generated by the projected clear space of the control assembly to the access opening in the outer cabinet – within the access area – is completely free of obstructions, including wiring.
- d) Access to the components in the control assembly is not impeded in the direction of access by other components or by wiring in this assembly.
- e) Extractor-type fuseholders and snap switches mounted through the control assembly enclosure are located so that there is unimpeded access to these components through the access opening in the outer cabinet and they are not immediately adjacent to unguarded uninsulated live parts outside the control assembly enclosure. See 7.2.4.

7.2.7 Component or control assemblies that may be rotated or otherwise displaced for service may also be acceptable if the electrical control components are accessible for service as indicated in 7.2.5.

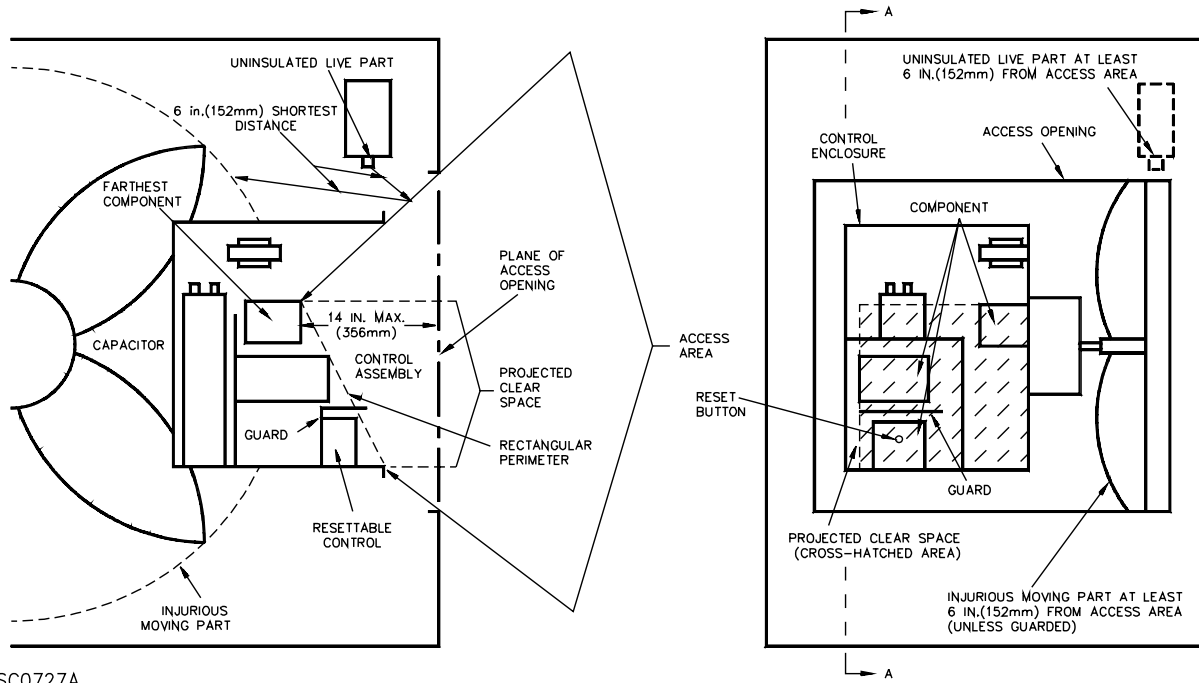
7.2.8 Other arrangements of components or guarding are also acceptable if electrical control components are accessible for service as indicated in 7.2.5.

7.2.9 The electrical components referred to in 7.2.5 – 7.2.8 include: fuses, adjustable or resettable overload relays, manual or magnetic motor controllers, magnetically operated relays, adjustable or resettable pressure or temperature controllers, manual switching devices, and clock timers. Such components in a low-voltage circuit are to comply with the requirements in 7.2.5 with respect to:

- a) Uninsulated live parts in a line-voltage circuit and
- b) Moving parts involving a risk of injury to persons.

Figure 7.4
Accessibility and protection

Figure 7.4 revised February 18, 1998



SC0727A

7.2.10 Electrical components in an appliance shall be located so that access for servicing or replacement will not be unduly restricted. It shall not be necessary to remove one electrical part in order to service or replace another.

8 Protection Against Corrosion

8.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means if corrosion of such parts could result in the risk of fire, electric shock, or injury to persons.

Exception No. 1: Surfaces of sheet steel and cast iron parts within an enclosure if the oxidation of iron or steel due to the exposure of the metal to air and moisture is not likely to be appreciable – thickness of metal and temperature also being factors.

Exception No. 2: Bearings, laminations, or minor parts of iron or steel, such as washers, screws, and the like.

Exception No. 3: A sheath of a heating element of other than an immersion-type heater.

9 Mechanical Assembly

9.1 General

9.1.1 An appliance shall be assembled so that it will not be adversely affected by a vibration of normal operation.

9.1.2 A switch, a fuseholder, a lampholder, an attachment-plug receptacle, a motor-attachment plug, or other component that is handled by the user shall be mounted securely and shall be prevented from turning.

Exception: A switch, that meets all four of the following conditions:

- a) The switch is of a plunger, slide, 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 operation of the switch.*
- b) The means of mounting the switch makes it unlikely that operation of the switch will loosen the switch.*
- c) Spacings are not reduced below the minimum acceptable values if the switch rotates.*
- d) Operation of the switch is by mechanical means rather than by direct contact by persons.*

9.1.3 The means to prevent turning required by 9.1.2 is to consist of more than friction between surfaces – for example, a lock washer, properly applied, is acceptable as the means to prevent turning of a device having a single-hole mounting means.

9.1.4 Uninsulated live parts shall be secured to the base or surface so that they will be prevented from turning or shifting in position if such motion may result in a reduction of spacing below the minimum values specified in Spacings, Section 28.

9.2 Shipping

9.2.1 An appliance shall be completely assembled when it leaves the factory.

Exception No. 1: Minor parts, such as handles, decorative trim, pans, trays, splash panels, and the like that are not necessary to prevent a risk of fire, electric shock, or injury to persons during operation of the appliance need not be assembled.

Exception No. 2: A cord set, a heating element with integral blades for plugging into a receptacle, a heating element intended for use in a radiant-heat food warmer, and the legs or the mounting brackets of an appliance – see 63.2 – may be shipped detached from the remainder of the appliance if packed in the same overall carton or if the separate cartons are secured together – such as by steel strapping or strong tape – so that they are not likely to become separated during the shipment.

Exception No. 3: A screw shell heat lamp need not be supplied or shipped with an appliance.

Exception No. 4: A part, as described in (a) or (b), of an appliance marked in accordance with 62.2 and 64.1 need not be completely assembled when shipped, or shipped in the same carton, or shipped in cartons secured together.

a) A panel that completes an enclosure the absence of which would be completely by another appliance in an adjacent or stacked installation. See 45.3.4 and 64.2.

b) An electrical subassembly that does not incorporate an automatic control that is affected, such as by temperature, by the remainder of the appliance, if:

1) Interconnecting leads and wiring are housed entirely within the appliance – see 15.3.1 – 15.3.6 – and the electrical connections are made with integral plugs and receptacles arranged so that no uninsulated live part capable of causing electric shock is accessible to unintentional contact when the subassembly is not in place; or

2) Internal connection of a permanently connected appliance are made in accordance with the requirements for power-supply connections in 10.1 – 10.3 and 62.7, and field-installed leads are housed entirely within the appliance.

3) External connections of a cord-connected appliance are made by a connecting cord, of a type specified in 10.5.1, with integral plugs and receptacles arranged so that no uninsulated live part capable of causing electric shock is accessible to unintentional contact if disconnected; or

4) External connections of a permanently connected appliance are made in armored cable or conduit in accordance with the requirements for power-supply connections in 10.1 – 10.4. See 62.7. If armored cable or conduit is permanently attached to one part of the appliance and stranded leads are installed, the lead ends are to be finished as described in 15.4.6. Solid wire leads need no additional end treatment. The armored cable will be provided with the appropriate connector and antishort bushing. The requirements in this clause are not intended to preclude the use of an external interconnecting cord of a type specified in 10.5.1 if flexible cord is needed for the prevention of transmission of noise or vibration or for facilitating the removal of a part of the appliance for maintenance or repair.

Exception No. 5: A device intended to be mounted separately from a permanently connected appliance, such as a contactor actuated by an automatic control that is part of the appliance, need not be assembled to or shipped with the appliance if marked in accordance with 62.2.

9.2.1 revised November 4, 1993