



UL 197

STANDARD FOR SAFETY

Commercial Electric Cooking Appliances

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Tenth Edition, Dated March 17, 2010

Summary of Topics

This revision to ANSI/UL 197 dated April 7, 2023 includes the addition of UL 62368-1 as an alternative to UL 60950-1; [28.3.3](#), [Table 34.1](#), [34.3.1](#) and [34.8.1](#).

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 revised requirements are substantially in accordance with Proposal(s) on this subject dated March 3, 2023.

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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.

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 ULSE's Collaborative Standards Development System (CSDS) at <https://csds.ul.com>

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Appendix A

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PART 1 – ALL APPLIANCES

INTRODUCTION

1 Scope

1.1 These requirements cover commercial electric cooking appliances rated 600 volts or less, intended for indoor use, 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 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, is 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 utilizes heat produced by a means other than electrical (for example, gelled or liquid fuel, coal, gas, or oil) is also investigated with respect to the additional risk of fire.

1.6 An appliance that utilizes heat produced by gelled or liquid fuel is also investigated with the appliance operating with the specific fuel(s) which it intended to be used.

1.7 Commercial cooking equipment employing integral systems for limiting the emission of grease laden air are intended to be installed in accordance with the Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, NFPA 96, and shall comply with the requirements of this Standard. Additionally, the effluent emitted from the system shall not exceed 5 mg/m^3 as measured in accordance with the U. S. Environmental Protection Agency (EPA) Test Method 202, Determination of Condensable Particulate Emissions From Stationary Sources.

1.8 Commercial cooking equipment employing integral recirculating systems shall comply with the requirements of this Standard and the requirements in the Standard for Recirculating Systems, UL 710B.

2 Glossary

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

2.2 ACCESSIBLE – Able to be contacted by an accessibility probe.

2.3 APPLIANCE – Utilization equipment that uses electrical energy for some function.

2.4 AUTOMATICALLY CONTROLLED APPLIANCE – An appliance is determined to be automatically controlled when:

a) The repeated starting of the appliance, beyond one complete predetermined cycle of operation to the point where some form of limit switch opens the circuit, is independent of any manual control;

b) During any single predetermined cycle of operation, the motor is caused to stop and restart one or more times;

c) Upon energizing the appliance, the initial starting of the motor is capable of being intentionally delayed beyond normal, conventional starting; or

d) During any predetermined cycle of operation, automatic changing of the mechanical load reduces the motor speed sufficiently to re-establish starting-winding connection to the supply circuit.

2.5 AUXILIARY CONTROL – A device that is not relied upon to prevent a risk of fire, electric shock, or injury to persons, and does not function to regulate the temperature of the appliance under intended conditions of use.

2.6 CIRCUITS

AUXILIARY – A fire-extinguishing system for the purpose of interrupting the coil circuit of the contactor used to control the source of heat in the appliance. Connection within the appliance is provided by auxiliary circuit terminals (See Section 29, Auxiliary Circuit Terminals).

BRANCH – The circuit conductors between the final overcurrent device protecting the circuit or appliance and the appliance.

SAFETY – The portion of 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.

2.7 CLEANING – A routine task performed by the user on accessible surfaces of the appliance to maintain sanitary conditions.

2.7.1 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.

2.8 CONTINUOUS DUTY – A requirement of service which demands operation at a substantially constant load for a period of at least 3 hours.

2.9 CONTROL CIRCUIT – A circuit that carries electrical signals directing the performance of a controller which, in turn, governs power delivered to a motor or other load within the appliance. A control circuit does not carry main power current.

2.10 CONTROL CIRCUIT, TAPPED HIGH-VOLTAGE – A control circuit that is tapped within the appliance from the load side of the overcurrent device for the controlled load.

2.11 DUTY CYCLE – A requirement of service that accounts for the intended use of an appliance at an intermittent load for a limited time, either by the user or by a timer.

2.12 EQUIPMENT

FIXED – An appliance that is intended to be fastened in place or located in a dedicated space and is permanently wired to the branch circuit.

PORTABLE – An appliance that is:

- a) Cord-connected;
- b) Intended to be transported for use at various locations; and

c) Designed to be carried by hand or provided with integral casters, wheels, and the like, or a cart to make it mobile.

STATIONARY – A cord-connected appliance that is intended to be fastened in place or located in a dedicated space.

2.13 EXPOSED – Visible but not necessarily able to be contacted by an accessibility probe.

2.14 FIELD-WIRING TERMINAL – A terminal to which a supply or other wire can be connected by an installer in the field.

2.15 LEAKAGE CURRENT – Electric current which flows through a person upon contact between accessible parts of an appliance and:

a) Ground; or

b) Other accessible parts of the appliance.

2.16 MEASUREMENT INDICATION UNIT (MIU) – The output voltage across the meter, in milli-volts RMS, in the measurement instrument in [Figure 46.2](#), divided by 500 ohms. (The instrument indication is equal to the RMS value in milli-amperes when the frequency is 60 Hz (sinusoidal current). The reading may not be a direct indication of the RMS or other common amplitude quantifier of leakage current when the leakage current is of complex waveform or frequency other than 50 or 60 Hz.)

2.17 NONCOMBUSTIBLE MATERIAL – Material that is not capable of being ignited and burned, such as material consisting entirely of, or a combination of, steel, iron, brick, tile, concrete, slate, glass, or plaster.

2.18 OIL OR GREASE FRYING APPLIANCE – An appliance in which oil or grease is placed in a reservoir that is heated as part of the cooking operation.

2.19 PANELBOARD – A single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent devices, and equipped with or without switches for the control of electric circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition of an appliance and accessible only from the front. Examples of a panelboard range from a 200 amp service panel to a 6x6x4 steel control box with permanent or DIN rail mounted components.

2.20 POLLUTION DEGREES

POLLUTION DEGREE 1 – No pollution or only dry, nonconductive pollution occurs. The pollution has no influence.

POLLUTION DEGREE 2 – Normally, only nonconductive pollution occurs; however, temporary conductivity caused by condensation may be expected.

POLLUTION DEGREE 3 – Conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

2.21 PRESSURE VESSEL – A closed tube or cavity in which air, liquid, or gas is stored.

2.22 PRESSURE VESSEL, FIRED – A pressure vessel in which air, liquid, or gas is heated; steam is generated; steam is super heated; or any combination thereof, under pressure or vacuum by the direct application of heat. In the case of an electrically heated vessel, if the heat source is internal to the vessel (for example, an immersion heating element) this constitutes the direct application of heat; however, if the heat source is external to the vessel, such as an external heating element or an external induction heat

source, this does not constitute the direct application of heat. A vessel heated solely by an external electric source is not a fired pressure vessel.

2.23 PRESSURE VESSEL, UNFIRED – A pressure vessel in which air, liquid, or gas is subjected to pressure or vacuum from an external source, without the direct application of heat (see [2.22](#), PRESSURE VESSEL, FIRED, for further clarification).

2.24 REMOTELY CONTROLLED APPLIANCE – An appliance that is out of sight of an operator who is at the starting device.

2.25 SHEATHED HEATING ELEMENT – A metal enclosure surrounding and containing a resistance element that is usually encased in magnesium oxide or a similar insulating material.

2.26 SERVICE EQUIPMENT – The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cutoff of the supply.

2.27 SIGNAL CIRCUITRY – Circuitry used for signaling purposes that controls no loads other than the control contacts of a switching device or devices.

2.28 SUPPLY CONDUCTORS – Conductors used to supply power to an appliance or other equipment. An equipment grounding conductor does not supply power and is not considered to be a supply conductor.

GROUNDING SUPPLY CONDUCTOR – A supply conductor that is conductively connected to ground through a connection at the service equipment, or at another location as specified by the National Electrical Code, ANSI/NFPA 70, and is therefore nominally at zero volts potential to ground. Also known as the "neutral" conductor or the "identified" conductor.

UNGROUNDING SUPPLY CONDUCTOR – A supply conductor that is not intended to be conductively connected to ground, except through an appliance or other load.

2.29 TEMPERATURE LIMITING CONTROL – A control that functions only under conditions that produce abnormal temperatures. The malfunction of such a control results in a risk of fire or electric shock.

2.30 TEMPERATURE REGULATING CONTROL – A control that functions to regulate the temperature of the appliance under intended conditions of use, and whose malfunction does not result in a risk of fire or electric shock.

2.31 TIMER

SINGLE TIME – A device that controls one complete operating cycle of the appliance and which requires the user to reinitiate.

REPETITIVE CYCLING – A device which controls complete, repetitive operating cycles of the appliance.

2.32 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, unless a tool is required to gain access to the device and the cover is marked in accordance with [86.13](#).
- c) Resetting a circuit breaker, or replacing a fuse or lamp that is accessible without the use of a tool;
- d) Making a routine operating adjustment necessary to adapt the appliance for a different intended function; and
- e) Routine cleaning.

2.33 WORKING PRESSURE – The maximum system pressure of an appliance measured during normal operating conditions. When more than one pressurized system is provided in an appliance, the appliance is capable of having multiple working pressures.

3 Components

Section 3 deleted

4 Units of Measurement

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

5 Undated References

5.1 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

5A General

5A.1.1 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;
- d) Additionally comply with the applicable requirements of this end product Standard; and
- e) Not contain mercury, unless used within a fluorescent, high intensity discharge, or neon lamp bulb.

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.

5A.1.2 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.

5A.1.3 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 [5A.1.1](#) (b) – (e).

5A.1.4 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.

5A.2 Ground-fault, arc-fault, and leakage current detectors/interrupters

5A.2.1 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."

5A.2.2 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.

5A.2.3 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.

5A.2.4 Arc-fault circuit-interrupters (AFCI) shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

5A.2.5 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.

5A.2.6 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 inches (102 mm) of the attachment plug.

5A.2.7 Arc fault detection testing shall include the applicable tests required for cord-type arc-fault circuit-interrupters, as in the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

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

5A.3 Surge protective device

5A.3.1 A device providing surge protection or transient suppression shall comply with the Standard for Surge Protective Devices, UL 1449.

5A.4 Terminal blocks

5A.4.1 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059. If used for field-wiring, a terminal block shall also be suitably rated for field-wiring. Field-wiring terminals shall also comply with [16.3](#), of UL 197.

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 Electrical Supply Connections for Permanently Connected Appliances, Section [16](#) (if used for Field-Wiring); Current-Carrying Parts, Section [20](#); Electrical Insulation, Section [24](#); and Electrical Spacings, Section [37](#), of this end product Standard.

5A.5 Quick-connects

5A.5.1 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 also be rated for the voltage and temperature of the intended use. They shall be applied per the installation instructions of the wire connector manufacturer.

5A.5.2 Quick-connect type wire connectors shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310.

5A.6 Insulating tape and tubing

5A.6.1 When relied upon to comply with requirements in this Standard:

- a) Insulating tape shall comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510; and
- b) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

5A.7 Programmable controllers

5A.7.1 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.) additional 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.

5A.8 Fabricated polymeric parts

5A.8.1 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, meet this requirement.

5A.9 Door latch release

5A.9.1 Unless provided with other means of exit, door(s) intended for entrance of persons into the heated compartment of an appliance; including a door panel assembly door, shall be able to be opened from the inside by a force applied outwardly to the door or to a release actuator. Doors shall comply with the Door Opening Test, [65B](#). In addition, doors with an interior latch release device shall comply with the Door Latch Release Test, [65A](#).

5A.9.2 If the door is provided with a key lock, it shall be constructed such that the lock can be opened from the interior without using a key or tool.

5A.9.3 Interior latch release actuators shall function with the appliance in its intended operating position and shall be operable from all spaces that are directly accessible when the door(s) is opened.

5A.9.4 A latch release device shall not depend on an electrical source for operation.

5A.9.5 A latch release device shall be constructed so that spillage of foods, or cleaning in accordance with the manufacturer's recommendations will not affect compliance with the requirements of the Door Latch Release Test, Section [65A](#).

6 Accessories

6.1 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 the accessory installed.

6.2 An appliance having provisions for the use of gelled or liquid fuel shall comply with the requirements in the Standard for Unvented Alcohol Fuel Burning Decorative Heating Appliances, UL 1370, and the requirements in this Standard, with or without the gelled or liquid fuel in place.

6.3 An appliance having provisions for the use of gelled or liquid fuel shall be provided with a means for maintaining the fuel container in a dedicated fixed location on the appliance such that it cannot be moved or relocated from the factory-assembled position.

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

6.5 When an accessory is to be installed by the user, the appliance shall comply with the requirements in Section [10](#), Accessibility of Live Parts, during and after the installation of the accessory.

6.6 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.

6.7 With reference to [6.6](#), 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.

6.8 A means for strain relief shall be provided and comply with the strain relief test in Section [60](#), Strain Relief Test for the wiring in the accessory if there is a possibility of transmitting stress to the terminal connections during installation.

6.9 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.

6.10 The intended installation of the accessory shall be indicated in the installation instructions included on or with the accessory. See [91.11](#).

6.11 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.

6.12 An electrical accessory intended for field installation shall be marked in accordance with [86.14](#).

7 Mechanical Assembly

7.1 General

7.1.1 An appliance shall be formed and assembled so that it has the strength and rigidity to resist the abuses to which it is subjected, including the vibration of normal operation, 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.

7.1.2 An enclosure, an opening, a frame, a guard, a knob, a handle, or the like shall not be sufficiently sharp to cause a risk of injury to persons in normal maintenance or use.

Exception: This requirement does not apply to a sharp edge that must be exposed to enable the appliance to perform its intended function.

7.2 Mounting of components

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

Exception: A switch is not required to be restrained from turning when it 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 required values when the switch rotates.*
- d) *Operation of the switch is by mechanical means rather than by direct contact by persons.*

7.2.2 The means to restrain turning required by [7.2.1](#) is to consist of more than friction between surfaces – for example, a properly applied lock washer is capable of being used as the means to restrain turning of a device having a single-hole mounting means.

7.2.3 Uninsulated live parts shall be secured to the base or surface so that they will be restrained from turning or shifting in position when such motion results in a reduction of spacing below the minimum values specified in Electrical Spacings, Section [37](#).

7.3 Shipping

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

Exception No. 1: Minor parts, such as handles, decorative trim, pans, trays, and splash panels, that are not required to prevent a risk of fire, electric shock, or injury to persons during operation of the appliance, are not required to 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 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 do not become separated during the shipment. See [88.2](#) and [91.1](#).

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

Exception No. 4: A part of an appliance, as described in (a) or (b), marked in accordance with [88.2](#) and [91.1](#) is not required to be completely assembled when shipped, or shipped in the same carton, or shipped in cartons secured together.

a) *A panel that completes an enclosure that would otherwise be completed by another appliance in an adjacent or stacked installation. See [50.4.5](#).*

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

1) *Interconnecting leads and wiring are housed entirely within the appliance 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 [16.1](#) – [16.5](#) and [88.7](#), 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 [17.1.1](#), 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 [16.1](#) – [16.5](#). See [88.7](#). When armored cable or conduit is permanently attached to one part of the appliance and stranded leads are installed, provision for connection of the leads is made in accordance with [22.5.7](#) (a) or (c). Solid wire leads need no additional end treatment. The armored cable is to 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 [17.1.1](#) 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, is not required to be assembled to or shipped with the appliance when marked in accordance with [88.2](#) and provided with instructions in accordance with [91.1](#).

Exception No. 6: A device intended to be mounted to an appliance in the field is not required to be assembled to or shipped with the appliance when marked in accordance with [88.2](#) and provided with instructions in accordance with [91.1](#). The device shall meet the requirements of Section [6](#), Accessories.

8 Electrical and Fire Enclosures

8.1 General

8.1.1 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 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 is not required when the enclosure is completed by another appliance in an adjacent or stacked installation. See [50.4.5](#) and [91.2](#).

8.1.2 When evaluating an appliance in accordance with Section [8](#), Electrical and Fire Enclosures, a risk of electric shock exists within a circuit unless that circuit meets one of the following criteria, both under normal conditions and under single component fault conditions – See Component Failure Test, [73.5](#):

- a) The circuit is supplied by an isolating source such that the maximum open circuit voltage potential available to the circuit is not more than 30 V ac or 42.4 V peak; or
- b) The circuit is supplied by an isolating source such that the current available through a 1500 ohm resistor connected across any potential in the circuit (including to ground) does not exceed 5 MIU.

8.1.3 For the purpose of this Standard, the secondary circuits that do not involve a risk of electric shock are:

- a) A Class 2 circuit (see [34.3](#));
- b) A limited voltage/current circuit (see [34.4](#));
- c) Other secondary circuits complying with [8.1.2](#).

8.1.4 When evaluating an appliance in accordance with Section [8](#), Electrical and Fire Enclosures, a risk of fire exists within a circuit unless that circuit meets one of the following criteria, both under normal conditions and under single component fault conditions – See Component Failure Test, [73.5](#):

- a) The circuit is supplied by an isolating source such that the maximum open circuit voltage potential available to the circuit is not more than 30 V ac or 42.4 V peak, and the current available is limited to a value not exceeding 8 amperes measured after 1 minute of operation; or
- b) The circuit is supplied by an isolating source such that the power available to the circuit is limited to less than 15 watts.

8.1.5 For the purpose of this Standard, the secondary circuits that do not involve a risk of fire are:

- a) A Class 2 circuit (see [34.3](#));
- b) A limited voltage/current circuit (see [34.4](#));
- c) A limiting impedance circuit (see [34.7](#));

Exception: A limiting impedance circuit that has not been evaluated for operation under single-fault conditions (see Exception No. 1 to [34.7.2](#)) involves a risk of fire.

- d) Other secondary circuits complying with [8.1.4](#).

Exception: Any part that exceeds 121°C during the Normal Temperature Test, Section [50](#), is identified as involving a risk of fire when evaluating the equipment in accordance with Section [8](#), Electrical and Fire Enclosures, regardless of the circuit in which it is located.

8.1.6 The following factors shall be taken into consideration when an enclosure is being evaluated:

- 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.

8.2 Metallic enclosures

8.2.1 The minimum thickness of cast metal shall be in accordance with [Table 8.1](#).

Exception: Thinner metal that has been found to be acceptable when the enclosure is evaluated by such factors as those mentioned in [8.1.6](#) is not required to comply with the minimum thicknesses in [Table 8.1](#). See Section [63](#), Strength of Enclosure, Frames, and Guards Test.

Table 8.1
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.

8.2.2 An enclosure of sheet metal shall be judged with respect to its size and shape, the thickness of metal and its acceptability for the particular application, and the factors described in 8.1.6. The use of sheet steel having a thickness less than 0.026 inch (0.66 mm) if uncoated or electroplated, or 0.029 inch (0.74 mm) if hot-dipped 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 and tested under the conditions described in Section 63, Strength of Enclosures, Frames, and Guards Test.

8.2.3 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 uncoated steel, of not less than 0.034 inch (0.86 mm) if galvanized steel, and of not less than 0.045 inch (1.14 mm) if 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 when the area surrounding a knockout has a thickness of not less than 0.053 inch (1.35 mm).

8.3 Nonmetallic enclosures

8.3.1 A nonmetallic enclosure shall comply with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

8.4 Fire containment – general

8.4.1 An opening in the bottom of an appliance shall not be located below an electrical part unless a solid, noncombustible pan complying with Figure 8.1 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 is not required to be flat or any regular shape and the transmission from the bottom to the rim, lip, and the like may have any convenient shape. 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 when:

- 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;*

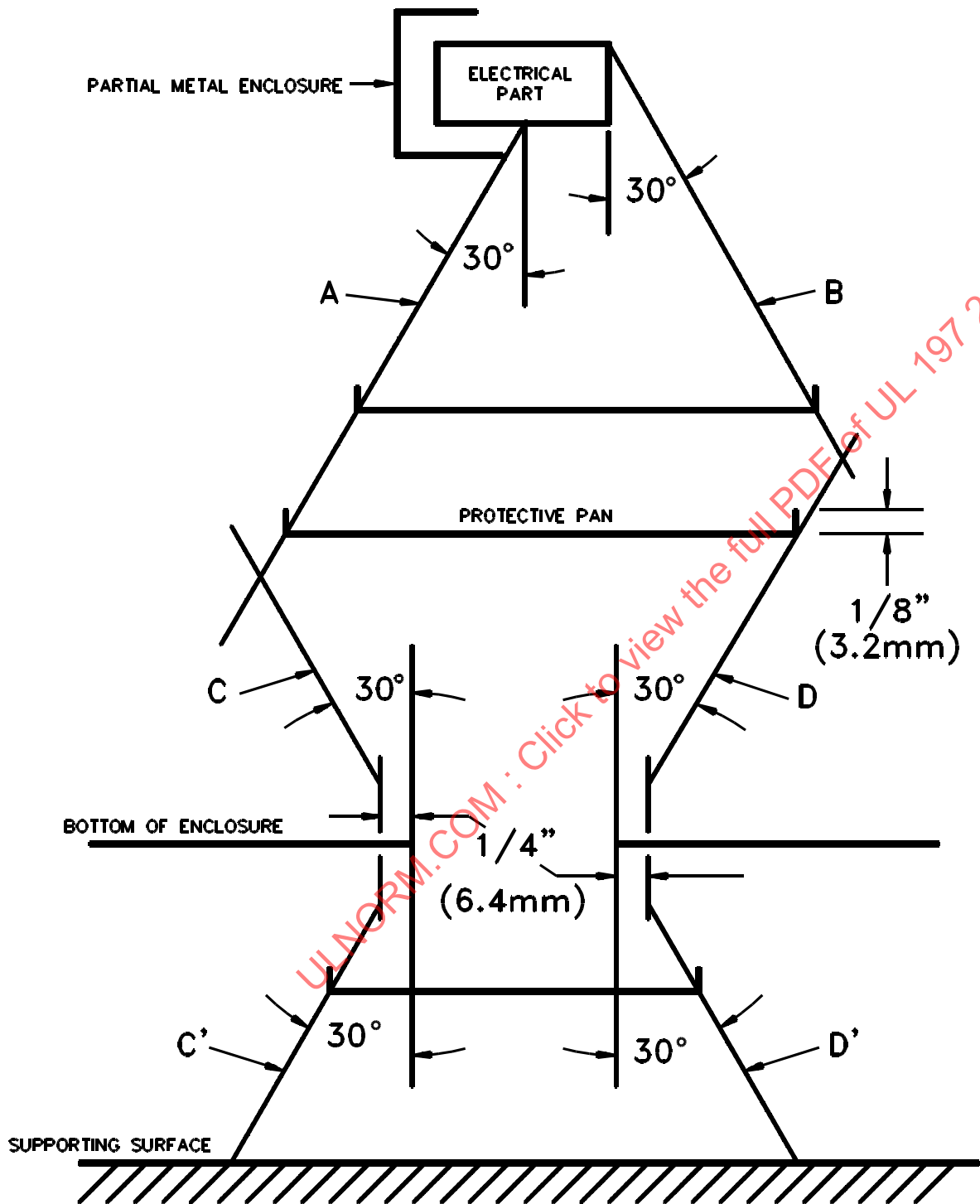
d) *The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that will prevent the temperature of the motor windings from exceeding 125°C (257°F) at the maximum load under which the motor will run without causing the protector to cycle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

Exception No. 3: This requirement does not apply to wiring of the flame-retardant rating VW-1 (FR-1), or wiring contained within sleeving rated VW-1, or the equivalent.

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Figure 8.1
Minimum extent of baffle for opening in bottom of enclosure



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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.

8.4.2 The structure of a part or of the appliance is not prohibited from providing the equivalent of the pan described in 8.4.1 when it complies with Figure 8.1. The raised edge is not prohibited from being incorporated in the opening.

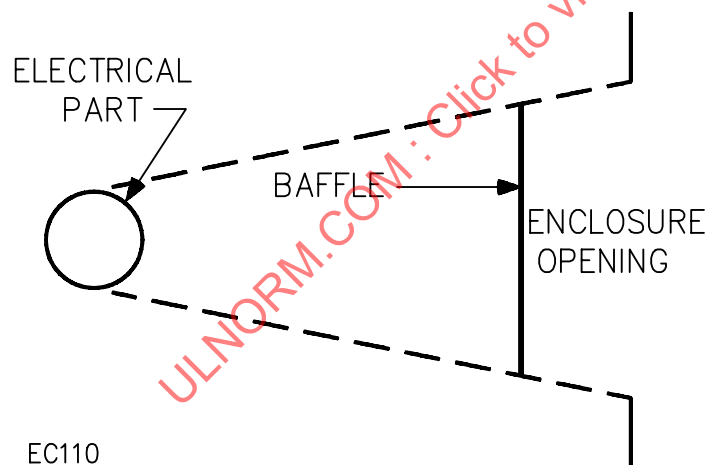
8.4.3 An opening in a surface other than the bottom of an enclosure that contains an arcing part such as a fuse, circuit breaker, or switch shall be provided with a baffle, such as the one illustrated in Figure 8.2, that will prevent the emission of flame, molten metal, burning insulation, or the like.

Exception No. 1: A baffle is not required for an opening in an enclosure that contains arcing parts other than an overcurrent-protective device, such as a fuse or circuit breaker, when:

- 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).*

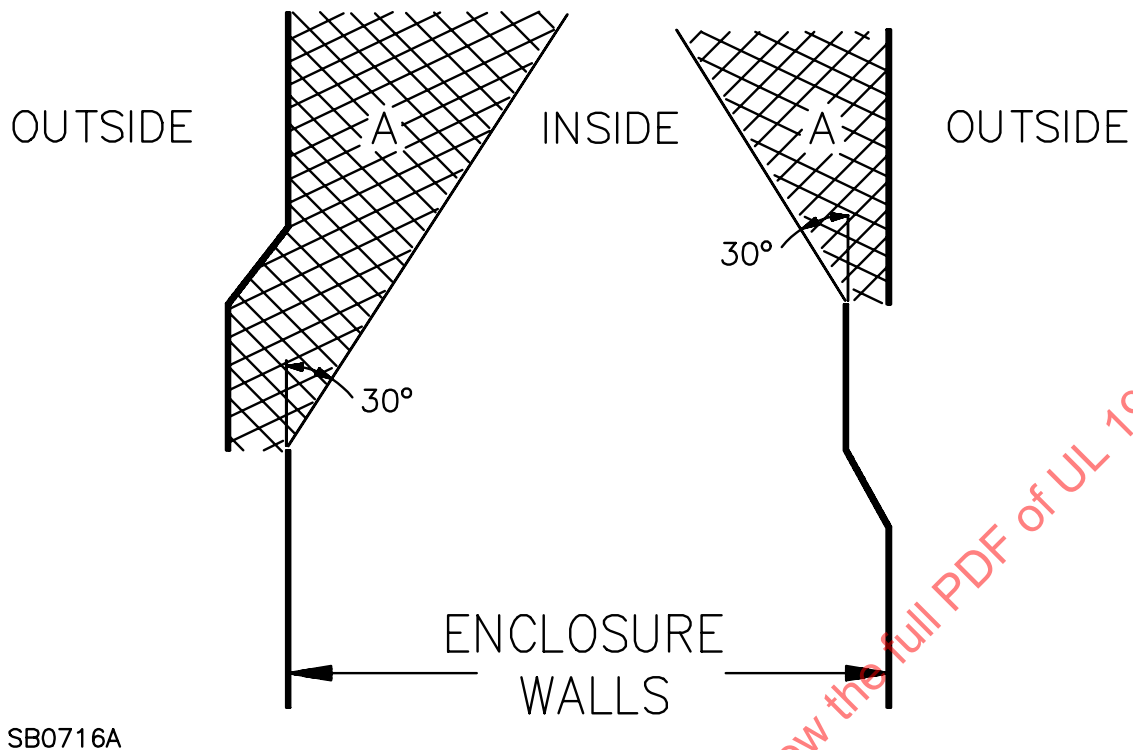
Exception No. 2: Louvers are not prohibited from being used in lieu of a baffle (see 8.4.4) to enclose electrical parts other than an overcurrent-protective device, such as a fuse or circuit breaker, when no electrical parts are located within area "A" indicated in Figure 8.3.

Figure 8.2
Relationship of baffle and electrical part to prevent emission



8.4.4 An opening in the side of an enclosure shall be so located and of such size that entry of foreign objects which create a risk of fire or electric shock is prevented and contact with internal parts by persons is prevented in accordance with Section 10, Accessibility of Live Parts, 11.1 and Section 13, Protection of Service Personnel. Louvers are not prohibited from being used when shaped to deflect external falling objects outward. See Figure 8.3.

Figure 8.3
Louver designs



8.4.5 No opening or joint in the enclosure of an appliance shall be located where spillage from normal operation, cleaning, or user servicing can enter the enclosure and affect the internal wiring or any other electrical component. A part that is removable without the use of tools, such as a grease pan, does not meet the intent of providing such protection.

8.5 Fire containment – enclosures for overcurrent protective device

8.5.1 A door or cover giving direct access to a fuse or any portion of a circuit breaker or supplementary protector other than the operating handle shall shut closely along all four sides of the door or cover against a 1/4-inch (6.4-mm) rabbet or the equivalent, or shall have one of the following for the full length of all edges:

- a) Turned flanges; 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 meets the intent of the requirement.

Exception No. 1: This requirement does not apply to a door or cover that gives access to a fuse or circuit breaker, or supplementary protector located in a secondary circuit that is supplied from an isolating transformer or an equivalent source that limits the available short-circuit current.

Exception No. 2: This requirement does not apply to a door or cover where the only fuses enclosed are:

a) *Control circuit fuses, when the fuses and control circuit loads (other than a fixed control circuit load, such as a pilot lamp) are within the same enclosure; or*

b) *Fuses located in extractor-type fuseholders with integral enclosures.*

8.5.2 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.

8.6 Grease troughs and pans

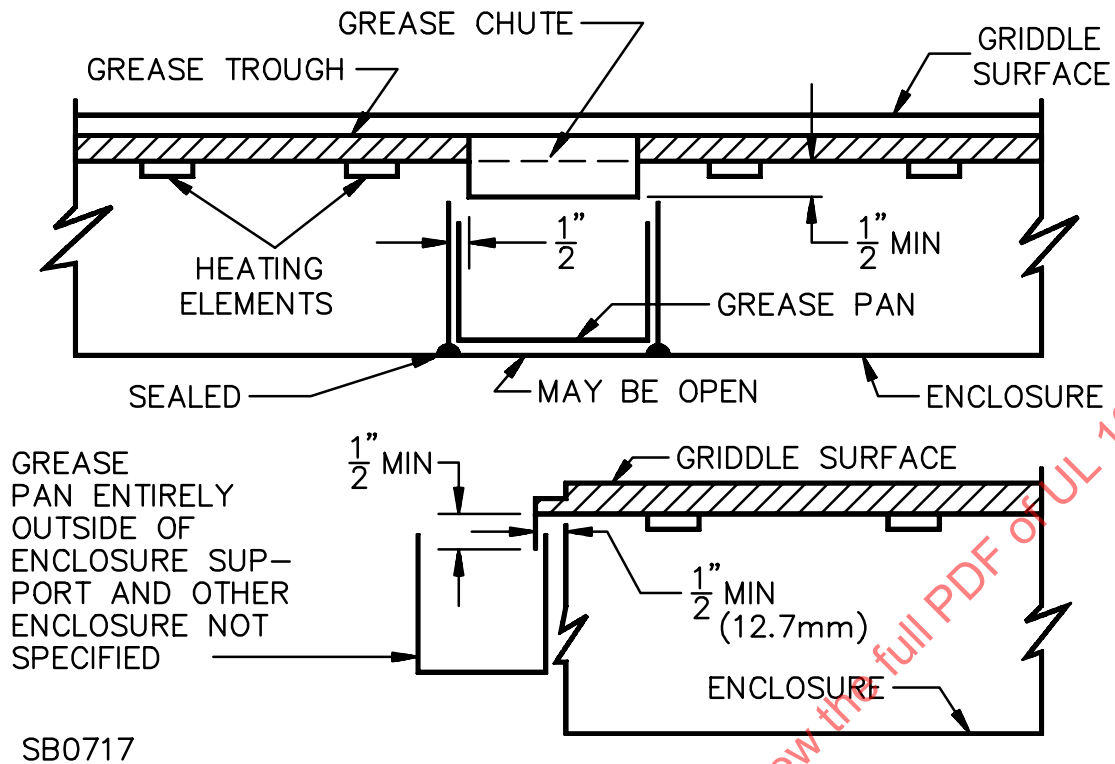
8.6.1 An appliance shall be constructed so that grease spillage does not enter the enclosure and contact live parts or wiring.

8.6.2 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.

8.6.3 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 8.4](#) illustrates some acceptable constructions.

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Figure 8.4
Grease chutes for griddles



9 Outer Cabinetry/ Enclosures

9.1 A nonmetallic outer cabinet or enclosure, and a nonmetallic part of an outer cabinet or enclosure, shall comply with the requirements for Enclosure Flammability – Large Mass Considerations in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Exception: The requirements of 9.1 do not apply to canopies, bags, decorative covers and other similar parts constructed of three layers or less of woven cotton, polyester, or similar material.

10 Accessibility of Live Parts

10.1 General

10.1.1 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.

10.1.2 The following are not considered to be uninsulated live parts:

- a) A coil of a controller, a relay, a solenoid, and a transformer, when they are provided with insulating overwraps at least 1/32 inch (0.8 mm) thick;
- b) Enclosed motor windings;
- c) Insulated terminals and splices; and
- d) Insulated wire.

10.1.3 An uninsulated live part, such as a terminal or bus bar, and not including film-coated wire, shall not be less than 1 inch (25.4 mm) from any opening in the enclosure of an appliance.

10.1.4 An enclosure opening shall be sized and located such that:

- a) It will not permit the entrance of a 3/4-inch (19.0-mm) diameter rod; and
- b) A probe as illustrated in [Figure 10.3](#) cannot be made to touch any uninsulated live part or enameled wire when inserted into the opening.

Exception No. 1: With respect to a part or wire within the enclosure of a motor, an opening larger than 3/4 inch (19.0 mm) is not prohibited when:

- a) A probe as illustrated in [Figure 10.1](#) cannot be made to touch any uninsulated live part when inserted through the opening; and
- b) A probe as illustrated in [Figure 10.2](#) cannot be made to touch film-coated wire when inserted through the opening.

Exception No. 2: An opening that will permit the entrance of a 3/4-inch (19.0-mm) diameter rod is acceptable when 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, and not less than 4 inches (102 mm). See [Figure 10.4](#).

Figure 10.1

Probe for uninsulated live parts within a motor

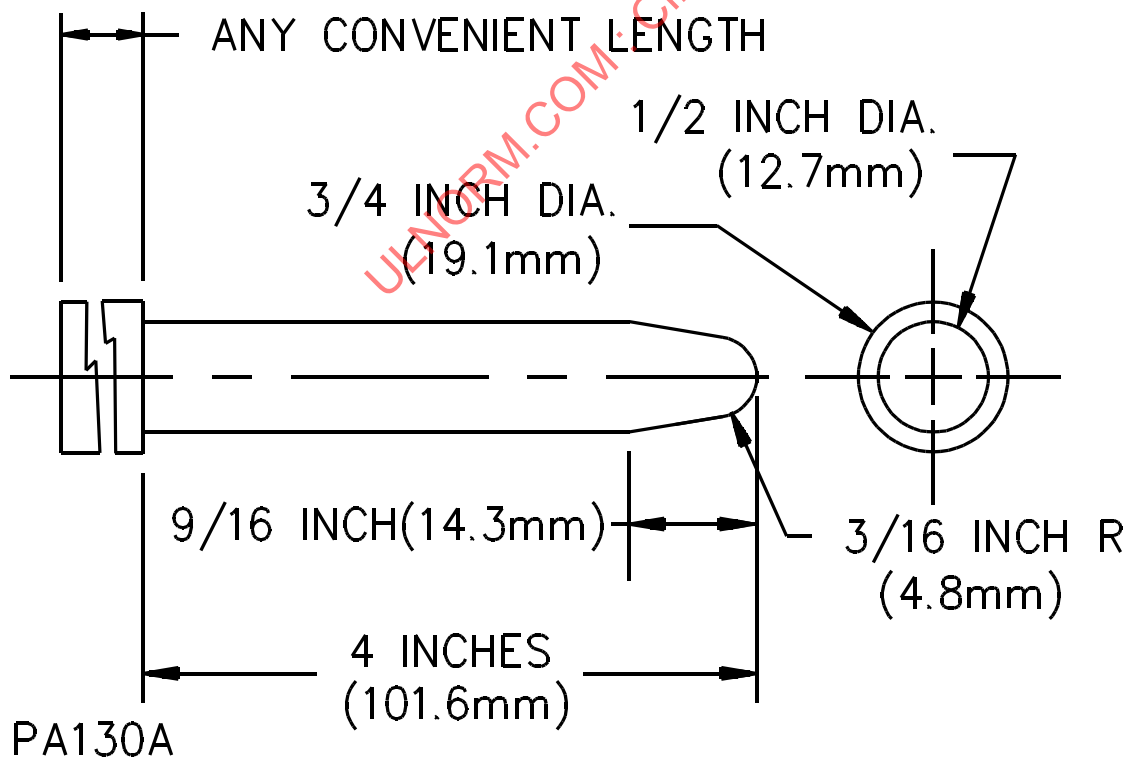


Figure 10.2
Probe for film-coated magnet wire of a motor

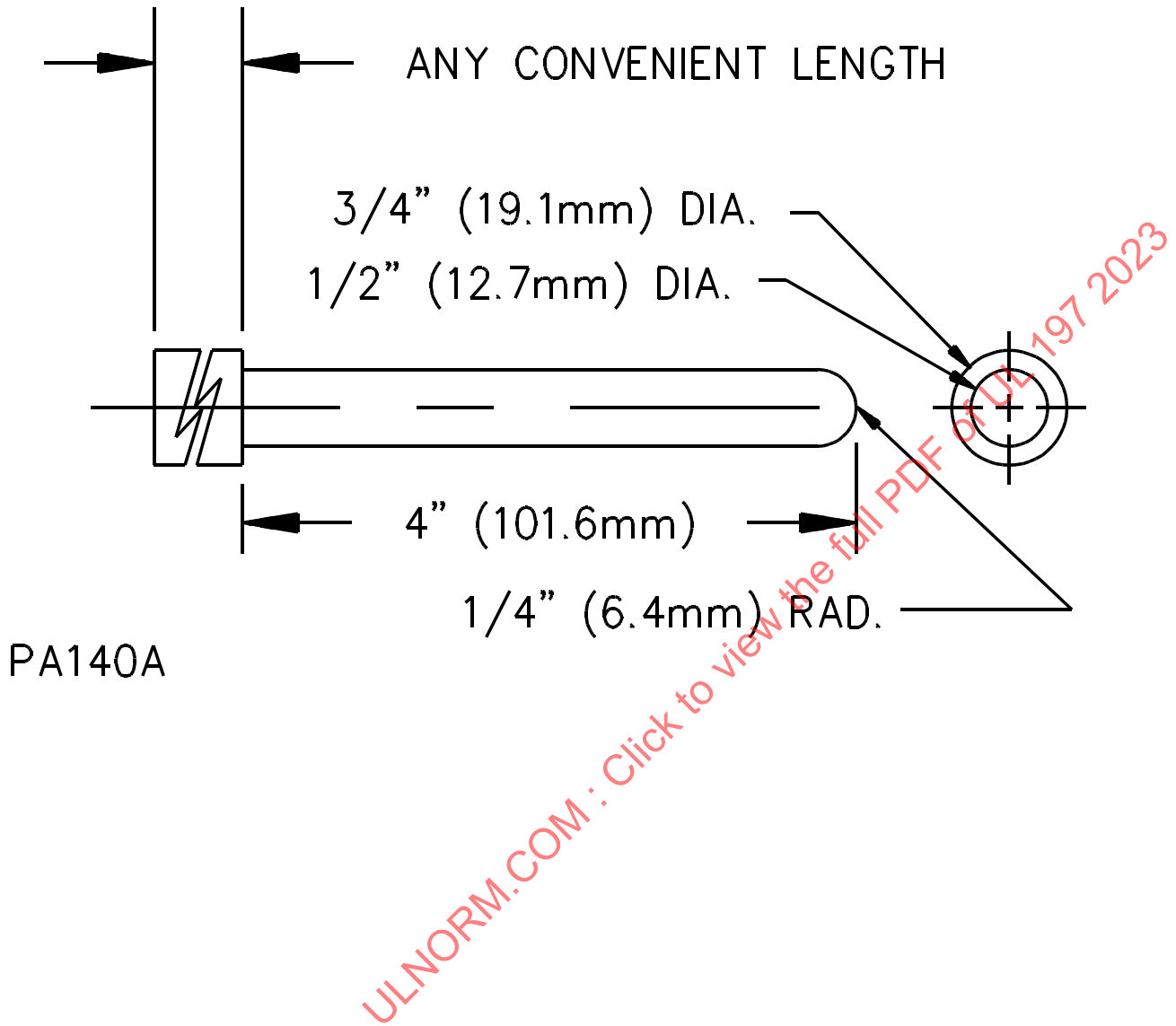


Figure 10.3
Accessibility probe

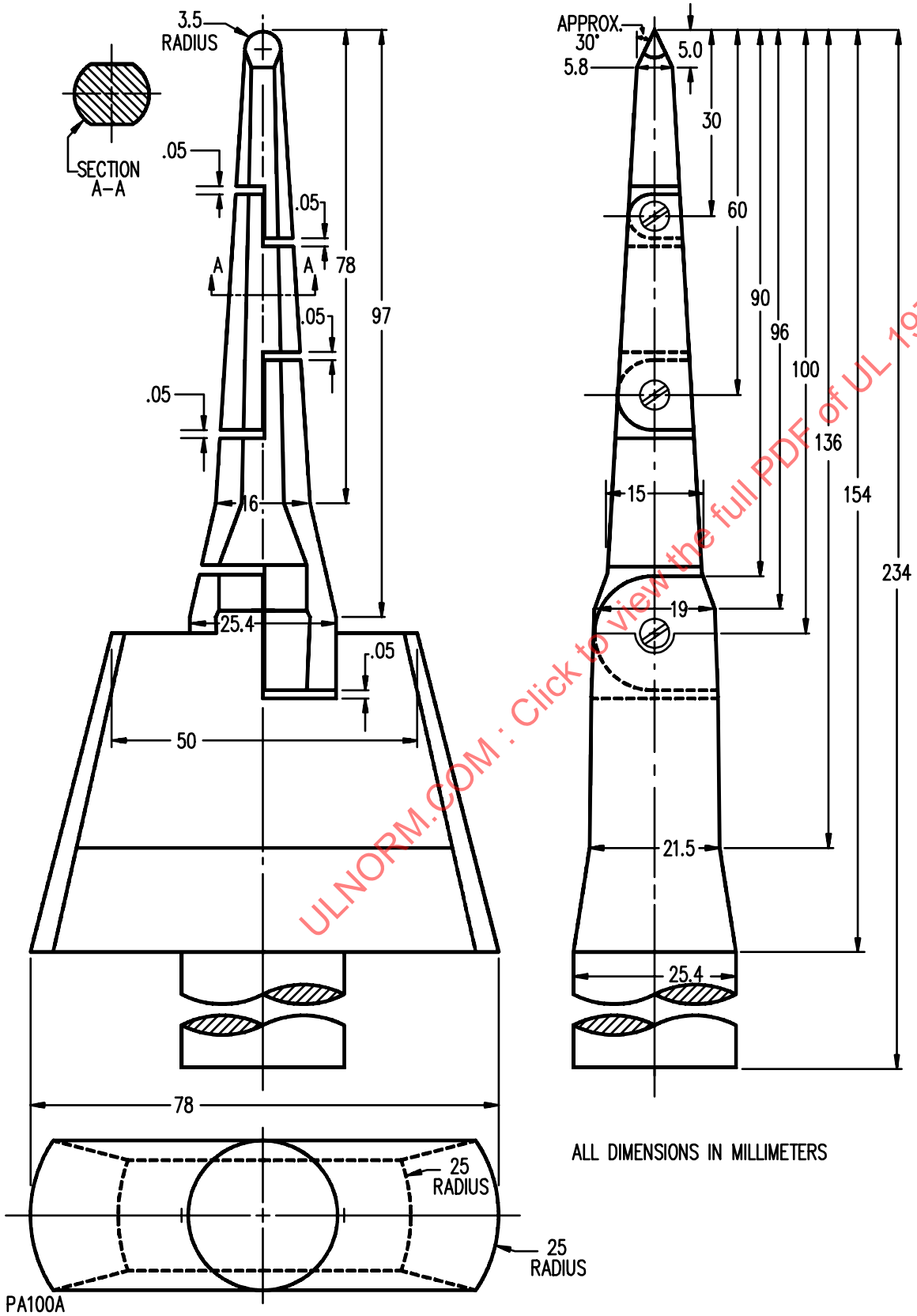
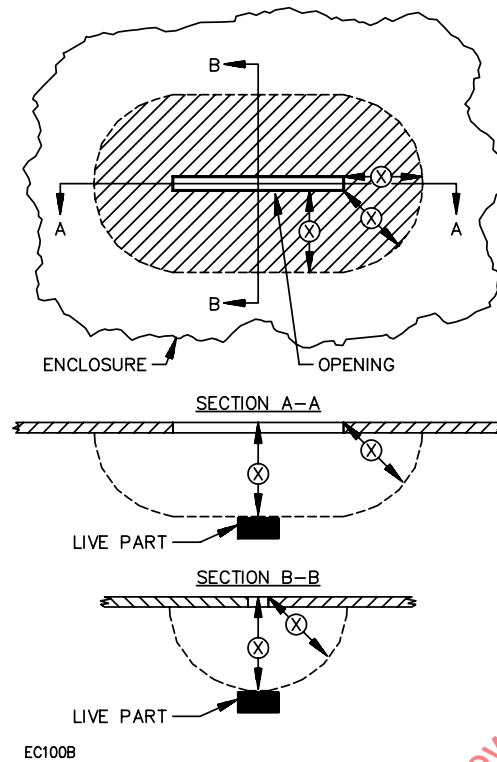
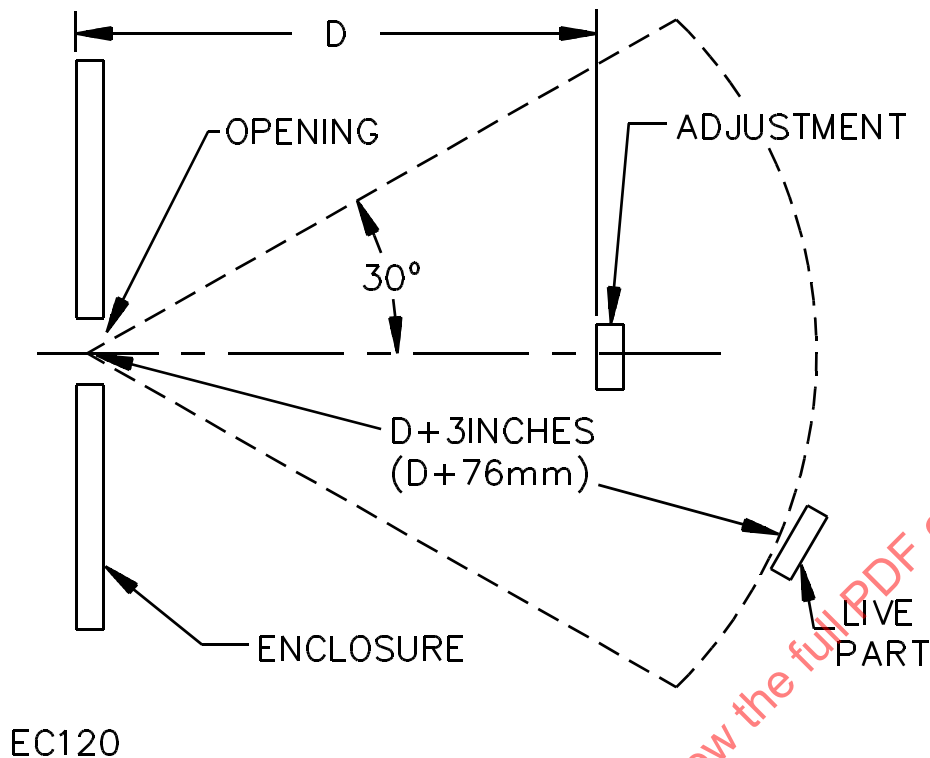


Figure 10.4
Opening in an enclosure



10.1.5 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 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 10.5](#).

Figure 10.5
Accessibility of live parts through adjustment opening



10.1.6 During the examination of an appliance in connection with the requirements in [10.1.4](#) – [10.1.5](#), a part of the outer enclosure that is capable of being removed without the use of tools, or that must be opened or removed for user servicing, is to be disregarded – that is, it shall not be assumed that the part in question affords protection against the risk of electric shock. A warning marking such as that specified in [89.10](#) does not meet the intent of reducing 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 [10.1.4](#) – [10.1.5](#) when the marking specified in [86.13](#) is on or adjacent to the cover.

10.2 Open wire heating elements

10.2.1 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.

10.2.2 An exposed open-wire element in an appliance shall not be accessible to contact by the user.

Exception No. 1: This requirement does not apply to a toaster with the minor dimension of the slot opening less than 1-1/2 inch and designed for operation on a circuit involving a potential to ground of 250 volts or less.

Exception No. 2: This requirement does not apply to the rotating head of a cotton-candy maker designed to rotate at 3000 revolutions per minute or more, provided the heating element can only be contacted through the opening into which sugar is poured.

10.3 Lamps, quartz enclosed heating elements, and similar components

10.3.1 A lamp, a quartz-enclosed heating element, or a similar component shall be installed or guarded so that it is not broken by utensils, such as pans or trays, inserted in an oven or similar compartment. The acceptability of a guard provided for protection is to be evaluated by impacting the guard as specified in [63.1.2](#).

10.3.2 A guard constructed of polymeric material shall comply with the enclosure requirements in accordance with the Standard for Polymeric Materials – Use in Electrical Evaluations, UL 746C.

10.3.3 Except as indicated in [10.3.4](#), the surface of a component as mentioned in [10.3.1](#) 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 horizontal plane.

10.3.4 When 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 shall not be unguarded unless no portion projects more than 3/4 inch (19 mm) below the top.

10.3.5 A lens, shield, or shade employed as the guard required by [10.3.1](#) 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.

10.3.6 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.

10.3.7 A lampholder – including one for a quartz-enclosed heating element – shall be so located so that a person replacing the lamp cannot unintentionally touch an uninsulated live part.

10.3.8 The requirement in [10.3.7](#) 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.

10.4 Fuses, circuit breakers, supplementary protectors, and manually reset controls

10.4.1 The requirements of [10.4.3](#), [10.4.4](#), [10.4.6](#), and [10.4.9](#) – [10.4.11](#) do not apply to a fuse or device that is not required by this standard when:

- a) The cover/enclosure part giving access to the fuse or device is marked in accordance with [86.13](#); or
- b) The fuse is a non-replaceable type.

10.4.2 A fuseholder, circuit breaker, supplementary protector, or manually reset thermostat shall not be accessible from outside the appliance without opening a door or a cover.

Exception: The operating handle of a circuit breaker, or supplementary protector, reset means of a manually reset thermostat and the insulating cap of an extractor-type fuseholder as specified in [10.4.11](#) (b) or (c) are not prohibited from being accessible from outside of the appliance.

10.4.3 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.

10.4.4 Access for replacing fuses and resetting circuit breakers and supplementary protectors shall not be unduly restricted. Upon removal of the cover or panel referenced in [10.4.3](#), such devices shall be

accessible from outside the unit via a straight line. Fuses and the actuators of circuit breakers and supplementary protectors shall not be recessed more than 12 inches (305 mm) behind the perimeter of a floor mounted appliance. See [13.4](#) – [13.10](#).

10.4.5 For the purpose of these requirements, the perimeter of the appliance is defined as the vertical surface containing the outermost edges of the appliance, including overhangs and other protrusions such as counter tops that are:

- a) Located within 3.0 feet (0.9 m) of the supporting surface; and
- b) Within 15 inches (380 mm) to either side of the fuse or actuator or within 5 inches (130 mm) to either side of the fuse/circuit breaker/supplementary protector enclosure, whichever is the greater distance.

Exception: Protrusions which do not exceed 4 inches (10 cm) from the edge of an appliance are not required to be defined as the perimeter of an appliance.

10.4.6 An appliance shall be constructed to permit at least a 90 degree opening of all doors and hinged panels which give access to a fuse or the actuator of a circuit breaker or supplementary protector.

10.4.7 When a panelboard is provided as a part of an appliance, it shall comply with the Standard for Panelboards, UL 67, and be installed in accordance with the following:

- a) The panelboard shall be mounted vertically;
- b) Any opening giving access to a panelboard shall be at least as wide and high as the deadfront of the panelboard;
- c) No part of the appliance shall obstruct the space between the panelboard and any opening giving access to the panelboard;

Exception: A panelboard is not prohibited from being located behind a door or cover when the construction complies with [10.4.8](#).

- d) The panelboard shall be marked in accordance with [86.23](#); and
- e) The face of the panelboard shall be directed outward and shall not be recessed more than 6 inches (150 mm) behind the perimeter of the appliance.

Exception: This requirement does not apply when:

- 1) Accessibility for servicing of another part of the overall appliance would be impeded by locating the panelboard as specified;
- 2) The panelboard is located to provide access to the fuses and/or actuators in accordance with [10.4.4](#) (for example, with the front of the panelboard located perpendicular to and immediately behind an access opening);
- 3) When the panelboard is provided with a door, the panelboard door is hinged on the side away from the direction of access;
- 4) At least one edge of the panelboard is located within 6 inches (150 mm) of the perimeter of the appliance in the direction of access; and
- 5) When the panelboard is located behind a door or cover, see [10.4.8](#), at least one edge of the panelboard is located within 1 inch (25 mm) behind the plane created by the inside of the door or cover.