



# UL 710B

## STANDARD FOR SAFETY

### Recirculating Systems

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UL Standard for Safety for Recirculating Systems, UL 710B

Second Edition, Dated September 2, 2011

### **Summary of Topics**

***This revision of ANSI/UL 710B, dated October 7, 2021, includes the addition of Ozone Generator requirements; [11.1.1.1](#), [11.1.6](#), [42.6.1](#), Section [64](#), and Supplement [SB](#).***

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated July 30, 2021.

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**ANSI/UL 710B-2021**

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**UL 710B**

**Standard for Recirculating Systems**

First Edition – September, 2004

**Second Edition**

**September 2, 2011**

This ANSI/UL Standard for Safety consists of the Second edition including revisions through October 7, 2021.

The most recent designation of ANSI/UL 710B as an American National Standard (ANSI) occurred on October 7, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover the following recirculating systems rated 600 volts or less and intended for indoor use:

- a) Non-integral recirculating systems for installation in commercial establishments for the preparation of food;
- b) Electric commercial cooking appliances provided with integral recirculating systems intended for installation in commercial establishments for the preparation of food; and
- c) Vending machines provided with integral recirculating systems.

1.2 These devices incorporate an air filtering system enclosed in a hooded or otherwise contained area intended to capture air from the cooking process area. The hood assembly typically includes a fan, collection hood, or equivalent design and an air filtering system (consisting of a grease filter with or without other filtering means). In addition, except as noted in the Exceptions to [37.1](#) and [38.1](#), the hood assembly includes a fire actuated damper, and a fire extinguishing system.

1.3 Recirculating systems covered by these requirements are intended for installation in accordance with:

- a) The Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, NFPA 96;
- b) The National Electrical Code, ANSI/NFPA 70; and
- c) Other codes such as the International Mechanical Code (IMC), and the Uniform Mechanical Code (UMC).

1.4 Integral recirculating systems shall comply with the requirements for the cooking appliance as noted below, except as modified or superseded by the requirements in this Standard.

- a) Commercial electric cooking appliances shall comply with the requirements in the Standard for Commercial Electric Cooking Appliances, UL 197.
- b) Vending machines shall comply with the requirements in the Standard for Vending Machines, UL 751.

### 2 Components

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

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

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

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

### 3 Units of Measurement

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

### 4 Undated References

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

### 5 Glossary

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

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

5.3 APPLIANCE – Utilization equipment that uses energy for some function. For the purpose this Standard, the term "appliance" includes recirculating systems.

5.4 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.

5.5 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.

#### 5.6 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 [25](#), 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.

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

5.8 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.

5.9 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.

5.10 COOKING APPLIANCE – A cooking device that has or is capable of having a surface of liquid grease or one in which grease is involved, such as a deep fat fryer, griddle, range, chain broiler, electric char-broiler, wok, tilt skillets, and similar appliances. The protected area is limited to the cooking surfaces of the appliance only.

5.11 CYLINDER – A container that provides storage for the extinguishing agent and expellant gas, or when used at a location remote to the extinguishing system unit, provides storage for expellant gas.

5.12 CYLINDER/VALVE ASSEMBLY – A container that incorporates a valve and that provides storage of the extinguishing agent and expellant gas until the valve is actuated. For cartridge operated units, this assembly includes the extinguishing agent storage container and cartridge mechanism. When actuated, the valve releases the agent into the distribution network of the extinguishing system.

5.13 DISCHARGE NOZZLE – A device that is used to uniformly distribute the extinguishing agent over or into a specific area.

5.14 DISCHARGE RATE – The ratio of the quantity of agent discharged from a nozzle to the discharge time measured within  $\pm 1$  second. When a minimum discharge rate is indicated, reference is made to the minimum quantity of agent discharged and the time measured within  $\pm 1$  second.

5.15 DISCHARGE TIME – The time interval between the first appearance of extinguishing agent at the nozzle and the time at which the discharge becomes predominantly gaseous.

5.16 DUCT (OR DUCT SYSTEM) – A continuous enclosed passageway for the transmission of air and cooking vapors.

5.17 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.

5.18 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.

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

5.19 EXPELLANT GAS – Dry nitrogen, dry air, or other gas used to facilitate the discharge of the extinguishing agent.

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

5.21 EXTINGUISHING SYSTEM UNIT – Identified components that are assembled into a system for the discharge of an extinguishing agent through fixed piping and nozzles for the purpose of extinguishing fires.

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

5.23 GAS CARTRIDGE – A container that provides storage for an expellant gas.

5.24 GREASE – For test purposes, grease is new vegetable shortening incorporating an antifoaming agent. For hood and duct and broiler testing only, grease is to be new or used vegetable shortening, or rendered animal fat.

5.25 GREASE AIR STREAM – Area between the cooking surface and the discharge side of the last filtration medium.

5.26 GREASE FILTER – A component of a grease vapor removal system that deflects the air and vapors passing through it in such a manner as to result in the grease vapors to concentrate, condense, or both, for the purpose of grease collection.

5.27 HOOD – A device provided as part of an exhaust system to direct and capture grease vapors and cooking effluent from a cooking appliance.

5.28 LOW QUALITY FATTY BEEF STEAKS – Steaks that contain 20 – 30 percent fat or gristle, well marbled, and uniform in size. An example of a cut of meat which meets the requirement is "goose neck round," which is 70 – 80 percent lean.

5.29 LOWER AIRFLOW LIMIT – The minimum airflow where capture will occur, or the minimum airflow that will allow the cooking appliance to operate (see 41.1), whichever is higher.

5.30 MANUAL MEANS OF ACTUATION – A means of system actuation in which the system operator initiates system discharge.

5.31 MEAT CAKES – Ground beef, nominal 70 percent lean, 4 inches (101.6 mm) in diameter, minimum 3/8-inch (9.5 mm) thick and weighing not less than 5 ounces (141.7 grams). The meat cakes are either fresh, frozen, or thawed.

5.32 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.

5.33 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.

5.34 OPERATING PRESSURE – The pressure in a fully charged container at 70°F (21°C).

5.35 PLENUM – The volume of enclosed space between the grease filters and the exhaust outlet of the system.

5.36 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.

5.37 PRE-ENGINEERED SYSTEM – A system that is tested in accordance with the limitations prescribed by the manufacturer for maximum and minimum pipe lengths, accessories, number of fittings, number and types of nozzles and nozzle placement, types of fire risks and their maximum areas, volumes, or both areas and volumes of protection.

5.38 RECIRCULATING SYSTEMS – Systems for control of smoke or grease laden vapor from commercial cooking equipment that do not exhaust to the outside of the building.

INTEGRAL – A recirculating system that forms an integral part of the cooking appliance.

NON-INTEGRAL – A recirculating system intended for installation over specific commercial cooking equipment.

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

5.40 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.

5.41 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.

5.42 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.

5.43 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.

5.44 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 [80.9](#);

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.

## CONSTRUCTION

### 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 Installation of an accessory by the user shall be by means of a receptacle and plug-in connector.
- 6.3 When an accessory is to be installed by the user, the appliance shall comply with the requirements in Section [9](#), Accessibility of Live Parts, during and after the installation of the accessory.
- 6.4 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.
- 6.5 With reference to [6.4](#), 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.
- 6.6 A means for strain relief shall be provided and comply with the strain relief test in Section [53](#), Strain Relief Test for the wiring in the accessory if there is a possibility of transmitting stress to the terminal connections during installation.
- 6.7 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.
- 6.8 The intended installation of the accessory shall be indicated in the installation instructions included on or with the accessory. See [82.10](#).
- 6.9 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.
- 6.10 An electrical accessory intended for field installation shall be marked in accordance with [78.18](#).

### 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.

## 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 [32](#).

## 7.3 Shipping

7.3.1 A recirculating system 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: The legs or the mounting brackets of a recirculating system may be shipped detached from the remainder of the appliance. See [81.2](#) and [82.6](#).*

*Exception No. 3: A part of an appliance, as described in (a) or (b), marked in accordance with [79.2](#) and [82.6](#) 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 [45.4.5](#).*

*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;*

*2) Internal connection of a permanently connected appliance are made in accordance with the requirements for power-supply connections in [13.1](#) – [13.5](#) and [70.7](#), and field-installed leads are housed entirely within the appliance; or*

3) External connections of a permanently connected appliance are made in armored cable or conduit in accordance with the requirements for power-supply connections in [13.1](#) – [13.5](#). See [79.7](#). 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 [18.5.7](#) (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.

*Exception No. 4: 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 [79.2](#) and provided with instructions in accordance with [82.6](#).*

*Exception No. 5: 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 [79.2](#) and provided with instructions in accordance with [82.6](#). The device shall meet the requirements of Section [6](#), Accessories.*

*Exception No. 6: A wet or dry chemical fire suppression system using an external propellant is not required to be charged at the place of manufacture.*

## 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 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. An enclosure that serves to confine or convey the exhaust products and houses electrical parts shall meet the requirements of this Section in addition to Section [40](#), Hood Materials.

*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 [45.4.5](#) and [82.6](#).*

8.1.2 When evaluating an appliance in accordance with this Section, 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, [71.5](#):

- 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 [29.3](#));
- b) A limited voltage/current circuit (see [29.4](#)); and
- c) Other secondary circuits complying with [8.1.2](#).

8.1.4 When evaluating an appliance in accordance with this Section, 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, [71.5](#):

- 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 [29.3](#));
- b) A limited voltage/current circuit (see [29.4](#));
- c) A limiting impedance circuit (see [29.7](#)); and

*Exception: A limiting impedance circuit that has not been evaluated for operation under single-fault conditions (see Exception No. 1 to [29.7.2](#)) involves a risk of fire.*

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

*Exception: Any part that exceeds 121°C (250°F) during the Normal Temperature Test, Section [45](#), is identified as involving a risk of fire when evaluating the equipment in accordance with this Section, 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 [55](#), Strength of Enclosures, Frames, and Guards Test.*

**Table 8.1**  
**Minimum acceptable thickness of cast metal**

Metal	Minimum thickness, inch (mm)	
	At reinforced surfaces <sup>a</sup>	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)

<sup>a</sup> 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 55, 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 – Other than hood exhaust system

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*

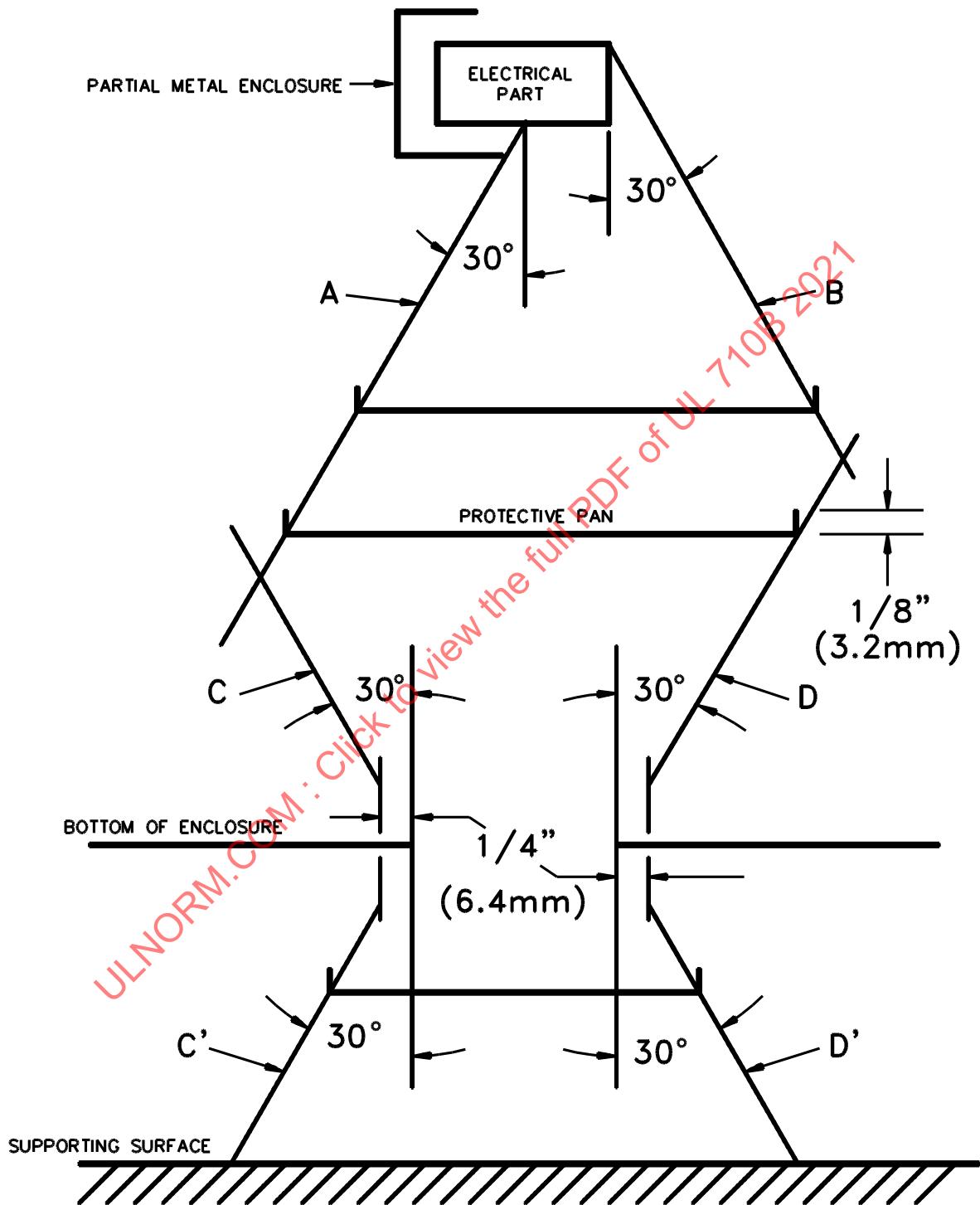
e) *The motor is impedance protected and the locked-rotor temperature of the motor winding is not more than 150°C (302°F) with the appliance otherwise operating as intended.*

*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.

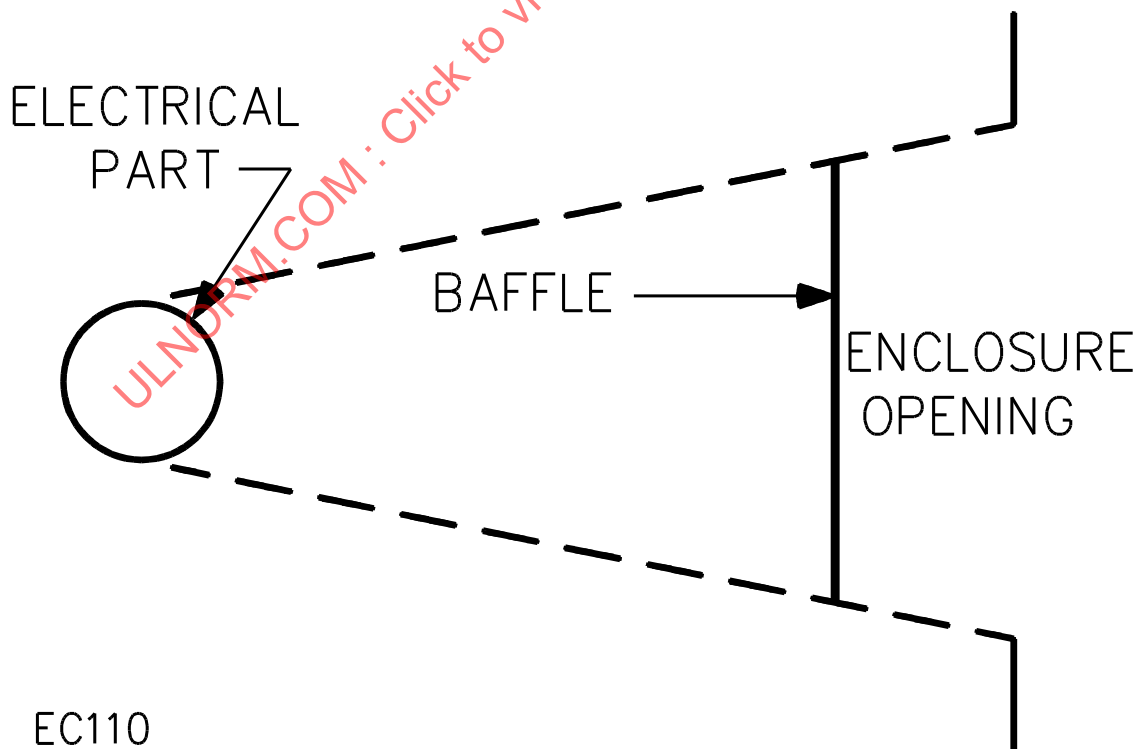
*Exception No. 1: A baffle is not required for an opening in an enclosure that contains arcing parts other than an overcurrent-protective device, such as a fuse or circuit breaker, when:*

- 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 (304.8 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 (304.8 mm) from the floor in any 1-foot-square area of the enclosure does not exceed 8 square inches (52 cm<sup>2</sup>).*

*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.*

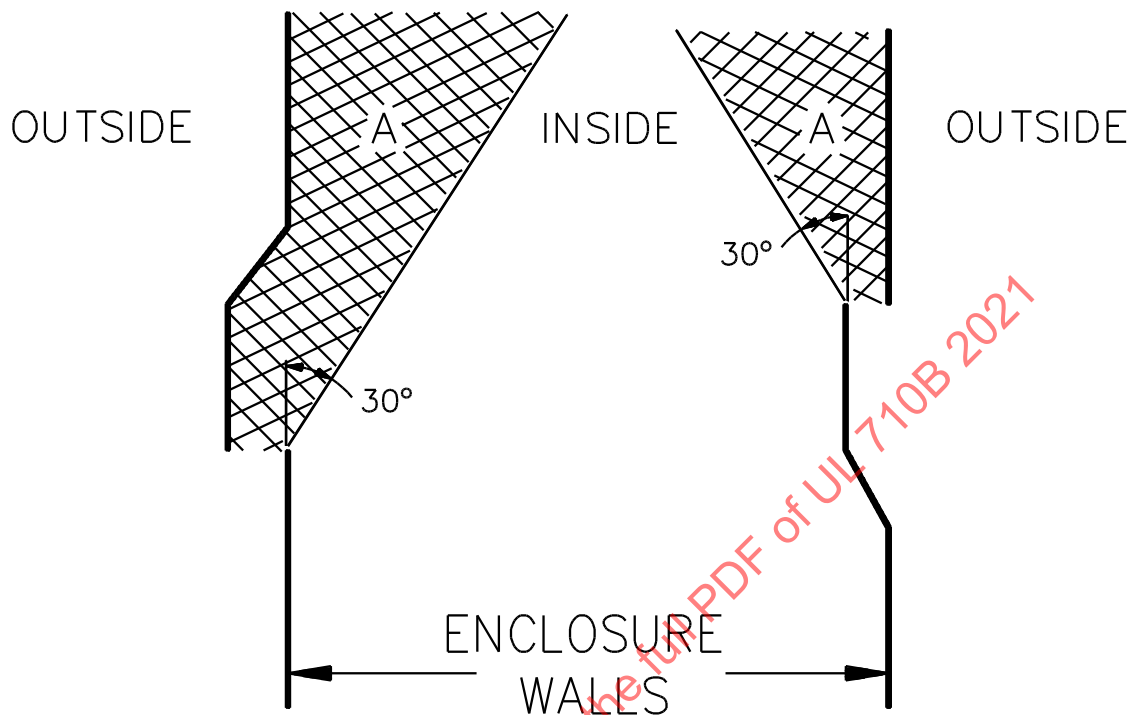
Figure 8.2

Relationship of baffle and electrical part to prevent emission



EC110

**Figure 8.3**  
**Louver designs**



SB0716A

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 this Section 9, Accessibility of Live Parts and Section 10, Protection of Service Personnel. Louvers are not prohibited from being used when shaped to deflect external falling objects outward. See [Figure 8.3](#).

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) An extractor type fuse with its own enclosure that is accessible without exposing live parts other than a fuse contact of the fuseholder, when the fuseholder is located in a circuit with a grounded supply conductor. See [15.2](#) and [15.3](#).*

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 (152.4 mm) apart.

## 9 Accessibility of Live Parts

### 9.1 General

9.1.1 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.

9.1.2 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.

9.1.3 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.

9.1.4 An opening shall not be larger than 3/4-inch (19.1 mm).

*Exception No. 1: Except as noted in [9.1.3](#), an opening larger than 3/4-inch (19.1 mm) meets the intent of this requirement when it does not permit the entrance of a 3/4-inch (19.1 mm) diameter rod and a probe as illustrated in [Figure 9.3](#) which cannot be made to touch any uninsulated live part or enameled wire when inserted into the opening.*

*Exception No. 2: With respect to a part or wire within the enclosure of a motor, an opening larger than 3/4-inch (19.1 mm) is not prohibited when:*

- a) A probe as illustrated in [Figure 9.1](#) cannot be made to touch any uninsulated live part when inserted through the opening; and*

b) A probe as illustrated in [Figure 9.2](#) cannot be made to touch film-coated wire when inserted through the opening.

Figure 9.1

Probe for uninsulated live parts within a motor

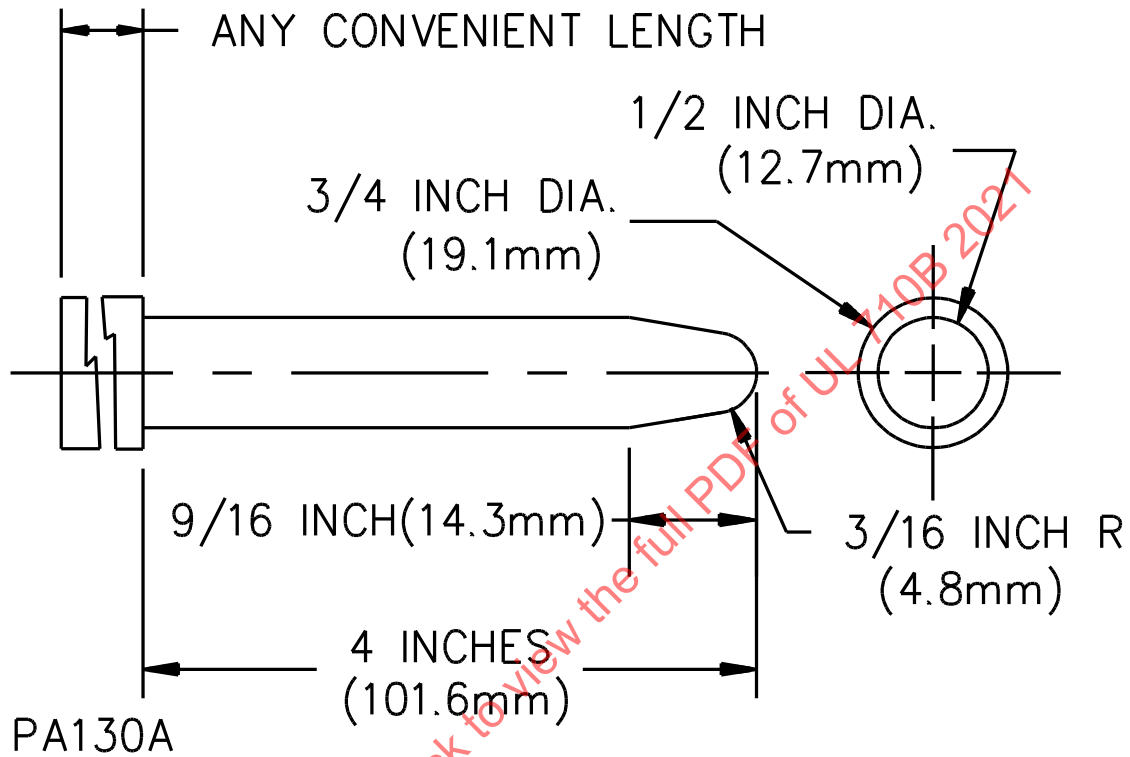
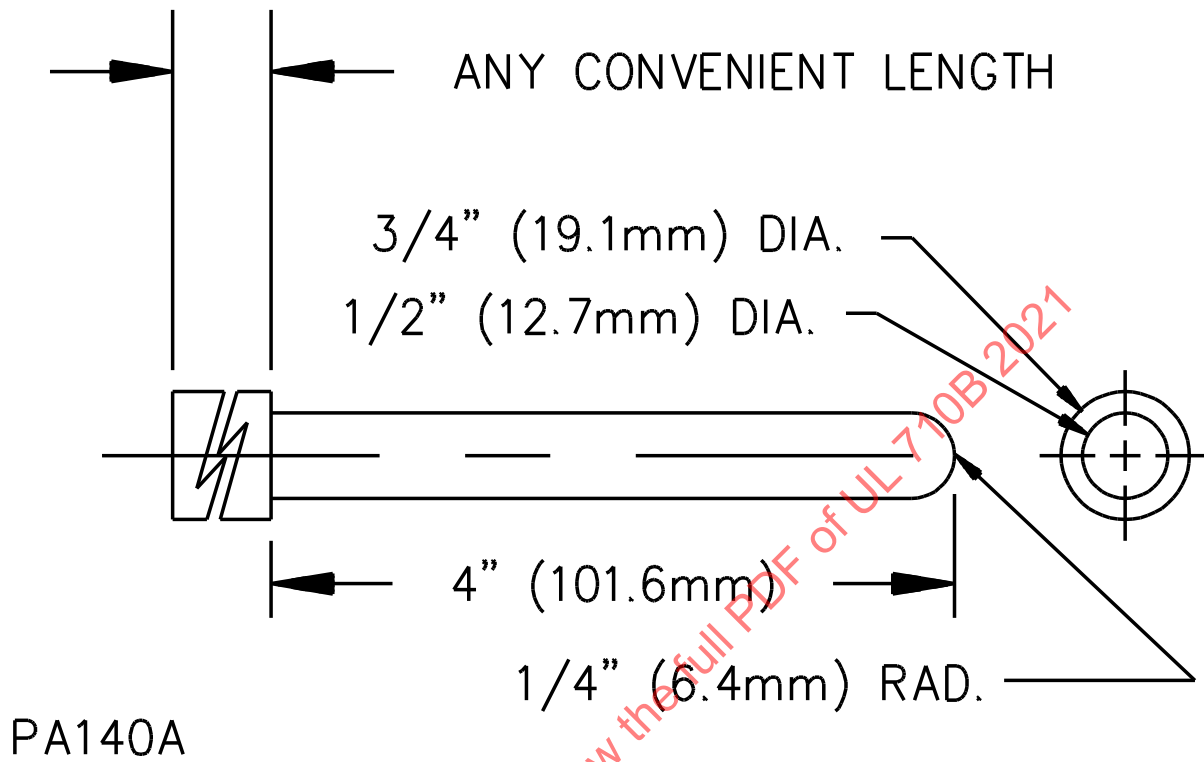


Figure 9.2  
Probe for film-coated magnet wire of a motor



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Figure 9.3  
Accessibility probe

