



UL 462

STANDARD FOR SAFETY

Heat Reclaimers for Gas-, Oil-, or Solid Fuel-Fired Appliances

UL Standard for Safety for Heat Reclaimers for Gas-, Oil-, or Solid Fuel-Fired Appliances, UL 462

Third Edition, Dated December 13, 2010

Summary of Topics

This revision to UL 462 is being issued to remove the reference to the withdrawal date of UL 873 and to address universal upkeep of UL Standards for Safety. These revisions are considered to be non-substantive and not subject to UL's STP process.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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December 13, 2010

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

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INTRODUCTION

1 Scope

1.1 These requirements cover heat reclaimers which are intended to recover a portion of heat from the flue gases of gas-, oil-, or solid fuel-fired appliances for the purpose of heating space or water. They are for installation on the vent or chimney connectors of the appliances which are for attachment to a Type B or Type L vent or a metal or masonry chimney. The heat reclaimers are covered for the maximum flue gas temperature marked on the heat reclaimer, which does not exceed 1000°F (538°C).

1.2 The heat reclaimers are intended for installation by a qualified agency in accordance with the manufacturer's instructions and the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances, NFPA 211 or with the National Fuel Gas Code, NFPA 54/ANSI Z223.1.

1.3 These heat reclaimers intended for connection to an electrical supply are to be rated 240 volts or less, and are for installation in accordance with the requirements for ordinary locations in the National Electrical Code, NFPA 70.

1.4 Heat reclaimers which include plumbing connections are to be installed in accordance with the applicable plumbing codes.

2 Components

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

2.2 A component need not comply with a specific requirement that:

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

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

2.4 Specific components are recognized as being 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 for which they have been recognized.

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 CHIMNEY CONNECTOR – The pipe which connects a fuel-burning appliance to a chimney.

5.3 COMBUSTIBLE MATERIAL, COMBUSTIBLE PRODUCTS, NONCOMBUSTIBLE MATERIALS – These terms, as used in this standard, are defined in the Standard Glossary of Terms Relating to Chimneys, Vents, and Heat-Producing Appliances, NFPA 97M.

5.4 DRAFT DIVERTER – (Also referred to as a Draft Hood.) A device built into a gas burning appliance or made a part of the vent connector from an appliance, which is intended to:

- a) Provide for the ready escape of the flue gases from the appliance in the event of no draft, back draft, or stoppage beyond the draft diverter,
- b) Prevent back draft from entering the heating appliance, and
- c) Neutralize the effect of stack action of the chimney or gas vent upon the operation of the appliance.

5.5 DRAFT REGULATOR, BAROMETRIC – A device which functions to maintain a desired draft in the oil-fired appliance by automatically reducing the chimney draft to the desired value.

5.6 ELECTRICAL CIRCUITS:

- a) High-Voltage Circuit – For the purpose of this standard, a circuit involving a potential of not more than 240 volts and having circuit characteristics in excess of those of a low-voltage or an isolated limited secondary circuit.
- b) Low-Voltage Circuit – A circuit involving a potential of not more than 30 volts alternating current (ac) [42.4 volts peak or direct current (dc)] and supplied by a primary battery or by a standard Class 2 transformer, or by a combination of transformer and fixed impedance which, as a unit, complies with all the performance requirements for a Class 2 transformer. (A circuit derived from a source of supply classified as a high-voltage circuit, using resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low-voltage nor an isolated limited secondary circuit.)
- c) Safety-Control Circuit – A circuit involving one or more safety controls.

5.7 **SOLID FUEL-FIRED APPLIANCE** – A heating appliance which has a freestanding fire chamber assembly of the circulating or direct radiation type. Solid fuel units are for attachment to a residential type chimney available for use with low-heat appliances and may be used to burn solid fuels commonly used in fireplaces. These units may be thermostatically controlled.

5.8 **VENT CONNECTOR** – The pipe which connects a gas-burning appliance to a vent.

CONSTRUCTION

6 Components

6.1 See 2.1 – 2.4 for requirements covering the construction and use of components on the heat reclaimers covered by this standard.

7 Assembly

7.1 All components necessary for the intended function of the heat reclaimer shall be included with the product.

7.2 A joint in the metal surface of a heat reclaimer which forms a passageway for the flue gases shall be tight, as attained by being welded, lock-seamed, riveted, bolted, or equivalent means. A joint shall not depend primarily on cement for tightness.

7.3 A heat reclaimer shall be provided with means other than vent or chimney connection for support of the assembly when it is installed.

7.4 A heat reclaimer for oil- and solid fuel-fired appliances shall include means for cleaning the passageways for flue gases without having to disassemble the heat reclaimer.

7.5 With respect to 7.4, an independently removable access panel that can be removed and replaced by use of conventional tools without moving the heat reclaimer from its installed position is not considered disassembly. When closed, this access panel shall form a tight seal to prevent leakage of flue gases.

7.6 A heat reclaimer shall be constructed so there is no reduction in the total free venting area as compared to the cross-sectional area of a chimney or vent connector pipe on which the heat reclaimer is to be installed. Also, it shall not significantly impede the flow of vent gases. This is to be determined by tests in accordance with Draft Loss Test, Section 28.

7.7 Unless a heat reclaimer that is intended to heat water is limited for installation on a water heating appliance and connected to the appliance such that the temperature of the water is regulated and limited by the controls on the appliance, it shall be provided with means to limit the temperature of the water flowing through the heat reclaimer to 210°F (99°C). See 27.2.1 – 27.2.2.

7.8 If a heat reclaimer is provided with a temperature-operated control for operation of the blower or a pump motor and the control is required to achieve conformance with 6.1.7, the temperature operated control shall comply with the Standard for Limit Controls, UL 353.

7.9 The heat exchanger of a heat reclaimer intended to heat water shall be of sufficient strength to withstand the Hydrostatic Strength Test as described in Section 29.

8 Materials

8.1 The outer casing or jacket of a heat reclaimer shall be made of steel or equivalent material, reinforced or formed if necessary, so that it is not likely to be damaged through handling in shipment, installation, and use. Sheet metal casings shall be made of steel having a minimum thickness of 0.020 inch (0.51 mm) if uncoated, or 0.023 inch (0.58 mm) if galvanized, or of nonferrous sheet metal having an average thickness of not less than 0.029 inch (0.74 mm), and all surfaces shall be protected against corrosion. The finish on the outer casing or jacket of the heat reclaimer shall not be damaged by heat during any of the tests.

8.2 A flueway of a heat reclaimer shall be constructed of cast iron or galvanized sheet steel having thickness of at least 0.032 inch (0.8 mm) for a heat reclaimer up to 16 inches (406 mm) in diameter, whereby the flue collar size determines the size of the heat reclaimer. For a heat reclaimer greater than 16 inches diameter the flueway of the same materials shall be at least 0.056 inch (1.42 mm) thick. Materials which provide equivalent rigidity, strength, durability and resistance to corrosion may be used.

8.3 A flue collar forming part of a heat reclaimer serving as a means of attachment to the vent or chimney connector pipe shall have the rigidity, heat resistance, and corrosion resistance at least equivalent to that of galvanized sheet steel having a thickness of not less than specified in Table 8.1.

Table 8.1
Minimum thickness of flue collars

Diameter of flue collar, inches (mm)	Minimum wall thickness, inch (mm)
Less than 6 (152)	0.019 (0.48)
from 6 (152) to 10 (254)	0.023 (0.58)
over 10 (254) up to 16 (406)	0.029 (0.74)
over 16 (406)	0.056 (1.42)

8.4 A radiation shield or baffle employed to prevent temperatures greater than those specified in Table 25.2 for electrical components shall be so constructed, formed, and supported, for the intended positioning and to prevent distortion or sagging in service. It shall be protected against corrosion and the finish shall not be damaged by heat when the heat reclaimer is tested under these requirements if the deterioration of the finish may cause temperatures greater than those specified in Table 25.2 on parts which it is intended to shield.

8.5 Alloys containing more than 1 percent magnesium shall not be used if the reflectivity of the material is employed to reduce the risk of fire.

9 Electrical Enclosures

9.1 General

9.1.1 Uninsulated live high-voltage parts shall be enclosed or guarded so that unintentional contact by persons during intended use of the equipment is not likely. This applies also to such parts located in a compartment into which access is required for intended care of the heat reclaimer, such as resetting controls, replacing filters, lubrication, cleaning, or the like.

9.1.2 The enclosure shall prevent the emission of molten metal, burning insulation, flaming particles, or the like, through openings onto combustible material.

9.1.3 Among the factors taken into consideration when judging the acceptability of an enclosure are:

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

For a nonmetallic enclosure or part of an enclosure, all these factors are considered with respect to thermal and chemical aging.

9.1.4 Sheet metal for the individual enclosure of electrical components shall comply with Table 9.1 or 9.2, as applicable.

Table 9.1
Minimum thickness of sheet metal for enclosures – carbon steel or stainless steel

Without supporting frame ^a				With supporting frame or equivalent reinforcing ^a				Minimum thickness in inches (mm)			
Maximum width ^b		Maximum length ^c		Maximum width ^b		Maximum length		Uncoated (MSG)		Metal coated (GSG)	
inches	(cm)	inches	(cm)	inches	(cm)	inches	(cm)				
4.0	(10.2)	Not limited		6.25	(15.9)	Not limited		0.020 ^d	(0.51)	0.023 ^d	(0.58)
4.75	(12.1)	5.75	(14.6)	6.75	(17.1)	8.25	(21.0)	(24)		(24)	
6.0	(15.2)	Not limited		9.5	(24.1)	Not limited		0.026 ^d	(0.66)	0.029 ^d	(0.74)
7.0	(17.8)	8.75	(22.2)	10.0	(25.4)	12.5	(31.8)	(22)		(22)	
8.0	(20.3)	Not limited		12.0	(30.5)	Not limited		0.032	(0.81)	0.034	(0.86)
9.0	(22.9)	11.5	(29.2)	13.0	(33.0)	16.0	(40.6)	(20)		(20)	
12.5	(31.8)	Not limited		19.5	(49.5)	Not limited		0.042	(1.07)	0.045	(1.14)
14.0	(35.6)	18.0	(45.7)	21.0	(53.3)	25.0	(63.5)	(18)		(18)	
18.0	(45.7)	Not limited		27.0	(68.6)	Not limited		0.053	(1.35)	0.056	(1.42)
20.0	(50.8)	25.0	(63.5)	29.0	(73.7)	36.0	(91.4)	(16)		(16)	

Table 9.1 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness in inches (mm)	
Maximum width ^b	Maximum length ^c	Maximum width ^b	Maximum length	Uncoated (MSG)	Metal coated (GSG)
inches (cm)	inches (cm)	inches (cm)	inches (cm)		
^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal that is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and that has sufficient torsional rigidity to resist the bending moments that may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure that is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes: (1) a single sheet with single formed flanges (formed edges), (2) a single sheet that is corrugated or ribbed, and (3) an enclosure surface loosely attached to a frame, for example, with spring clips ^b The width is the smaller dimension of a rectangular sheet metal piece that is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet. ^c For panels which are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.					

Table 9.2

Minimum thickness of sheet metal for enclosures – aluminum, copper, or brass

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness, inch (mm)
Maximum width ^b	Maximum length ^c	Maximum width ^b	Maximum length	
inches (cm)	inches (cm)	inches (cm)	inches (cm)	
3.0 (7.6)	Not limited	7.0 (17.8)	Not limited	0.023 (0.58)
3.5 (8.9)	4.0 (10.2)	8.5 (21.6)	9.25 (24.1)	0.029 (0.74)
4.0 (10.2)	Not limited	10.0 (25.4)	Not limited	0.036 (0.91)
5.0 (12.7)	6.0 (15.2)	10.5 (26.7)	13.5 (34.3)	0.045 (1.14)
6.0 (15.2)	Not limited	14.0 (35.6)	Not limited	0.058 (1.47)
6.5 (16.5)	8.0 (20.3)	15.0 (38.1)	18.0 (45.7)	0.075 (1.91)
8.0 (20.3)	Not limited	19.0 (48.3)	Not limited	
9.5 (24.1)	11.5 (29.2)	21.0 (53.3)	25.0 (63.5)	
12.0 (30.5)	Not limited	28.0 (71.1)	Not limited	
14.0 (35.6)	16.0 (40.6)	30.0 (76.2)	37.0 (94.0)	
18.0 (45.7)	Not limited	42.0 (106.7)	Not limited	
20.0 (50.8)	25.0 (63.5)	45.0 (114.3)	55.0 (139.7)	
^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal that is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and that has sufficient torsional rigidity to resist the bending moments that may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure that is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes: (1) a single sheet with single formed flanges (formed edges), (2) a single sheet that is corrugated or ribbed, and (3) an enclosure surface loosely attached to a frame, for example, with spring clips ^b The width is the smaller dimension of a rectangular sheet metal piece that is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet. ^c For panels which are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.				

9.1.5 Steel enclosures shall be protected against corrosion by painting, plating, or other equivalent means.

9.1.6 If insulating material other than electrical insulation is provided within the enclosure, consideration is given to the burning characteristics and combustibility of the material and the proximity of an ignition source.

9.1.7 All intended mounting positions of the heat reclaimer are to be considered when determining if it complies with the requirement of 9.1.2 and 9.1.6.

9.2 Doors and covers

9.2.1 A cover or access panel of an enclosure for uninsulated live parts shall be provided with means for securing it in place.

9.2.2 A hinged or pivoted panel or cover shall be positioned or arranged so that it is not subject to falling or swinging due to gravity or normal vibration in such a manner as to cause injury to persons by the panel or cover, or by the hazardous moving parts or uninsulated live parts that are accessed due to opening of the cover.

9.2.3 The equipment shall be so arranged that an overcurrent protective device such as a fuse, the intended protection functioning of which requires renewal, can be replaced, and manual-reset devices can be reset without removing parts other than a service cover or panel and a cover or door enclosing the heat reclaimer. See 9.2.6.

9.2.4 A required protective device shall be inaccessible from outside the heat reclaimer without opening a door or cover, except that the operating handle of a circuit breaker, the operating button of a manually operable motor protector, the reset button of a manually resettable temperature switch, and similar parts may project outside the heat reclaimer enclosure.

9.2.5 A fuseholder shall be so constructed, installed, or protected that adjacent uninsulated high-voltage live parts within 4 inches (102 mm), other than the screw shell of a plug fuseholder, cartridge fuse clips, or wiring terminals to the fuseholder, will not be exposed to contact by persons removing or replacing fuses. An insulating barrier of vulcanized fiber or similar material employed for this purpose shall be not less than 0.028 inch (0.71 mm) in thickness.

9.2.6 The door or cover of an enclosure shall be hinged if it gives access to fuses or any motor overload protective device, the intended protective functioning of which requires renewal, or if it is necessary to open the cover in connection with the intended operation of the protective device such as resetting a manual reset overload protective device.

Exception: A hinged cover is not required if the only fuses enclosed are:

- a) Control-circuit fuses of 2 amperes or less, provided 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) Extractor-type fuses each with its own enclosure, or*
- c) Fuses in low-voltage circuits.*

9.2.7 Hinged covers, where required, shall not depend solely upon screws or other similar means requiring the use of tools to hold them closed, but shall be provided with a catch or spring latch.

9.2.8 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the door in place and would require some effort on the user's part to open it is considered to be a means for holding the door in place as required in 9.2.7.

9.2.9 A door or cover giving direct access to fuses in other than low-voltage circuits shall shut closely against a 1/4-inch (6.4-mm) rabbet or the equivalent, or shall have either turned flanges for the full length of four edges or angle strips fastened to it. Flanges or angle strips 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 construction which provides equivalent protection, such as a fuse enclosure within an outer enclosure or a combination of flange and rabbet may be used.

9.2.10 Strips used to provide rabbets, or angle strips fastened to the edges of a door, shall be secured at not less than two points, not more than 1-1/2 inches (38.1 mm) from each end of each strip and at points between these end fastenings not more than 6 inches (152 mm) apart.

9.3 Openings

9.3.1 During the examination for conformance with the requirements of 9.3.3, 9.3.4, and 9.3.5, a part of the enclosure, including air filters, which may be removed without the use of tools, is to be removed.

9.3.2 The acceptability of openings in an enclosure shall be determined on the basis of possible emission of flame, burning particles and molten metal and accessibility of bare live parts and film-coated wire in accordance with 9.3.4 – 9.3.13.

9.3.3 An opening in an enclosure to provide clearance around a dial, knob, lever, or handle shall not allow the entrance of a rod having a diameter of 9/64 inch (3.6 mm) at any setting or position of the dial, knob, or the like. The probe illustrated by Figure 9.1 shall not contact uninsulated live part or film-coated wire through such opening.

9.3.4 Except as permitted in 9.3.3 and 9.3.6 – 9.3.9, the enclosure shall have no openings other than:

- a) Not more than four unused holes intended for mounting various components inside the enclosure. The largest dimension of each such opening shall not be greater than 5/32 inch (4.0 mm) (No. 8 screw diameter).
- b) Not more than four holes 1/8 inch (3.2 mm) or less in diameter for the escape of air or drainage of paint during the painting process if they are located as close to the corners of the enclosure as possible.

9.3.5 Ventilating openings in an enclosure shall be judged on the basis of the necessity for their existence and their size and location in accordance with the following:

- a) A ventilating opening shall be necessary to prevent the attainment of excessive temperatures on parts of the heat reclaimer, as demonstrated by a heating test with such opening(s) blocked.
- b) Openings shall not be located in the bottom of the enclosure.
- c) The location of the ventilating openings shall conform with the requirements of 14.2.6.

- d) If an enclosure houses fuses, or any portion of a circuit breaker other than the operating handle, ventilating openings shall not be provided unless the construction affords containment of electrical fault disturbances equivalent to that provided by the requirements in 9.3.1 and 9.3.2.
- e) The compartment or that part of an enclosure which contains field-wiring splices in the high-voltage circuit shall not be provided with ventilating openings.
- f) There shall be no emission of flame or molten material, or other risk of fire, during all tests, such as transformer burnout and burnout of relays with blocked armature.
- g) An opening shall not permit entrance of a 3/4-inch (19.1-mm) diameter rod.

The technical drawing illustrates the PA100A antenna mast through three primary views:

- Front View (Left):** Shows the mast's profile with a base width of 78 mm and a top diameter of 16 mm. It features four mounting holes along its length. Key dimensions include a total height of 97 mm, a base thickness of .05 mm, and various hole spacings (.05 mm). A section line A-A is indicated.
- Side View (Right):** Provides a detailed view of the mast's taper and mounting details. The total height is 234 mm. Mounting holes are positioned at heights of 30, 60, 90, 96, 100, 136, 154, and 234 mm from the base. The top has an approximate 30-degree angle. Other dimensions shown are 5.0, 5.8, 15, 19, 21.5, and 25.4 mm.
- Cross-Sectional Views:**
 - SECTION A-A (Top Left):** A circular cross-section with a hatched pattern and a radius of 3.5 mm.
 - Bottom Section:** A longitudinal cross-section of the base flange, showing two mounting slots and a central hole. It includes radii of 25 mm at the ends and a central hole diameter of 25.4 mm.

ALL DIMENSIONS IN MILLIMETERS

PA100A

9.3.6 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part or film-coated wire, an opening in an enclosure shall comply with either item a or b.

- a) For an opening that has a minor dimension (see 9.3.10) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 9.1.
- b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 9.3.

Exception: An opening in an integral enclosure of a motor need not comply with these requirements if it complies with the requirements in 9.3.7.

Table 9.3
Minimum acceptable distance from an opening to a part that may involve a risk of electric shock

Minor dimensions of opening ^a		Minimum distance from opening to live part or file-coated wire	
Inches	(mm) ^b	Inches	(mm)
3/4	(19.1) ^c	4-1/2	(114)
1 ^c	(25.4) ^c	6-1/2	(165)
1-1/4	(31.8)	7-1/2	(190)
1-1/2	(38.1)	12-1/2	(318)
1-7/8	(47.6)	15-1/2	(394)
2-1/8	(54.0)	17-1/2	(444)
d		30	(762)
^a See 9.3.10.			
^b Between 3/4 and 2-1/8 inches, interpolation is to be used to determine a value between values specified in the table.			
^c Any dimensions less than 1 inch applies to a motor only.			
^d More than 2-1/8 inches, but not more than 6 inches (152.0 mm).			

9.3.7 With respect to a part or wire as mentioned in 9.3.6, in an integral enclosure of a motor as mentioned in the exception to 9.3.6:

- a) An opening that has a minor dimension (see 9.3.10) less than 3/4 inch (19.1 mm) is acceptable if:
 - 1) Film-coated wire cannot be contacted by the probe illustrated in Figure 9.3;
 - 2) In a directly accessible motor (see 9.3.11), an uninsulated live part cannot be contacted by the probe illustrated in Figure 9.2; or
 - 3) In an indirectly accessible motor (see 9.3.11), an uninsulated live part cannot be contacted by the probe illustrated in Figure 9.2.
- b) An opening that has a minor dimension of 3/4 inch or more is acceptable if a part or wire is spaced from the opening as specified in Table 9.3.