



UL 823

STANDARD FOR SAFETY

Electric Heaters For Use In Hazardous
(Classified) Locations

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UL Standard for Safety for Electric Heaters For Use in Hazardous (Classified) Locations, UL 823

Ninth Edition, Dated October 20, 2006

Summary of Topics

This revision to ANSI/UL 823 dated January 11, 2021 includes the following changes in requirements:

– Revisions to include +60°C and -60°C explosion testing with test factors using precompression explosion testing equipment; [1.7](#), [33.28](#), [33.28A](#), [33.28B](#), [Table 33.4](#), [Section 34A](#), [SB1.29](#) – [SB1.31](#) and [Table SB1.6](#)

– Revisions to permit the use of electronic medium for required documentation; [55.20](#), [55.26](#), and [Section 56](#)

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 May 22, 2020 and October 23, 2020.

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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 <https://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover explosion-proof, dust-ignition-proof and dust-tight portable and fixed electric heaters for installation and use in hazardous (classified) locations, Class I, Divisions 1 and 2, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class II, Division 2, Groups F and G; and Class III, Divisions 1 and 2, in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover explosion-proof electrical equipment for installation and use in Class I, Zone 1, Groups IIA, IIB and IIC hazardous (classified) locations and dust-ignition-proof equipment for use in Zone 20, 21, and 22 locations.

1.3 These requirements also cover explosion-proof electrical equipment that has been investigated for use in one or more specific gas or vapor atmospheres with or without additional Class I Groups. See [55.4](#).

1.4 These requirements cover electric air heaters, electric hot-water or steam radiators, and electric hot plates rated 600 volts or less.

1.5 These requirements also cover paint heaters, rated 600 volts or less, for use at pressures not exceeding 100 psig (690 kPa). Paint heaters operating at more than 100 psig may be investigated in accordance with these requirements and any additional requirements judged to be necessary.

1.6 These requirements do not cover medical equipment.

1.7 These requirements cover heaters for use only under the following atmospheric conditions:

- a) A minimum ambient temperature of minus 60°C (minus 76°F);
- b) An oxygen concentration not greater than 21 percent by volume; and
- c) A nominal barometric pressure of one atmosphere.

2 General

2.1 An electric heater for use in hazardous locations shall also comply with the applicable requirements for a similar product for use in ordinary locations.

2.2 An electric heater for Class III locations shall comply with requirements for Class II, Group G, except that an enclosure for Class III, Division 2 shall be of the type described in [45.3](#).

3 Components

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

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

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

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

3.4 Specific components are incomplete in construction features or are 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.

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.

6 Enclosure Types

6.1 A heater that is marked enclosure Type 7 shall comply with the applicable requirements for Class I. A heater that is marked enclosure Type 9 shall comply with the applicable requirements for Class II.

6.2 An enclosure that is intended for use in other environmental conditions shall also comply with the applicable requirements for each enclosure type, for example Type 3, 4X, or 6, specified in the Standard for Enclosures for Electrical Equipment, UL 50.

7 Class I, Zone and Group Equivalency

7.1 Class I, Zone 1, Group IIA

7.1.1 Explosion-proof electrical equipment intended to be marked in accordance with [55.2](#) shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group D hazardous (classified) locations.

7.2 Class I, Zone 1, Group IIB

7.2.1 Explosion-proof electrical equipment intended to be marked in accordance with [55.3](#) shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group C hazardous (classified) locations.

7.3 Class I, Zone 1, Group IIC

7.3.1 Explosion-proof electrical equipment intended to be marked in accordance with [55.5](#) shall comply with all the requirements for explosion-proof electrical equipment for use in both Class I, Group A and Class I, Group B hazardous (classified) locations.

7.4 Zone 20, Zone 21, and Zone 22

7.4.1 Dust-ignition-proof electric heaters intended to be marked Zone 20 and 21 in accordance with [55.8](#) shall comply with all the requirements for dust-ignition-proof electrical equipment for use in Class II, Division 1 hazardous (classified) locations.

7.4.2 Dusttight electric heaters intended to be marked Zone 22 in accordance with [55.9](#) shall comply with all the requirements for Dusttight electric heaters for use in Class II, Division 2 hazardous (classified) locations.

8 Glossary

8.1 For the purpose of this Standard, the following definitions apply.

8.2 AXIAL JOINT SECTION – The portion of a flat, labyrinth, or rabbet joint that is parallel to the axis of the parts forming the joint.

8.3 CEMENTED JOINT – A joint which relies upon a cement or other similar compound to prevent the propagation of an explosion to a surrounding atmosphere by filling all voids between the mating parts forming the joint, such that no flamepath exists. Intended for joints which are not disturbed after assembly. See [11.2](#).

8.4 CLEARANCE, AXIAL – The clearance between parts forming the axial joint section.

8.5 CLEARANCE, DIAMETRICAL – The clearance between two parts measured as the difference in the diameters.

8.6 CLEARANCE, RADIAL – The clearance between parts forming the joint section radiating from the axis or center.

8.7 FLAMEPATH – The joint formed upon assembly of parts that are intended to arrest the flame and vent hot gases produced when an ignition of an explosive atmosphere takes place within an explosion-proof enclosure.

8.8 INTERNAL LENGTH OF JOINT – The distance from the innermost point to the outermost point of the joint formed upon assembly of the parts comprising that joint.

8.9 LABYRINTH JOINT – A joint consisting of an arrangement of mating steps, grooves or collars consisting of two or more axial sections having one radial section between each axial section, or two or more radial sections with one axial section between each radial section, whereby the flame path changes direction more than twice.

8.10 RABBET JOINT – A rabbet joint consists of an axial section and a radial section that form a right angle, whereby the flamepath must change direction. A rabbet joint is also known as a spigot joint.

8.11 RADIAL JOINT SECTION – The portion of the joint that is perpendicular to the axis of the parts forming the joint.

8.12 SEALED JOINT – A joint where a sealing material applied to a joint surface does not increase the maximum clearance between joint surfaces beyond the dimensions specified in this Standard. See [11.3.1](#) and [19.4](#).

8.13 SHAFT PATH – A path formed upon assembly of a shaft and shaft opening in an enclosure.

8.14 STRAIGHT OR FLAT JOINT – A joint where, upon assembly of the parts forming the joint, a straight flame path in a single plane is formed.

8.15 TEST FACTOR – A factor of safety imposed upon a test condition.

8.16 **THREADED JOINT** – A joint formed upon assembly of two mating threaded sections.

CONSTRUCTION – ALL HEATERS

9 General

9.1 A portable heater shall be of the hand-held type or shall be mounted on a movable base or stand with or without casters or wheels.

10 Enclosure

10.1 Enclosure

10.1.1 The enclosure housing the electrical components, such as heater elements, switches, and thermostats, shall be made of iron, steel, copper, brass, bronze, aluminum, or an alloy containing not less than 80 percent aluminum, or shall be made of nonmetallic material which complies with the requirements in Section 32, Non-Metallic Enclosure Materials Tests. A metal such as zinc or magnesium or their alloys shall not be used.

10.1.2 Copper shall not be used for the enclosure of an electric heater for use in Class I, Group A locations. A copper alloy shall not be used for an enclosure unless it is coated with tin, nickel, or other acceptable coating, or unless the copper content of the alloy is not more than 30 percent.

10.2 Thickness

10.2.1 Except as indicated in 10.2.2 and 10.2.3, the thickness of enclosure walls shall not be less than specified in Table 10.1.

Table 10.1
Thickness of metal for enclosure

Maximum enclosure dimensions				Minimum thickness, inch (mm)					
Length or diameter,		Area of any one surface,		Cast brass, bronze, copper, of malleable iron		Cast iron and aluminum		Sheet steel	
inches	(m)	square inches	(m ²)						
22	(0.56)	480	(0.31)	0.093	(2.36)	0.125	(3.18)	0.067	(1.70)
30	(0.76)	620	(0.40)	0.093	(2.36)	0.125	(3.18)	0.093	(2.36)
60	(1.52)	1500	(0.97)	0.125	(3.18)	0.187	(4.75)	0.125	(3.18)
Over 60	(over 1.52)	Over 1500	(over 0.97)	0.187	(4.66)	0.250	(6.55)	0.187	(4.66)

10.2.2 A heating element shall be permitted to have a sheath thickness less than 3/32 inch (2.4 mm) if the element:

- a) Is cast in metal, with the cast metal not less than 1/8 inch (3.2 mm) thick over the sheath; or
- b) Complies with the Dielectric Voltage-Withstand Test, Section 29, and the manufacturing and production tests specified in 51.1(c).

10.2.3 A sheet-metal enclosure of a heater for use in Class II locations shall be permitted to have a thickness not less than specified in Table 10.2 if the heater is intended only for:

- a) Ceiling mounting and is marked in accordance with [55.16](#); or
- b) Wall mounting, complies with the requirements in [29.3](#) and [29.4](#), and is marked in accordance with [55.17](#).

Table 10.2
Thickness of sheet metal for Class II locations

Specific construction ^a		Minimum thickness of sheet metal, inch (mm)					
		Uncoated steel		Zinc-coated steel		Copper, brass, or aluminum	
At Openings for Conduit		0.032	(0.81)	0.034	(0.86)	0.040	(1.02)
Length more than 26 inches (660 mm)	Component Support	0.026	(0.66)	0.029	(0.74)	0.032	(0.81)
	No Component Support	0.020	(0.51)	0.023	(0.58)	0.025	(0.64)
Length not more than 26 inches	Component Support	0.020	(0.51)	0.023	(0.58)	0.025	(0.64)
	No Component Support	0.016	(0.41)	0.019	(0.48)	0.020	(0.51)

NOTE – This table applies only to heaters as described in [10.2.3](#) and [39.2.2.1](#).

^a A component refers to an electrical device, such as a lampholder, switch, and the like.

10.2.4 [Table 10.2](#) applies to any single surface of a single flat sheet. Rigid members consisting of 1/2 by 1/2 inch (12.7 by 12.7 mm), 90-degree angle strips formed of sheet steel not less than 0.032 inch (0.81 mm) thick, or flat steel bars not less than 3/8 inch (9.5 mm) thick shall be permitted to be used to reinforce and divide a large area into sections for which thinner metal shall be permitted to be used. Such reinforcement, unless along the longer dimensions of the surface, is to be additionally secured to the adjacent sides of the enclosure. A single piece of sheet metal that is corner-bent to form an angle of not more than 120 degrees is considered to be reinforced along the bend, and its thickness shall be permitted to be based on the length of the largest flat surface involved.

10.2.5 A machined or threaded joint in the wall of a cast-metal enclosure shall have at least the thickness specified in [Table 10.1](#) through the overlap.

11 Joints in Enclosures

11.1 General

11.1.1 Joints in an enclosure shall comply with the applicable requirements in [11.1.2](#) – [11.7.3.1](#), and Section [33](#), Explosion Tests.

Exception: This requirement does not apply to joints that comply with the requirements in Supplement [SA](#), Alternative Joints in Enclosures, and Supplement [SB](#), Alternative Explosion Tests.

11.1.2 A joint in an enclosure shall be of the metal-to-metal, metal-to-glass, metal-to-polymeric, polymeric-to-polymeric, or polymeric-to-glass type. The joint surface shall have an arithmetical average roughness of not more than 250 microinches (0.0064 mm), in accordance with the Standard for Surface Texture, ANSI/ASME B46.1.

11.2 Cemented joints

11.2.1 When a part that is not intended to be removed after assembly, and that is not required to be opened to install or service the equipment is sealed with a sealing compound, the sealing compound shall:

- a) For Class I equipment, resist solvent action in compliance with [32.5](#), Tests on sealing compounds;
- b) Resist moisture in compliance with UL 1203, High Humidity Tests; and
- c) Comply with the requirements of [29.2](#), Impact test, without loosening or cracking, or showing other signs of deterioration.

11.2.2 The length of the compound seal shall be either the minimum length of joint required for an unsealed joint, or 5/8 inch (15.9 mm), whichever is less.

11.2.3 The cement shall contain no voids between the mating parts forming the joint.

11.2.4 The cement shall not be relied upon for mechanical security of the joint.

11.3 Joints with flamepaths Class I, Groups A, B, C, and D

11.3.1 A sealing material applied to a joint surface in accordance with Exception No. 1 to [21.3](#) shall not increase the maximum clearance between joint surfaces beyond the dimensions specified in this Standard.

11.3.2 A polymeric-to-polymeric joint shall be of the labyrinth or threaded type, and shall comply with the requirements in Section [32](#), Non-Metallic Enclosure Materials Tests.

11.3.3 The free-internal volume is determined to be the total internal volume of an electrical enclosure minus the volume of internal components. The volume of potting compounds is not used in the determination of the free-internal volume.

Exception No. 1: Potting compounds used for factory-installed lead wire seals, coil encapsulation, or coilinsulation are to be used in the determination of the free-internal volume.

Exception No. 2: Potting compounds are to be used in determining the free-internal volume when the compounds:

- a) Have been investigated to determine that they will withstand exposure to the flammable vapors involved in that they will remain in place inside the enclosure; and*
- b) Are free of voids.*

11.3.4 A feeler gauge utilized to measure the clearances specified in these requirements is to be 1/8 to 1/2 inch (3.2 to 12.7 mm) wide, with a 1/2-inch-wide gauge preferred. The width of the joint is to be measured with the parts forming the joint assembled in the most unfavorable position.

11.3.5 A gasket shall not be employed in a metal-to-metal, metal-to-polymeric, or polymeric-to-polymeric joint. A gasket that is adjacent to a joint and does not increase the clearance, nor decrease the length of the joint specified in this Standard for the Group and type of joint, meets the intent of this requirement.

11.3.6 A gasket functioning as an active member in the flamepath is not prohibited from being employed in a metal-to-glass or polymeric-to-glass joint when the gasket complies with the requirements in [11.3.7](#) –

[11.3.10](#). The maximum clearance between the gasket and the metal, polymeric, or glass shall not be more than that specified in this Standard for the Group and type of joint.

11.3.7 The use of a gasket functioning as an active member in the flamepath shall be limited to a joint that is not disturbed during the installation or intended servicing of the equipment.

11.3.8 A gasket functioning as an active member in the flamepath shall be a metal-covered type, formed from polytetrafluoroethylene, or other material that has been investigated and found capable of being used for the application. A metal-covered gasket in a metal-to-glass or polymeric-to-glass joint shall be mechanically attached to the glass. There shall be no overlapping of the metal covering the gasket on the joint surfaces. A gasket in a metal-to-glass joint shall be subjected to tests to determine the effects of solvent vapors, heat, aging, compression, distortion under conditions of use, and cold flow or creep when the gasket is of the elastomeric or thermoplastic type. The means of securing the gasket to the cover or enclosure, the gasket construction, and the gasket material are to be investigated in determining the tests to be conducted.

11.3.9 When a gasket of polytetrafluoroethylene or similar material is used, it shall be installed in such a manner as to reduce the occurrence of cold flow of the gasket material. The means of securing the gasket to the cover or enclosure, the gasket construction, and the gasket material are to be investigated in determining the tests to be conducted.

11.3.10 A material that upon aging readily hardens or adheres to a joint surface, or both, is not to be used as a gasket material. A gasket which is attached by an adhesive or a cement does not comply with this Standard.

11.3.11 A joint of the labyrinth type shall comply with the requirements in [33.13](#).

11.3.12 A labyrinth joint shall consist of not less than 3 adjacent segments where the path changes direction not less than 2 times.

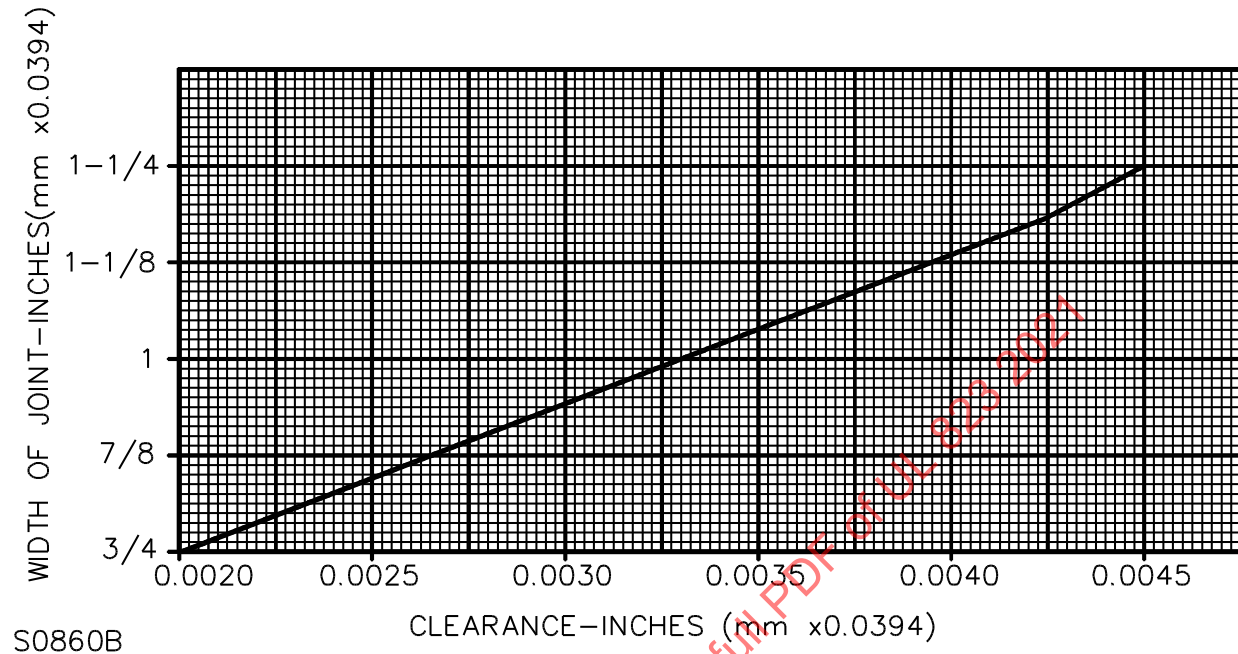
11.4 Class I, Groups C and D locations

11.4.1 General

11.4.1.1 Except as indicated in [11.4.1.2](#) – [11.4.1.5](#) and [11.4.2.1](#), the width of a joint and the clearance, when assembled, shall be as specified in [Figure 11.1](#). The width of the joint shall not be less than 3/4 inch (19.1 mm).

11.4.1.2 A rabbet joint is not prohibited from having a diametrical clearance at the axial section of not more than twice the clearance specified in [Figure 11.1](#) when neither the axial nor the radial section of the joint is less than 1/16 inch (1.6 mm) wide.

Figure 11.1
Relation between clearance and width of joint



11.4.1.3 An enclosure having a free-internal volume of not more than 300 cubic inches (4.92 dm³) is not prohibited from having a 1/2 inch (12.7 mm) wide rabbet joint or a 3/8 inch (9.5 mm) wide flat joint when details comply with (a) or (b), respectively.

a) One-half-inch-wide rabbet joint (see [Figure 11.2](#)).

- 1) Neither the axial nor the radial section of the joint is less than 3/64 inch (1.2 mm) wide;
- 2) The diametrical clearance of the axial section and the clearance of the radial section is not more than 0.002 inch (0.05 mm); and
- 3) The joint width measured from the inside of the enclosure to the nearest edge of each bolt clearance hole and elsewhere is not less than 1/2 inch (12.7 mm).

b) Three-eighths-inch-wide flat joint (see [Figure 11.3](#)).

- 1) The clearance between the joint surfaces is less than 0.0015 inch (0.038 mm) or such that a 0.0015-inch feeler gauge will not enter the joint more than 1/8 inch (3.2 mm) at any point;
- 2) The thickness of the cover at the joint width is not less than 3/8 inch (9.5 mm), unless stiffened or reinforced material less thick has been found to be capable of being used when judged with respect to opening of joint clearance under internal pressures; and
- 3) The joint width measured from the inside of the enclosure to the nearest edge of each bolt clearance hole is not less than 3/8 inch (9.5 mm).