UL 834

STANDARD FOR SAFETY

Heating, Water Supply, and Power Boilers – Electric

UL Standard for Safety for Heating, Water Supply, and Power Boilers – Electric, UL 834

Fifth Edition, Dated April 13, 2004

Summary of Topics

This revision of ANSI/UL 834 dated July 17, 2019 includes Limit control clarifications.

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 revisions are substantially in accordance with Proposal(s) on this subject dated May 17, 2019.

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Standard for Heating, Water Supply, and Power Boilers – Electric

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April 13, 2004

This ANSI/UL Standard for Safety consists of the Fifth edition including revisions through July 17, 2019.

The most recent designation of ANSI/UL 834 as an American National Standard (ANSI) occurred on July 11, 2019. 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 electric heating, water supply, and power boilers rated at 15,000 volts or less intended for commercial or industrial applications utilizing hot water or steam. They may also be used for commercial, industrial, or residential use space heating applications.

1.2 The boilers covered by these requirements are intended for installation in accordance with the National Electrical Code, NFPA 70, the International Mechanical Code, and the Uniform Mechanical Code.

1.3 Each boiler consists of sheathed resistance-type heating elements and a vessel or tank constructed, inspected, and stamped in accordance with the applicable sections of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. Each boiler is provided with one or more safety valves or safety relief valves conforming to ASME requirements with all necessary temperature or pressure regulating controls, including an integral limit control, wiring, and auxiliary equipment assembled as a unit.

1.4 These requirements do not cover water supply boilers and hot water and steam generating equipment employing constructions which are outside the scope of, or not covered by, the ASME codes, nor commercial cooking or medical and dental equipment, nor other electric heating equipment or appliances which are covered in, or as part of, separate, individual requirements. Electrode-type boilers also are not covered by these requirements.

1.5 The equipment covered by this standard shall be one of the following types of water heating boilers:

a) High Pressure – A boiler furnishing:

1) Steam at pressures in excess of 15 psi (103 kPa); or

2) Hot water at temperatures in excess of 250°F (121°C) or at pressures in excess of 160 psi (1103 kPa).

b) Low-Pressure Hot-Water and Low-Pressure Steam – A boiler furnishing:

1) Hot water at pressures not exceeding 160 psi and at temperatures not more than 250°F; or

2) A boiler furnishing steam at pressures not more than 15 psi.

c) Miniature – A boiler that does not exceed the following limits:

1) 16 inches (406 mm) inside diameter of shell; and

2) 5 cubic feet (0.14 m^3) gross volume, exclusive of casing and insulation, and 100 psi (690 kPa) maximum allowable working pressure.

For the applicable ASME Code symbol, see Section 5.

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 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.

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.

2.5 A component of a boiler intended to be manually operated or adjusted or that will definitely require periodic servicing, for example replacement or cleaning, shall be accessible without the use of special tools.

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 Special Designations

5.1 A boiler assembly shall be constructed, equipped, inspected, tested, and marked in accordance with the applicable sections of the ASME Boiler and Pressure Vessel Code. The boiler marking shall consist of the ASME Code symbol and one of the following Designators.

″E″ – Designates a high pressure boiler [see 1.5(a)] constructed as follows:

1) The boiler pressure vessel has been assembled by a manufacturer other than the boiler manufacturer in accordance with the ASME Boiler and Pressure Vessel Code, Section I, Rules for Construction of Power Boilers or Section VIII, Division 1 as permitted by ASME Boiler and Pressure Vessel Code, Section I, Part PEB, Rules for Construction of Pressure Vessels;

2) The pressure vessel is stamped with the ASME Code Designator ″S″, ″M″, or ″U″; and

3) The boiler is assembled by methods that do not involve any welding or brazing of parts to the pressure vessel.

″H″ – Designates a low pressure steam or hot water boiler [see 1.5(b)] constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section IV, Rules for Construction of Heating Boilers.

″M″ – Designates a miniature boiler [see 1.5(c)] constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section I, Part PMB, Rules for Construction of Power Boilers.

″S″ – Designates a high pressure steam or high-temperature water boiler [see 1.5(a)] constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section I, Rules for Construction of Power Boilers.

″U″ – This Designator, along with the letters ″UB″, applies only to a pressure vessel when the vessel is constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels. The boiler has been completed in accordance with Section I, Part PEB, of the ASME Boiler and Pressure Vessel Code, Rule for Construction of Power Boilers.

6 Glossary

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

6.1.1 CONTROL ENCLOSURE PANEL – An enclosure for individual electrical components to prevent accidental contract with energized parts and to protect the components from physical damage.

6.2 PROTECTIVE (SAFETY) CONTROL – A control intended to prevent the risk of electric shock, fire, or injury to persons during abnormal operation of the appliance. An example would be a water temperature limit control. A protective control always provides Type 2 action. (See definitions 6.11 and 6.12.)

6.3 LIMIT CONTROL – A protective (safety) control that is responsive to changes in pressure, temperature, liquid level, or flow. This control may be used for regulating purposes or may be set beyond the intended operating range of the controlled equipment to limit its operation. This control may be electrical or mechanical in nature.

6.4 LOW VOLTAGE CIRCUIT – A circuit involving a potential of not more than 30 volts rms (42.4 volts peak) supplied by a battery or by a standard Class 2 transformer or other acceptable transforming device, or by a combination of transformer and fixed impedance having output characteristics in compliance with requirements established for a Class 2 transformer. A circuit obtained by connecting resistance in series with a line voltage supply circuit as a means of limiting the voltage and current is not considered to be a low voltage circuit.

6.5 OPERATING CONTROL – A control intended to start or regulate the appliance during normal operation. An example would be a water temperature-regulating control. An operating control could provide Type 1 and Type 2 actions. (See definitions 6.11 and 6.12). However, for the purposes of these requirements, is not intended to provide the regulating function of the boiler, see Section 31, Limit Controls.

6.6 PORTABLE – A boiler that is moved or can be easily moved from one place to another in normal use.

6.7 SAFETY RELIEF VALVE – An automatic pressure relieving device actuated by pressure upstream of the valve and characterized by opening pop action with further opening with increase in pressure over the popping pressure.

6.8 SAFETY VALVE – An automatic pressure relieving device actuated by pressure upstream of the valve and characterized by opening pop action.

6.9 TEMPERATURE-PRESSURE RELIEF VALVE – An automatic resetting pressure relieving device, actuated by pressure and by an integral thermal element that is in contact with, or is responsive to, the heated fluid. Functions similar to safety relief valve.

6.10 TRIM – Term used by industry for safety controls (mechanical, electrical, and visible) as stated in the ASME Code. This does not include decorative parts of the boiler. Examples of trim include the following:

a) Hot water heating boilers (Section IV):

1) Pressure gage;

2) Thermometer;

3) Water gage glass(es);

4) Pressure relief valves; and

5) Flow switches.

b) Low pressure steam boilers (Section IV):

1) Water gage glass(es);

2) Steam gages; and

3) Pressure relief valves.

c) High temperature hot water boilers (Section I):

1) Water gage glass(es);

2) Pressure gages;

3) Temperature gages; and

4) Pressure relief valves.

d) High pressure steam boilers (Section I):

1) Water gage glasses (including protective rods or shields on tubular water gage glasses);

2) Water gage glass connections;

3) Gage cocks;

4) Pressure gages; and

5) Pressure relief valves.

6.11 TYPE 1 ACTION – Automatic action for which the manufacturing deviation and the drift of its operating value, operating time, or operating sequence have not been declared and tested to the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1.

6.12 TYPE 2 ACTION – Automatic action for which the manufacturing deviation and the drift of its operating value, operating time, or operating sequence have been declared and tested to the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1.

6.13 MEDIUM VOLTAGE – Voltage greater than 600 V, up to and including 15,000 V.

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CONSTRUCTION

7 Frame and Enclosure

7.1 General

7.1.1 The frame and enclosure of a boiler shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses likely to be encountered during intended service. The degree of resistance inherent in the boiler shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other serious defects that alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

7.1.2 An enclosure for individual electrical components, an outer enclosure, and combinations of the two are considered in determining compliance with 7.1.1.

7.1.3 An enclosure shall be reinforced or formed if necessary so that it is not likely to be damaged through handling in shipment, installation, and use.

7.1.4 Among the factors taken into consideration when an enclosure is being judged for acceptability are:

a) Mechanical strength;

b) Resistance to impact;

c) Moisture absorptive properties;

d) Combustibility;

e) Resistance to corrosion; and

f) Resistance to distortion at temperatures to which the enclosure may be subjected under conditions of normal or abnormal use.

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

7.1.5 An outer cabinet is to be judged with respect to the size, shape, and thickness of metal. See 7.3.1.

7.1.6 An opening for ventilation in the enclosure of a heater or in an externally mounted component shall be located so that it does not vent into concealed spaces of a building structure such as into a false-ceiling space, into hollow spaces in the wall, and the like when the heater is installed as intended.

Exception: This requirement does not apply to an opening for a mounting screw or nail, or for a manufacturing operation (such as paint drainage) if the opening has no dimension more than 17/64 inch (6.75 mm) or an area no more than 0.055 square inch (35.49 mm^2).

7.1.7 An opening for ventilation in the enclosure, other than in the bottom, shall be provided with one or more baffles that will reduce the likelihood of the emission of flame, molten metal, burning insulation, or the like from the boiler. A baffle as illustrated in Figure 7.1 located between an electrical part and an opening is considered to be acceptable.

Exception No. 1: In a compartment other than the one that houses a motor-overload relay or overcurrent-protective device, such as a fuse or circuit breaker, the baffles mentioned above may be omitted if:

a) No ventilating opening in a vertical wall is more than 3/8 inch (9.5 mm) wide; or

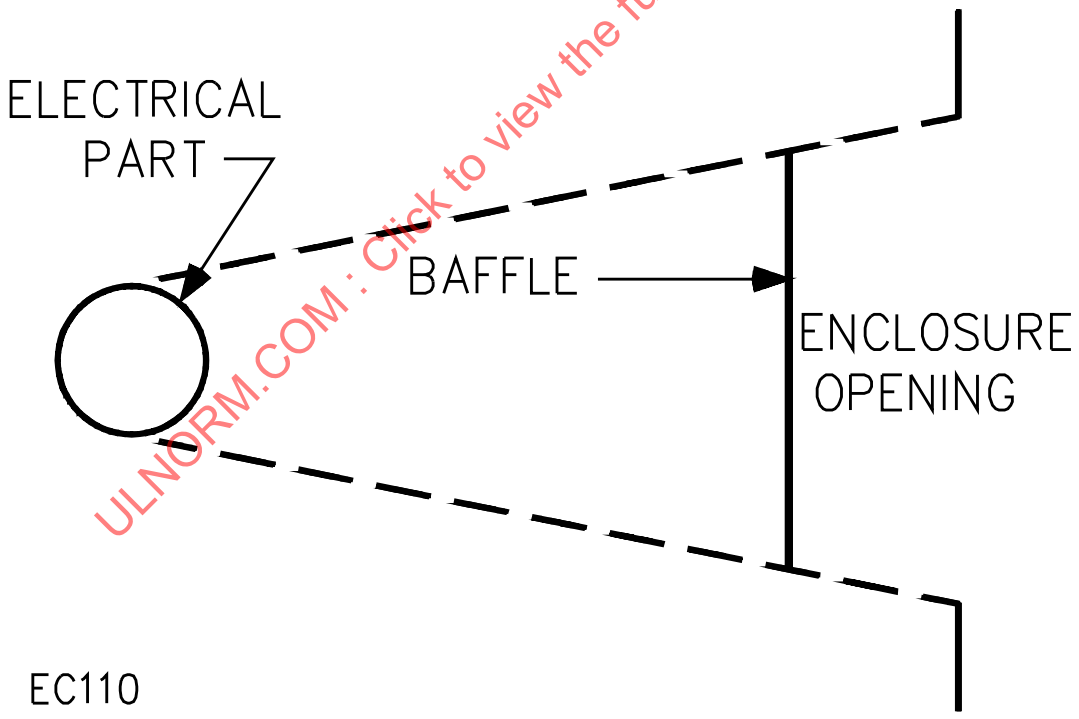
b) The enclosure is constructed so that it is found to be acceptable by short-circuit tests in accordance with Section 50.

Exception No. 2: Louvers in a vertical wall are acceptable without baffling if:

a) The width of each opening is not more than 3/8 inch (9.5 mm); and

b) There is no direct line-of-sight to a motor-overload relay or overcurrent-protective device.

Figure 7.1
Relationship of baffle and electrical part



7.2 Doors and covers

7.2.1 The door or cover of an enclosure shall be provided with means for holding it securely in place in the closed position.

7.2.2 The door or cover of an enclosure shall be hinged if:

a) It gives access to any fuse, circuit breaker, or manual reset temperature control in other than a low-voltage circuit; and

b) Uninsulated live parts are exposed during the routine replacement of the fuse or resetting of the manual reset device. Such a door or cover shall also be provided with an automatic latch (see 7.2.5) or the equivalent. If live parts other than the screw shell of a plug fuseholder are exposed inside the enclosure, a captive screw or equivalent means, which requires the use of a tool or key to open, shall be provided to secure the door or cover in place. See 7.2.3.

Exception: A hinged cover is not required for a device in which the only fuses enclosed are:

a) Control-circuit fuses, 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) An extractor-type fuse with its own enclosure.

7.2.3 The captive screw may be omitted from the door or cover over the compartment housing the uninsulated live parts if it is provided in the cover that must be opened to gain access to the door or cover. An arrangement employing two mating hinged doors is acceptable if the automatic latch and captive screw are provided only on one door if:

a) That door is to be opened first and closed last; and

b) The latch and screw will hold the other door closed.

7.2.4 A door or cover giving access to a fuse, circuit breaker, overload relay, or other overload-protective device in other than a low-voltage circuit shall be tight-fitting and shall overlap the surface of the enclosure around the opening.

7.2.5 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the door closed and requires some effort on the user's part to open it is considered to be an acceptable means for holding the door closed as required by 7.2.2.

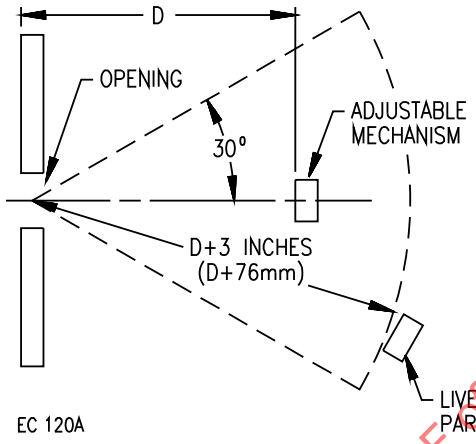
7.2.6 A cover interlocking mechanism is considered to comply with 7.2.2 if it:

a) Must be engaged in the closed position of the cover before parts are energized; and

b) Secures the cover in the closed position, when provided as the sole means for securing the door or cover closed.

7.2.7 If an opening is provided for access to a control that is intended to be reset, adjusted, or otherwise manipulated by the user or service personnel, it shall not be possible to contact live uninsulated or film-coated insulated parts when examined in conjunction with Figure 7.2.

Figure 7.2
Acceptability of live part through adjustment opening



A live part beyond an opening that may be used in making an adjustment that is considered to be a function of user servicing is not considered to be accessible if a 1/16-inch (1.59-mm) diameter straight rod cannot 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 a line drawn between the center of the opening and the center of the face of the adjusting mechanism. The length of the rod beyond the opening shall not exceed the distance between the opening and the face of the adjusting mechanism by more than 3.0 inches (76.2 mm).

7.3 Enclosure thickness

7.3.1 Sheet metal that serves as an electrical enclosure shall comply with Tables 7.1 and 7.2. An enclosure thinner than specified in Tables 7.1 and 7.2 shall comply with 7.1.1 with respect to the following:

a) Location of the enclosure;

b) Construction and location of components; and

c) The strength and rigidity of the frame and enclosure.

Table 7.1
Minimum thickness of sheet metal for electrical 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		Metal coated	
inches	(cm)	inches	(cm)	inches	(cm)	inches	(cm)	(MSG)		(GSG)	
4.0	(10.2)	Not limited		6.25	(15.9)	Not limited		0.020	(0.51)	0.023	(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	(0.66)	0.029	(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)	
22.0	(55.9)	Not limited		33.0	(83.8)	Not limited		0.060	(1.52)	0.063	(1.60)
25.0	(63.5)	31.0	(78.7)	35.0	(88.9)	43.0	(109.2)	(15)		(15)	
25.0	(63.5)	Not limited		39.0	(99.1)	Not limited		0.067	(1.70)	0.070	(1.78)
29.0	(73.7)	36.0	(91.4)	41.0	(104.1)	51.0	(129.5)	(14)		(14)	
33.0	(83.8)	Not limited		51.0	(129.5)	Not limited		0.080	(2.03)	0.084	(2.13)
38.0	(96.5)	47.0	(119.4)	54.0	(137.2)	66.0	(167.6)	(13)		(13)	
42.0	(106.7)	Not limited		64.0	(162.6)	Not limited		0.093	(2.36)	0.097	(2.46)
47.0	(119.4)	59.0	(149.9)	68.0	(172.7)	84.0	(213.4)	(12)		(12)	
52.0	(132.1)	Not limited		80.0	(203.2)	Not limited		0.108	(2.74)	0.111	(2.82)
60.0	(152.4)	74.0	(188.0)	84.0	(213.4)	103.0	(261.6)	(11)		(11)	
63.0	(160.0)	Not limited		97.0	(246.4)	Not limited		0.123	(3.12)	0.126	(3.20)
73.0	(185.4)	90.0	(228.6)	103.0	(261.6)	127.0	(322.6)	(10)		(10)	

[a] A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal which is rigidly attached to, and has essentially the same outside dimensions as, the enclosure surface and which has the torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Constructions that are considered to have equivalent reinforcing may be accomplished by designs that will produce a structure which 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 which is corrugated or ribbed; and

3) An enclosure surface loosely attached to a frame, e.g., with spring clips.

[b] The width is the smaller dimension of a rectangular sheet metal piece which 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, e.g., side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified.

[d] Sheet steel for an enclosure intended for outdoor use is required to be not less than 0.034 inch (0.86 mm) in thickness if metal coated and not less than 0.032 inch (0.81 mm) in thickness if uncoated.