UL 174

STANDARD FOR SAFETY

Household Electric Storage Tank Water Heaters

UL Standard for Safety for Household Electric Storage Tank Water Heaters, UL 174

Eleventh Edition, Dated April 29, 2004

Summary of Topics

This revision of ANSI/UL 174 dated December 16, 2021 includes a clarification of requirement for nonmetallic dip tubes; 17.2.3

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 revised requirements are substantially in accordance with Proposal(s) on this subject dated October 22, 2021.

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The most recent designation of ANSI/UL 174 as an American National Standard (ANSI) occurred on December 10, 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 household electric storage tank and small capacity storage tank water heaters rated no more than 600 volts and 12 kilowatts to be installed in accordance with the National Electrical Code, NFPA 70, and with model plumbing and mechanical codes.

1.2 These requirements do not cover immersed electrode, side arm, booster, instantaneous or immersion type water heaters or water heating portions of water dispensing appliances. These requirements do not cover water heaters with a tank capacity of less than 1 gallon (3.8 L) or more than 120 gallons (454 L).

1.3 Electric booster water heaters, electric commercial storage tank water heaters, and remote control assemblies for such heaters, rated 600 volts or less are not covered by this standard. They are covered in the Standard for Electric Booster and Commercial Storage Tank Water Heaters, UL 1453.

1.4 Permanently installed electric water heaters, rated 600 volts or less, for heating the water supplied through plumbing to separately heated public or private pools or tubs, in which swimming, wading, bathing, or partial or total immersion of persons, is to be involved are not covered by this standard. They are covered in the Standard for Electric Water Heaters for Pools and Tubs, UL 1261.

1.5 Water heaters rated 600 volts or less with a tank capacity of less than 1 gallon (3.8 liters) are not covered by this standard. They are covered under the Standard for Electric Heating Appliances, UL 499.

1.6 A water heater intended for use in a hazardous location is to be judged on the basis of its compliance with these requirements; however, further examination and testing shall be conducted to determine whether it is acceptable for the intended use.

2 Components

2.1 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 individual sections of this standard for component requirements.

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.

3 Units of Measurement

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

3.2 Unless otherwise stated, all electrical measurements are in root-mean-square units (rms).

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 purposes of these requirements, the following definitions shall apply.

5.2 DIP TUBE – A metallic or other tube attached to the inlet of a storage tank for the purpose of carrying cold inlet water to the bottom of the tank.

5.3 ENCLOSURE – The part of an electric water heater that surrounds insulated and uninsulated current-carrying live parts and that is intended to contain a fire resulting from an electrical fault.

5.3.1 FRAME – 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 which may be applied via the enclosure surface when it is deflected.

5.4 HEAT TRAP – A device that is capable of being integrally assembled or independently attached to the hot water connection of a water heater such that a portion of this device develops a cold water seal to reduce the natural convection and resultant heat loss from the hot water stored in the water heater.

5.5 INLET WATER DEFLECTOR (DIFFUSER) – A component, usually nonmetallic, attached to the inlet tube or pipe when the inlet is at or near the bottom of the water heater tank, that serves to spread the cold water uniformly on a horizontal plane to aid in mixing of the hot and cold water.

5.5.1 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 or Type 2 action. (See definitions 5.9 and 5.10.)

5.6 OUTER JACKET – The part of the water heater that surrounds the storage tank and that is intended to provide mechanical protection for the tank and for thermal insulation when the insulation is provided. The outer jacket also serves as an enclosure of current-carrying parts and insulated conductors between heating elements in separate control or wiring compartments.

5.6.1 PROTECTIVE 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 5.9 and 5.10.)

5.7 SMALL CAPACITY STORAGE TANK WATER HEATER – A water heater marked with a rated capacity within the range of 1 gallon (3.8 L) to 5 gallons (18.9 L).

5.8 STORAGE TANK – The part of the heater (either with or without the heating elements) that is intended to contain or store water and that has a rated capacity of 1 gallon (3.8 L) or more.

5.8.1 THERMOSTATIC MIXING VALVE – A device installed on the water heater that automatically moderates the water outlet temperature independent of the water heater temperature-regulating control setting.

5.9 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.

5.10 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.

CONSTRUCTION

6 Frame, Enclosures, and Outer Jacket

6.1 General

6.1.1 The frame, if provided, enclosure, and outer jacket of a water heater shall have the strength and rigidity required to resist the abuses encountered during intended use. The degree of resistance inherent in the appliance 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.

6.2 Enclosures

6.2.1 A sheet-metal enclosure made of steel or aluminum that encloses or protects a live electrical part shall have a minimum thickness as indicated in Table 6.1. A cast-metal enclosure shall have a minimum thickness as indicated in Table 6.2.

Exception: An enclosure thinner than specified in Table 6.1 and Table 6.2 is able to be used when it complies with Section 41, Enclosure Strength Test.

Table 6.1
Minimum thickness of sheet-metal enclosures

	Sheet steel					
	Uncoated		Galvanized		Sheet aluminum	
	inch	(mm)	inch	(mm)	inch	(mm)
Sheet metal enclosing live parts in a heater of any size, either (1) not serving as the jacket or (2) serving as the jacket of a heater of no more than 52 gallons (197 L) capacity.	0.020	(0.51)	0.023	(0.58)	0.032	(0.81)
Sheet metal enclosing live parts and serving as the outer jacket of a heater of more than 52 gallons capacity.	0.026	(0.66)	0.029	(0.74)	0.036	(0.91)

Table 6.2
Minimum thickness of cast metal enclosures

	Cast metal		Malleable iron		Die cast metal	
	inch	(mm)	inch	(mm)	inch	(mm)
Unreinforced blast surfaces of enclosures housing electrical parts	0.125	(3.18)	0.094	(2.39)	0.078	(1.98)
Curved, ribbed, or otherwise reinforced enclosures for electrical parts	0.094	(2.39)	0.062	(1.57)	0.047	(1.19)

6.2.2 A magnesium enclosure shall not be used unless the following are taken into consideration:

a) Mechanical strength;

b) Resistance to impact; and

c) Combustibility under conditions of intended or abnormal use.

6.2.3 An enclosure made of polymeric material shall comply with the fixed equipment requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and be rated for the maximum temperature it is subjected to during normal operation as determined during the Temperature Test specified in Section 28.

Exception: A water heater is required to comply only with the stationary equipment requirements in UL 746C when the water heater has:

a) A tank capacity of five gallons (18.9 L) or less; and

b) A power-supply cord provided in accordance with Electrical Supply Connections – Cord Connection, Section 12.

6.3 Outer jacket

6.3.1 A sheet metal outer jacket of steel or aluminum that also encloses insulated or uninsulated current-carrying parts shall have a minimum thickness as indicated in Table 6.1.

Exception: An outer jacket thinner than specified in Table 6.1 is able to be used when it meets the requirements in Section 41, Enclosure Strength Test.

6.3.2 An outer jacket of polymeric material that also encloses insulated or uninsulated current-carrying parts shall comply with the enclosure requirements in Table 6.3 and Table 6.4.

Exception: An outer jacket is required to comply only with the requirements in Table 6.5, when the outer jacket:

a) Does not enclose any current-carrying parts; or

b) Encloses parts that are completely covered with minimum 1/32 inch (0.8 mm) thick electrical insulation.

Table 6.3
Polymeric material enclosure application code

Supply connection	Encloses current-carrying parts		Direct support of current-carrying parts	Indirect support of current-carrying parts	Enclosure application code
	Parts with insulation less than 0.028 inch (0.71 mm) thick	No parts with insulation less than 0.028 inch (0.71 mm) thick			
Conduit	X	–	–	–	1
Conduit	–	X	–	–	2
Conduit	X	–	X	–	3
Conduit	X	–	–	X	4
Conduit	–	X	–	X	5
Cord	X	–	–	–	6
Cord	–	X	–	–	7
Cord	X	–	X	–	8
Cord	X	–	–	X	9
Cord	–	X	–	X	10

Table 6.4
Polymeric material enclosure property and test requirements

Application code (see Table 6.3 for code)	Minimum flammability classification[a]	Resistance to ignition		Electrical				End product tests[d]			
		Maximum hot wire (HWI)[b] PLC[c]	Maximum high current (HAI)[b] PLC[c]	Minimum dielectric strength, volts[b]	Maximum high voltage track rate (HVTR)[b] PLC[c]	Maximum comparative tracking index (CTI)[b] PLC[c]	Volume resistivity[b] 50 me gohms /cm wet	Input resistance	Crush resistance	Mold stress relief	Strain relief
1	5V	3	2	5000	–	–	X	X	X	–	–
2	5V	–	2	5000	–	–	–	X	–	X	–
3	5V	3	2	5000	1	4	X	X	X	X	–
4	5V	3	2	5000	–	–	X	X	X	–	–
5	5V	–	2	5000	–	–	–	X	–	–	–
6	5V	3	2	5000	–	–	X	X	X	–	X
7	5V	–	2	5000	–	–	–	X	–	X	X
8	5V	3	2	5000	1	4	X	X	X	X	X
9	5V	3	2	5000	–	–	X	X	X	–	X
10	5V	–	2	5000	–	–	–	X	–	–	X

[a] The flammability classification is to be determined by tests described in the Standard for Tests for Flammability of Plastic Material for Parts in Devices and Appliances, UL 94, unless it has already been determined to be 5V.

[b] Tests are to be conducted in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

[c] The Performance Level Category (PLC) value is as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

[d] Tests are to be conducted in accordance with UL 746C.