

**Underwriters Laboratories Inc.®**A not-for-profit organization dedicated to public safety
and committed to quality service**January 4, 1994****Revision pages for****Standard for****Electric Water Bed Heaters****UL 1445, Fourth Edition**

Attached to this transmittal notice is a revision of the fourth edition of UL 1445.

THIS REVISION IS BEING ISSUED TO CORRECT THE INADVERTENT OMISSION OF PAGES 1 AND 2 FROM THE AUGUST 23, 1993 REVISIONS TO THE FOURTH EDITION OF UL 1445.

Revised and/or additional pages may be issued from time to time.

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

Page	Date
1	March 15, 1991 (Reprinted January 4, 1994)
2	January 4, 1994
3 — 6	March 15, 1991
7, 8	August 23, 1993
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UL 1445

Standard for

Electric Water Bed Heaters

First Edition — October, 1975

Second Edition — June, 1978

Third Edition — May, 1984

Fourth Edition

March 15, 1991

Approval as an American National Standard covers the numbered paragraphs on pages dated March 15 and 18, 1991. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the approved text.

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Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

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A CHANGE ON A PAGE DATED AUGUST 23, 1993 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THESE NEW AND REVISED REQUIREMENTS ARE NOW IN EFFECT.

The new and revised requirements are substantially in accordance with UL's bulletin on this subject dated May 7, 1993. The bulletin is now obsolete and may be discarded.

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A1	March 15, 1991

(7)

Metallic Enclosures

7.5 Cast and sheet metal portions of an enclosure shall be no thinner than indicated in Table 7.1.

Revised paragraph 7.5 effective August 30, 1993

TABLE 7.1
MINIMUM ACCEPTABLE THICKNESS OF
ENCLOSURE METAL

Metal	At Small, Flat, Unreinforced Surfaces and at Surfaces That Are Reinforced by Curving, Ribbing, or Are Otherwise of a Shape or Size to Provide Adequate Physical Strength	
	Inch	(mm)
Die-cast	3/64	1.2
Cast Malleable Iron	1/16	1.6
Other Cast Metal	3/32	2.4
Uncoated Sheet Steel	0.026	0.66
Galvanized Sheet Steel	0.029	0.74
Nonferrous Sheet Metal	0.036	0.91

Polymeric Enclosures

7.6 A polymeric enclosure of a control unit or heating element shall comply with the requirements for stationary equipment in the Standard for Polymeric Materials — Use in Electrical Equipment Evaluations, UL 746C. Paragraphs 7.7, 7.8, and 7.9 apply only to heater constructions where the current-carrying parts are laminated or molded into or in contact with the polymeric enclosures.

Revised paragraph 7.6 effective August 30, 1993

7.7 Following the impact test specified in Section 18 of the Standard for Polymeric Materials — Use in Electrical Equipment Evaluations, UL 746C, a heater shall be tested in accordance with paragraphs 24.3 — 24.6, except the immersion time is to be for 1 hour, and the heater shall:

A. Have a leakage current of no more than 2.5 milliamperes; and

B. Withstand for 1 minute, without breakdown, the application of a 60 hertz, essentially sinusoidal potential of 2500 volts or a dc potential of 3500 volts.

Added paragraph 7.7 effective August 30, 1993

7.8 In lieu of the abnormal operation requirements in the Standard for Polymeric Materials — Use in Electrical Equipment Evaluations, UL 746C, the requirements for the abnormal operation test in Section 26 of this standard shall be applied.

Added paragraph 7.8 effective August 30, 1993

7.9 In lieu of the mold stress-relief distortion requirements in the Standard for Polymeric Materials — Use in Electrical Equipment Evaluations, UL 746C, the accelerated aging test requirements in Section 28 of this standard shall be applied.

Added paragraph 7.9 effective August 30, 1993

7.10 A polymeric material that serves as electrical insulation — such as in heater constructions where the current-carrying parts are laminated or molded into or in contact with a polymeric material — shall also comply with the requirements for electrical insulation in Section 15.

Added paragraph 7.10 effective August 30, 1993

7.11 In lieu of the flammability requirements in the Standard for Polymeric Materials — Use in Electrical Equipment Evaluations, UL 746C, a polymeric material that serves as an enclosure or as electrical insulation shall have a minimum flame rating of 94V-0 or shall comply with the requirements in UL 746C.

Added paragraph 7.11 effective August 30, 1993

7.12 A polymeric material used as the enclosure of a heater shall be investigated with respect to its ability to withstand the temperature to which it is exposed during normal operation. An enclosure material that is exposed to temperatures greater than its Relative Thermal Index, as described in the Standard for Polymeric Materials — Long Term Property Evaluations, UL 746B, shall be judged on the basis of the test described in Section 33.

Added paragraph 7.12 effective August 30, 1993

8. Materials Used to Secure Parts

8.1 A material (such as a potting compound or an adhesive) used to secure parts and relied upon to reduce the risk of fire, electric shock, or injury to persons, shall comply with the requirements for adhesives in the Standard for Polymeric Materials — Use in Electrical Equipment Evaluations, UL 746C.

Added paragraph 8.1 effective August 30, 1993

8.2 The requirement in paragraph 8.1 also applies to a material used to secure a conductive part, including a nameplate, that may, if loosened or dislodged:

- A. Energize an accessible dead metal part,
- B. Result in a live part being accessible,
- C. Reduce spacings below the minimum acceptable values, or
- D. Short-circuit live parts.

Added paragraph 8.2 effective August 30, 1993

8.3 Whether the conditions specified in items A — D of paragraph 8.2 can occur shall be considered with respect to both:

- A. A part inside the device, and
- B. A part on the outside of the device that may affect equipment in which the device is to be installed.

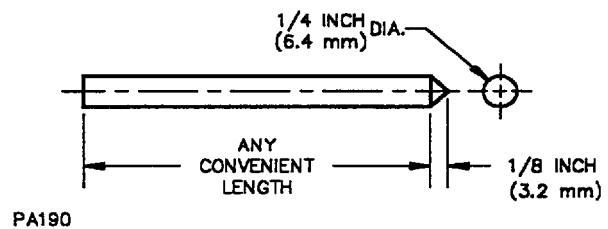
Added paragraph 8.3 effective August 30, 1993

9. Accessibility of Live Parts

9.1 A live part of an appliance shall be located or enclosed so that unintentional contact with an uninsulated live part will be prevented.

9.2 An opening in an enclosure is acceptable if the probe in Figure 9.1, when inserted as far as possible into the opening, (1) does not enter the opening for a distance of more than 1/8 inch (3.2 mm) and (2) does not touch any uninsulated live part.

FIGURE 9.1
PROBE



9.3 During the application of the probe as described in paragraph 9.2, a part of the outer enclosure that may be removed without the use of tools, or a control knob that depends on friction alone for attachment, is to be removed.

10. Mechanical Assembly

10.1 A heater shall be assembled so that it will not create the likelihood of fire, electric shock, or injury to persons during normal and abnormal conditions of use.

10.2 A switch, lampholder, receptacle, plug connector, or other component that is handled by the user shall be mounted securely and shall be prevented from turning by means other than by friction between surfaces; for example, a lock washer, properly applied, is acceptable as the means for preventing a small, stem-mounted switch or other device having a single-hole mounting means from turning.

Exception: A lampholder of the type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning if rotation cannot reduce spacings below the minimum required values.

32.5 When connected as specified in paragraph 22.1 and using the roller described in paragraph 32.9 a heater is to be flexed for 3000 cycles across both its entire length and then its entire width (for a total of 6000 cycles) at 6 to 10 cycles per minute. Every 500 cycles, the roller is to be repositioned to ensure that it will flex the entire heater area and stress all thermostats, electrical connections, and other critical components. A cycle is defined as the motion required for the roller to cross the entire length or width of the heater, whichever is appropriate, and return to its starting point.

Exception: The test is modified for a rigid heater as described in paragraph 32.7.

32.6 A rigid heater of a construction that is (1) determined to cause discomfort if the user contacts it while lying on the bed, resulting in the likelihood of the heater being relocated to a position where such contact is not likely; (2) marked in accordance with item 2 of part D of paragraph 39.7; and (3) provided with the applicable instructions specified in item B of paragraph 41.2, is to be subjected to a total of 500 cycles of flexing consisting of 250 cycles lengthwise and 250 cycles crosswise.

32.7 Using untested samples of a heater, the test described in paragraphs 32.4 and 32.5 is to be repeated but with the 4-inch (102-mm) thick foam underlay replaced by one having a thickness of 1/2 inch (12.7 mm).

Equipment

32.8 The polyurethane foam material indicated in paragraphs 32.4 and 32.7 is to be open cell material, having a density of 1.25 — 1.5 pounds per cubic foot (0.020 — 0.024 g/cm³) and a 25 percent Indentation Force Deflection (IFD) rating of 32 — 38 pounds (142 — 169 N), in accordance with the force deflection test given in the Method of Testing Flexible Cellular Materials — Slab, Bonded, and Molded Urethane Foams, ASTM D3574-1977.

32.9 The roller indicated in paragraph 32.5 is to be constructed of 3/4-inch (19.1-mm) plywood, or an equivalent, mutually agreeable material having a length of 34 inches (864 mm) and a hexagonal cross section of 19 inches (483 mm) measured as the diameter of a circle circumscribing the hexagon. The corners are to be rounded to a 1 inch (25.4 mm) radius. The roller or its supporting structure or both, is to be weighted such that it exerts a force of 250 pounds (1112 N) uniformly distributed over the length of the roller, upon the test surface.

33. Polymeric Enclosure Test

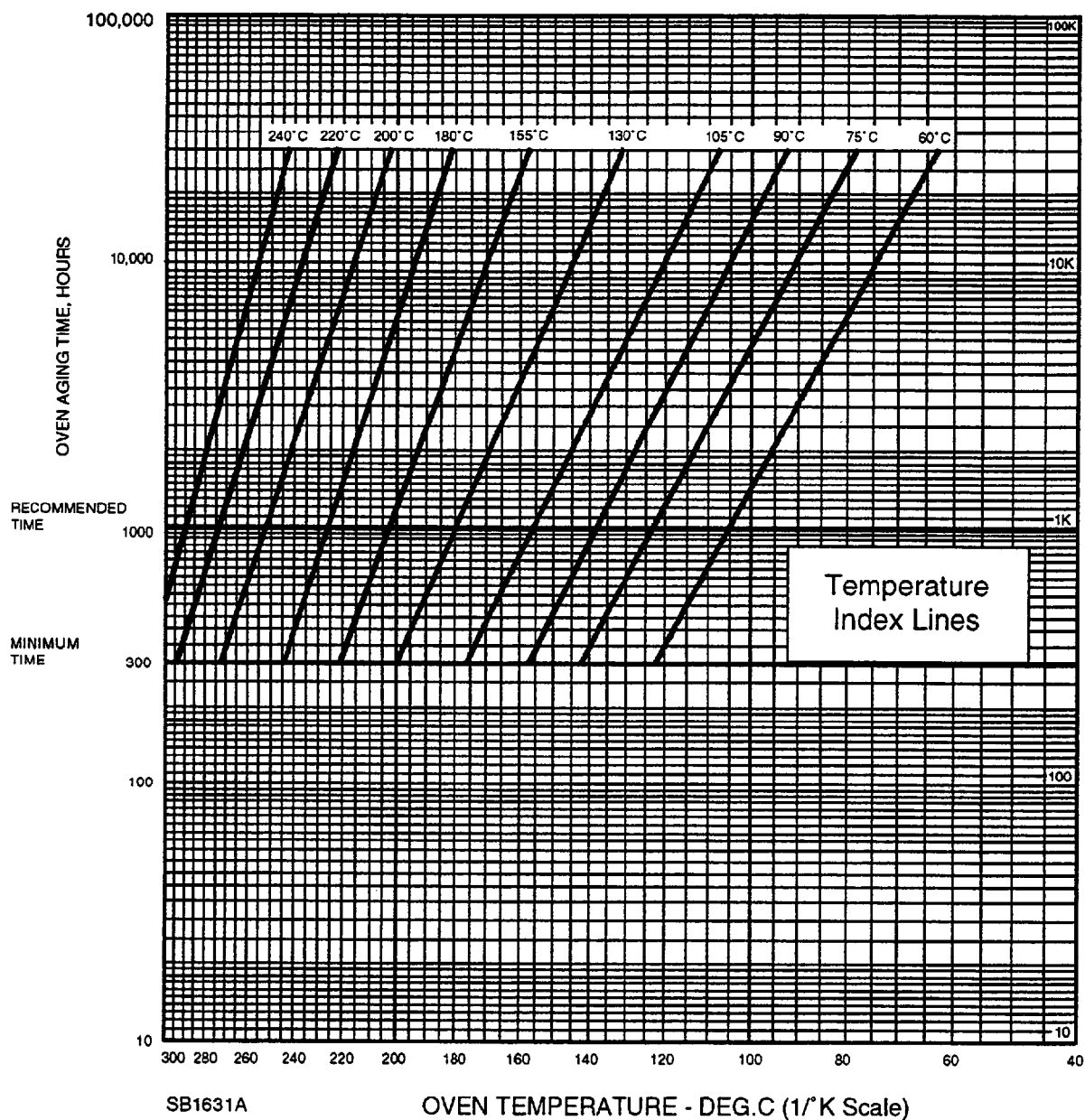
33.1 An enclosure material that is exposed to temperatures greater than its Relative Thermal Index shall comply with the tests described in paragraphs 33.2 and 33.3.

Paragraph 33.1 revised and reinstated August 30, 1993

33.2 Each of three samples of the complete heater to be tested is to be placed in a full draft circulating-air oven for 1000 hours. The temperature of the oven is to be maintained as indicated in Figure 33.1, where the temperature index line is the measured normal operating temperature of the material, but not less than 60°C (140°F).

Paragraph 33.2 revised and reinstated August 30, 1993

FIGURE 33.1
CONDITIONING TIME VERSUS OVEN TEMPERATURE
FOR TEMPERATURE INDEX



Added Figure 33.1 effective August 30, 1993

33.3 After each sample has cooled to room temperature following the 1000-hour conditioning, the enclosure is to be such that each sample complies with the requirements for immersion, mechanical load, and flammability.

Paragraph 33.3 revised and reinstated August 30, 1993

34. Tests of Control Units

Control Unit Impact and Calibration Tests

34.1 When tested as described in paragraphs 34.2 — 34.6, a control unit shall:

- A. Withstand the impact due to dropping without exposure of live parts,
- B. Show a plus variation of no more than 10°C (18°F) in its maximum cutout temperature, and
- C. Comply with the water exposure test in paragraphs 34.11 and 34.12.

34.2 With reference to item B of paragraph 34.1, the requirement does not apply if the control unit is short-circuited during the normal temperature test, or if the impact due to dropping results in a fail safe condition (for example, the circuit to the heater permanently opens).

34.3 The calibration tests on a temperature responsive control are to be performed on representative production samples that have been produced and calibrated within the same tolerances permitted in factory production. The set point temperature of the sample is to be the maximum for which the device is intended. The tests are to be performed on three samples in a manner producing a true and measurable sensing-element temperature.

34.4 A temperature responsive control is to be mounted in an air oven having forced circulation of at least 100 cubic feet per minute (2.83 m³ per minute) and that is designed so as to nullify effects of radiation. Thermocouples are to be attached to the sensing element or located in air adjacent to the element. Indication of cutout is to be obtained by a low energy circuit of such value as to preclude a current assist, and the cutout is to be determined as the average of two trials.

34.5 Prior to calibration, uniform temperatures of all parts of the control are to be attained by holding the temperature approximately 11°C (20°F) below the set point until conditions of equilibrium have been established. The

temperature is then to be raised at a rate of no more than 0.5°C (1.0°F) per minute until the control functions.

34.6 Each of the three samples is then to be subjected to drops from a height of 3 feet (0.914 m) onto the hardwood surface described in paragraph 3.7. Each sample is to be dropped three times in such a manner that the control enclosure will strike in three different positions. For bulb and capillary tube type controls, these parts (bulb and tube) are not to strike the surface first. Following the dropping, a check is to be made for exposure of live parts (using the probe described in paragraph 9.2). To determine compliance with item B of paragraph 34.1, the cutout temperature is to be remeasured as described in paragraphs 34.3 — 34.5. Each sample is then to be tested in accordance with paragraphs 34.11 and 34.12 to determine compliance with item C of paragraph 34.1.

Dielectric Voltage-Withstand Test

34.7 Each of the three control unit samples shall withstand for 1 minute, without breakdown, the application of a 60 hertz, essentially sinusoidal potential of 1240 volts or a dc potential of 1750 volts between live parts and grounded or exposed metal parts (or, for a control unit with an outer enclosure of insulating material, metal foil wrapped tightly around the enclosure).

34.8 The samples are to be tested as described in paragraph 24.6.

Short Circuit Test

34.9 A control unit shall be tested in series with a standard, nonrenewable cartridge-type fuse on an alternating-current circuit of 120 volts, 60 hertz. Results are acceptable if there is no ignition of cotton surrounding the outer enclosure of the control unit.

34.10 To determine compliance with the requirements in paragraph 34.9, the output terminals of each of three samples of the control unit are to be short-circuited and the control unit switch is to be in the closed position. The enclosure of each control unit is to be covered with loosely packed surgical cotton. Each control unit, in series with a 20 ampere cartridge fuse, is then to be connected to the test circuit. The test circuit is to be such that the available short-circuit current at the test terminals will be 1000 amperes. The short-circuit is to be closed on the control unit by means of a switching device.

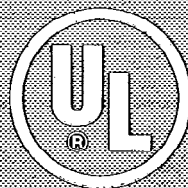
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● Electric Water
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March 15, 1991**STANDARD FOR****ELECTRIC WATER BED HEATERS****UL 1445, FOURTH EDITION**

Accompanying this transmittal notice is a copy of the fourth edition of UL 1445.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT EXCEPT FOR PARAGRAPHS 7.3, 7.5 — 7.11, AND 15.3 AND SECTIONS 8, 30, 31, AND 34, WHICH BECOME EFFECTIVE AUGUST 30, 1993 AS INDICATED IN THE SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEMS.

THE CURRENT REQUIREMENTS IN EFFECT FOR THE REQUIREMENTS HAVING A FUTURE EFFECTIVE DATE ARE LOCATED IN THE BACK OF THE STANDARD.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this standard unless the applicant specifically requests that the product be judged under the current requirements. However, should the applicant elect this option, it should be noted that compliance with all the requirements in this standard will be required as a condition of continued Listing and Follow-Up Services after the effective date and understanding of this should be signified in writing.

As indicated on the title page, this UL Standard for Safety is an American National Standard.

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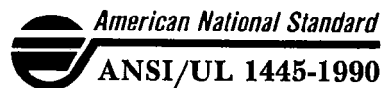
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March 15, 1991



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