



**Summary of Substantive Changes
between the 14th edition, dated November 7, 2014 and the
February 11, 2013 update of the 13th edition of
UL 499, “Electric Heating Appliances”**

Presented to the IAPMO Standards Review Committee on June 8, 2013

General: The changes to this standard might have an impact on currently listed products. The substantive changes are:

- Added requirements for instantaneous water heaters with open-wire heating elements (see Sections 2.3, 15.4, 25.4, 29, 35, 53.50 and Table 29.1 as follows:
- Added a requirement for instantaneous water heaters to be equipped with a temperature limiting means in addition to the control thermostat (see Section 26.9)
- Added the additional requirement to supply safety instructions for leakage current collectors (see Section 53.51)
- Removed the prescriptive method of measuring distances using X-ray to determine compliance with the spacing requirement of Section 78.3 (see former Section 72.4).
- Included an acceptable alternative to the horse hair pad for the abnormal test on vivarium heaters employing thin film resistance heating elements (see Section 93.3.3)

Section 2, Glossary: Added a definition for instantaneous water heaters with open-wire heating elements as follows:

[2.3 INSTANTANEOUS WATER HEATER, BARE-ELEMENT – A water heater in which uninsulated heating elements are immersed in the water.](#)

Section 15, Heating Elements: Added requirements for instantaneous water heaters with open-wire heating elements in direct contact with water as follows:

[15.4 An instantaneous water heater with an open-wire element immersed in water shall additionally comply with the requirements of Sections 11, 27, 29 and 35. It shall not employ a power supply cord or plug.](#)

Section 25, Switches: Added requirements for the flow actuated switch of instantaneous water heaters incorporating an open-wire heating element as follows:

[24.4](#)~~25.4~~ A switch on a cord-connected heating appliance or the flow actuated switch of an instantaneous water heater, either of which incorporating an open-wire heating element construction, shall be of such a type and so connected that it will disconnect the element or elements that it controls from all conductors of the supply circuit.



Section 26, Automatic Controls and Control Circuits: Added a requirement for instantaneous water heaters to be equipped with a temperature limiting means in addition to the control thermostat as follows:

26.9 Instantaneous water heaters shall be equipped with a temperature-limiting means in addition to its control thermostat to disconnect all ungrounded conductors. Such temperature-limiting means shall be installed to sense maximum water temperature and be a trip-free, manually reset type.

Exception: Instantaneous water heaters with a capacity of 4 liters or less that comply with all applicable requirements of this standard are not required to be provided with a temperature-limiting means.

Section 29, Leakage Current Collectors: Added requirements for instantaneous water heaters with open-wire heating elements in direct contact with water as follows:

29.1 An instantaneous water heater with an open-wire element immersed in water shall be provided with a leakage current collector that complies with 29.2 – 29.7 and Escape Current Test, Section 35.

Exception: A leakage current collector is not required if the open-wire heating element is isolated from the supply source.

29.2 A leakage current collector shall be provided at the water inlet and outlet. It shall be continuous metal piping, including the inlet / outlet, or may be discrete metal parts at the inlet / outlet. 29.3

Leakage current collectors shall be reliably bonded to the equipment grounding terminal of the appliance. A bonding conductor shall not be accessible to the user when the appliance is installed as intended.

29.4 A leakage current collector shall have a minimum length of five times its own inside diameter or the equivalent ratio of length to cross-section for non-circular configurations.

29.5 A leakage current collector shall be made of an unplated metal such as brass, stainless steel, or other equally corrosion-resistant metal that is intended to resist galvanic action in accordance with 29.6. Galvanized metal pipe is not considered to be sufficiently corrosion-resistant for use as a current collector.

When copper alloy is used, it shall be comprised of not more than 15 percent zinc. 29.6 In accordance with 29.5, sheet and plate aluminum in contact with water shall be of an alloy of the 5000 series as given in the American National Standard Specification for Aluminum-Alloy Sheet and Plate, ANSI/ASTM B209; and cast aluminum shall be one of the alloys shown in Table 29.1.

29.7 Replaceable heater elements shall be replaceable without disturbing the grounding or bonding of the appliance or current collectors. See 53.50.

Section 35, Escape Current Test: Added requirements for the leakage current collectors provided with instantaneous water heaters with open-wire heating elements in direct contact with water as follows:

35.1 An instantaneous water heater with a leakage current collector as described in Leakage Current Collectors, Section 29 shall not produce leakage currents greater than 0.5 mA when tested in accordance with 35.2 – 35.4.

35.2 The appliance shall be connected to a closed loop water supply system that is insulated from ground, accommodates insertion of an escape current probe and is provided with a variable flow rate



pump. The maximum length of the water path from the inlet and outlet fittings of the product to the point of escape current measurement shall not exceed 12 in (300 mm). The water shall be the hard water solution of 36.5.1.

35.3 The appliance shall be supplied at rated voltage from an isolating transformer with controls set to the most unfavorable condition. An escape current probe (see 35.4) shall be connected to a milliammeter having a maximum 500 W input impedance and that is, in turn, connected to the equipment grounding terminal of the appliance.

35.4 The escape current probe shall consist of uncoated wire mesh screen having approximately 5 strands/in of 0.2 in (5 strands/cm 0.6 mm) diameter wire and measuring approximately 4 by 4 in (100 by 100 mm) and provided with a solid copper conductor for connection to the milliammeter. The conductor shall be no smaller than the equipment grounding conductor required for installation of the appliance. The probe shall be immersed to intercept the water flow from each outlet individually as well as the combined flow. The probe shall be located within 1 in (25 mm) of the water outlet openings.

Section 53, Details: Added additional marking requirements for instantaneous water heater with open-wire heating elements, and a requirement to supply safety instructions for leakage current collectors as follows:

53.50 An instantaneous water heater with a bare-element water heater of 2.3 shall be marked where visible during installation with the following or equivalent:

- a) "CAUTION: DO NOT INSTALL IN A BATH ENCLOSURE OR SHOWER STALL OR CONNECT TO A SALT-REGENERATED WATER SOFTENER OR A WATER SUPPLY OF SALT WATER"; and*
- b) "For use on an individual branch circuit only."*

53.51 Equipment employing a leakage current collector of 29.1 shall also include the following safety instruction: "Supply this appliance only from a grounded system. A green terminal (or a wire connector marked "G", "GR", "GROUND", OR "GROUNDING") is provided for wiring the appliance. To reduce the risk of electric shock, connect this terminal or connector to the grounding terminal of the electric service or supply panel with a continuous copper wire in accordance with the electrical installation code".

Section 78, Insulation: Removed the prescriptive method of measuring distances using X-ray to determine compliance with 78.3 as follows:

~~*72.3*~~*78.3 The thickness of magnesium oxide (MgO) or other similar insulating material between the resistance element and the inside of the sheath, and the material of an end seal between the terminal pin and the inside of the sheath shall not be:*

- a) Less than 0.016 inch (0.41 mm) for elements rated 300 volts or less, and*
- b) Less than 0.031 inch (0.79 mm) for elements rated more than 300 volts.*

~~*72.4 To determine whether the distances between the resistance element and the sheath complies with the requirements of 72.3, measurements are to be made from two X-ray photographs of actual size taken in planes at right angles to each other at various points on the element.*~~



Section 93.3.3, Abnormal test: Included an acceptable alternative to the horse hair pad for the abnormal test as follows:

~~87.3.3.1~~93.3.3.1 *A sample of the vivarium heaters employing thin film resistance heating elements is to be positioned on softwood surface covered with tissue paper and draped with a layer cheesecloth and then covered with a 1 in (25.4 mm) layer of horse hair pad and operated until ultimate results. [An acceptable alternative to the all-cattle hair felt is SAE J314, Grade F-11, 25.4-mm \(1-inch\) thick wool felt.](#)*

The following new table was added:

[Table 29.1, Aluminum alloys](#)