



Safety and public health requirements for plumbing products — Water heaters and hot-water storage tanks



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- Australian Chamber of Commerce and Industry
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- Electrical Compliance Testing Association of Australia
- Gas Appliance Manufacturers Association of Australia
- NSW Fair Trading
- Plumbing Products Industry Group

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Preface

This Standard was prepared by the Australian members of the joint Standards Australia/Standards New Zealand Committee EL-020, Electric Water Heating Appliances, to supersede AS 3498—2009.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide uniform requirements that regulatory authorities may apply in Australia for basic safety and public health issues relating to the use of water heaters and hot-water storage tanks.

This edition is a major revision of the superseded edition. The main objective of the revision was to introduce a new class of water heaters intended to limit the water temperature at the outlet from sanitary fixtures that are connected to the water heater and used primarily for personal hygiene purposes to no greater than 45 °C. The methods of test in the superseded edition were expanded to enable validation of the delivery temperature performance and durability of such water heaters which are defined in this edition as 45 °C-limited water heaters.

Other changes include:

- (a) The classification of water heaters that claim to limit the water temperature at the outlet from sanitary fixtures that are connected to the water heater and used primarily for personal hygiene purposes to no greater than 50 °C, as 50 °C-limited water heaters.
- (b) The addition of definitions for delivery temperature, installer temperature adjustment, set temperature and user temperature adjustment to improve clarity of testing and conformance requirements.
- (c) Consolidation of the testing steps for 50 °C-limited water heaters.
- (d) A requirement for a delivery temperature warning on water heaters other than 45 °C-limited water heaters and 50 °C-limited water heaters.
- (e) Updates to reference current Standards.

The terms “normative” and “informative” have been used in this Standard to define the application of the appendix to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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Australian Standard®

Safety and public health requirements for plumbing products — Water heaters and hot-water storage tanks

1 Scope

This Standard specifies basic requirements, related to safety and public health, for water heaters and hot-water storage tanks that are intended for connection to a drinking water supply, such as:

- (a) storage water heaters;
- (b) heat-exchange water heaters;
- (c) hot-water storage tanks with an external energy source;
- (d) instantaneous water heaters; and
- (e) boiling-water dispensers.

This Standard applies to water heaters using any type of heating irrespective of the source of the heat energy imparted to the water, including electric resistance, gas, liquid or solid fuels, heat pumps, waste-heat recovery systems, solar energy, or any other means of heating drinking water.

This Standard also applies to water heaters intended to deliver directly to sanitary fixtures used primarily for personal hygiene purposes such that the water temperature at the outlet from such fixtures is limited to no greater than 45 °C or 50 °C.

This Standard does not include requirements affecting the durability of water heaters, except those applying to safety devices. It does not apply to steam generators, sterilizers, washing machines, wash boilers, urns, kettles, or hot-water supply systems intended solely for space heating, swimming pools, spa pools or industrial processes.

NOTE The installation of water heaters and hot-water supply systems is covered by the Plumbing Code of Australia (PCA) and AS/NZS 3500.4.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents for informative purposes are listed in the Bibliography.

AS 1361, *Electric heat-exchange water heaters — For domestic applications*

AS 1357.1, *Valves primarily for use in heated water systems, Part 1: Protection valves*

AS 3688, *Water supply and gas systems — Metallic fittings and end connectors*

AS 4552, *Gas fired water heaters for hot water supply and/or central heating*

AS/NZS 2712, *Solar and heat pump water heaters — Design and construction*

AS/NZS 3500.0, *Plumbing and drainage, Part 0: Glossary of terms*

AS/NZS 4020, *Testing of products for use in contact with drinking water*

AS/NZS 5263.1.2, *Gas Appliances, Part 1.2: Gas fired water heaters for hot water supply and/or central heating*

AS/NZS 60335.2.21, *Household and similar electrical appliances — Safety, Part 2.21: Particular requirements for storage water heaters*

AS/NZS 60335.2.35, *Household and similar electrical appliances — Safety, Part 2.35: Particular requirements for instantaneous water heaters*

AS/NZS 60335.2.40, *Household and similar electrical appliances — Safety, Part 2.40: Particular requirements for electrical heat pumps, air conditioners and humidifiers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in AS/NZS 3500.0 and those below apply.

3.1 delivery temperature

water temperature at the outlet from sanitary fixtures that are connected to the water heater and used primarily for personal hygiene purposes

Note 1 to entry: See [Figures A.1](#) to [A.4](#).

3.2 heat exchanger

system to transfer heat from a heat transfer fluid to the drinking water

Note 1 to entry: This definition is not intended to apply to heat exchangers in water heaters where heating of stored or supplied water is via a combustion process.

3.3 inline booster

water heater installed downstream of a solar preheater to boost the water temperature, where required, before the water is delivered into the heated water pipework

3.4 installer temperature adjustment

means for the installer to adjust the offset between set temperature and the outlet temperature

Note 1 to entry: The purpose of this adjustment is to allow an installer, during commissioning, to increase the outlet temperature to compensate for temperature losses in the pipework between the outlet of the appliance and sanitary fixtures.

3.5 set temperature

selected value of water temperature delivered to sanitary fixtures

Note 1 to entry: For an appliance with an indication of temperature setting, it is the indicated value otherwise it is the value nominated by the manufacturer.

3.6 supplementary temperature control device

device supplied with a water heater that controls the temperature of heated water delivered at the outlet of the water heater or outlet of this device

3.7 user temperature adjustment

means to adjust the set temperature intended for use by the end user

EXAMPLE Rotational dials and push-buttons.

3.8 water heater

3.8.1

45 °C-limited water heater

water heater that limits the water temperature at the outlet from sanitary fixtures that are connected to the water heater and used primarily for personal hygiene purposes to no greater than 45 °C

3.8.2

50 °C-limited water heater

water heater that limits the water temperature at the outlet from sanitary fixtures that are connected to the water heater and used primarily for personal hygiene purposes to no greater than 50 °C

4 Product conformity

For the purposes of this Standard, evidence of conformance to the hydrostatic-type tests specified in AS/NZS 60335.2.21, AS/NZS 60335.2.35, AS/NZS 60335.2.40, AS 1361, AS 4552 or AS/NZS 5263.1.2 as appropriate shall be deemed as evidence of conformance to [Clause 6.2](#).

For the purposes of this Standard, the following are deemed evidence of conformance to [Clause 7.1](#) and [Clauses 7.4](#) to [7.13](#) as applicable:

- (a) For electric water heaters, a certificate of approval or a certificate of suitability, as appropriate, issued by a certifying body recognized or accepted by the relevant electrical approval authorities.
- (b) For gas water heaters:
 - (i) a certificate of approval issued by a certifying body recognized or accepted by the relevant regulatory authority as evidence of conformance to AS 4552 or AS/NZS 5263.1.2; or
 - (ii) approval issued by the relevant regulatory authorities as evidence of conformance to regulatory requirements.
- (c) For all other water heaters and hot-water storage tanks, approval issued by the relevant regulatory authorities as evidence of conformance to regulatory requirements.

NOTE Depending on the type of water heater or hot water storage tank there may be other regulatory requirements (e.g. minimum energy performance).

5 Materials in contact with drinking water

Materials and components in contact with drinking water shall conform to AS/NZS 4020.

6 Design and construction of water-carrying components

6.1 Inlet and outlet plumbing connections

The dimensions and configurations of connections for inlet and outlet pipes shall conform to AS 3688 or be in accordance with the relevant Australian Standard(s) listed in [Clause 2](#).

6.2 Strength of components

Water heaters and hot-water storage tanks, including internal pipework, shall be designed to withstand without failure any pressure to which they will be subjected during normal operation.

6.3 Safe failure

Failure of any single component of the water heater or hot-water storage tank shall not result in an unsafe condition under the specified conditions of use.

NOTE Evidence of risk analysis is one way of demonstrating conformance to this requirement.

6.4 Contamination of drinking water supply

Where a drinking water supply is used to top up a heat-transfer fluid within the appliance, means shall be provided to prevent contamination of the drinking water supply by the heat-transfer fluid.

7 Control and protection

7.1 General requirements and conditions

The following requirements apply to the design of water heaters, hot-water storage tanks and heat-transfer fluid circuits:

- (a) The water temperature at the outlet of the water heater or hot-water storage tank shall not exceed 100 °C under normal operating conditions.
- (b) The water temperature at the level of the temperature and pressure relief valve(s) of any unvented water heater or hot-water storage tank shall not exceed 93 °C under normal operating conditions.
- (c) Any excessive pressure that may develop at maximum energy input shall be relieved in a safe and visible manner.
- (d) For unvented storage water heaters, a safety energy cut-out device shall operate in the event of failure of the normal temperature control device before hot water is discharged from the temperature/pressure relief valve(s), as a result of the water temperature exceeding the temperature setting of the safety device(s).
- (e) In the event of any failure of a component, vessel or circuit, any heating medium shall not be able to enter the drinking water circuit, unless:
 - (i) the heating medium is drinking water; or
 - (ii) the heating medium is a non-toxic heat transfer fluid conforming to AS/NZS 2712.

NOTE The above requirement may be fulfilled by ensuring that the drinking water circuit is maintained at a pressure greater than the secondary circuit.

- (f) For storage water heaters, the total energy input from all sources shall not exceed the thermal capacity of the temperature protection device at 100 °C under normal operating conditions.
- (g) For solar water heaters, the determination of total energy input shall be based on an ambient air temperature of 50 °C, radiation intensity of 1100 W/m² and a water temperature of 100 °C at the collector inlet.
- (h) For heat pump water heaters, the determination of total energy input shall be calculated at a condenser temperature of 100 °C plus the total energy input of any other sources at an ambient air temperature of 50 °C.
- (i) For the purposes of this Standard, an unvented solar water heater shall not be considered to be an uncontrolled storage water heater if one of the following devices controls the water

temperature at the level of the temperature/pressure relief valve(s) to be less than 93 °C without dumping water other than due to normal expansion:

- (i) A thermosiphon arrester valve.
- (ii) An energy dissipater mechanism that does not release water.
- (iii) Other devices or designs that consistently and reliably automatically limit the water temperature to less than 93 °C.

NOTE Refer to AS/NZS 2712 for the corresponding methods of test for evaluating solar water heaters.

7.2 Inhibition of growth of Legionella bacteria

Means shall be provided to inhibit the growth of Legionella bacteria in drinking water within the water heater. A water heater shall be deemed to conform to this requirement, if it satisfies one or more of the following:

- (a) For a storage water heater, heat pump water heater or solar water heater, at least 90 % of the stored water is heated to 60 °C for at least one single period of not less than 32 min in each 7 day period.
- (b) For a storage water heater, heat pump water heater or solar water heater, at least 45 % of the water contained within the storage tank is heated to a minimum of 60 °C daily.
- (c) The water heater is operated such that all water is subjected to a temperature-dependent minimum exposure period as specified in [Table 1](#) within 7 days before passing through the heated water outlet.
- (d) The water heater is an instantaneous water heater or a water heater with a heat exchanger, or a combination of both, containing less than a total of 10 L of drinking water that is intended to be supplied directly from the cold water supply or from a storage or solar water heater that conforms to Items (a), (b) or (c) above.
- (e) The water heater is a storage solar pre-heater that is intended to supply another water heater that conforms to Items (a), (b) or (c) above.
- (f) The water heater is a storage solar water heater with an instantaneous inline booster where the booster heats the water to a minimum of 70 °C before passing through the booster's heated water outlet if the water from the solar water heater is less than 55 °C.

Table 1 — Minimum exposure period

Temperature	Minimum exposure period
70 °C or greater	1 s
66 °C	2 min
60 °C	32 min
55 °C	6 h

7.3 Temperature control requirements

7.3.1 Requirements for 45 °C-limited water heaters

7.3.1.1 Temperature adjustment

A 45 °C-limited water heater shall conform to the following:

- (a) The temperature at the appliance outlet for delivery to sanitary fixtures used primarily for personal hygiene purposes (see [Figures A.1](#) to [A.4](#)) shall not be adjustable to a temperature exceeding 50 °C.
- (b) Any means to adjust the temperature at the appliance outlet for delivery to sanitary fixtures used primarily for personal hygiene purposes (see [Figures A.1](#) to [A.4](#)) in excess of 45 °C shall not be readily accessible to the end user.

NOTE The adjustment in excess of 45 °C may be achieved by an installer temperature adjustment.

- (c) The temperature at the appliance outlet for delivery to sanitary fixtures used primarily for personal hygiene purposes (see [Figures A.1](#) to [A.4](#)) shall be factory adjusted to not exceed 45 °C.
- (d) When the appliance is installed and commissioned and with any user temperature adjustment set to the maximum value, the steady-state delivery temperature shall not exceed 45 °C.

NOTE The installation instructions include clear and detailed instructions on how to install and commission the appliance.

7.3.1.2 Delivery temperature stability

A 45 °C-limited water heater shall conform to the following:

- (a) During the initial 20 s, following a change in test conditions when tested in accordance with [Clauses A.5.2](#) to [A.5.5](#) and [Clause A.5.6.2](#), the delivery temperature shall not exceed the set temperature by more than the temperature rises and durations given in [Table 2](#).
- (b) After the initial 20 s, following a change in conditions when tested in accordance with [Clauses A.5.2](#) to [A.5.5](#) and [Clause A.5.6.2](#), the delivery temperature shall not fluctuate by more than ± 2 °C from the set temperature and not exceed 45 °C.
- (c) For appliances fitted with an installer temperature adjustment in excess of 45 °C, after the initial 20 s following start-up from cold conditions when tested in accordance with [Clause A.5.6.3](#), the delivery temperature shall not exceed 50 °C.

Table 2 — Delivery temperature rises and duration

Temperature rise °C	Duration s
+4	20.00
+5	6.30
+6	4.00
+7	2.50
+8	1.90
+9	1.20
+10	0.75
+11	0.50
+12	0.25

7.3.1.3 User temperature adjustment indication and sensitivity

A 45 °C-limited water heater with user temperature adjustment shall conform to the following:

- (a) Any indication of temperature setting shall indicate the set temperature value in °C.

NOTE Examples of indication of temperature setting include a graduated scale and a digital display.
- (b) Where the appliance does not provide an indication of temperature setting, the user temperature adjustment mechanism shall be limited to operate between the maximum and minimum settings nominated by the manufacturer.
- (c) The sensitivity of any user temperature adjustment over the adjustment range shall be as follows:
 - (i) For appliances with rotational user temperature adjustment, the set temperature shall not change by more than 2 °C when the adjustment mechanism is rotated through 10° when tested in accordance with [Appendix E](#).
 - (ii) For appliances with push-button user temperature adjustment, the set temperature shall not change by more than 1 °C for each actuation of the adjustment mechanism when tested in accordance with [Appendix E](#).

7.3.2 Requirements for 50 °C-limited water heaters

7.3.2.1 Temperature adjustment

A 50 °C-limited water heater shall conform to the following:

- (a) The temperature at the appliance outlet for delivery to sanitary fixtures used primarily for personal hygiene purposes (see [Figures A.1 to A.4](#)) shall not be adjustable to a temperature exceeding 55 °C.
- (b) Any means to adjust the temperature at the appliance outlet for delivery to sanitary fixtures used primarily for personal hygiene purposes (see [Figures A.1 to A.4](#)) in excess of 50 °C shall not be readily accessible to the end user.

NOTE The adjustment in excess of 50 °C may be achieved by an installer temperature adjustment.
- (c) The temperature at the appliance outlet for delivery to sanitary fixtures used primarily for personal hygiene purposes (see [Figures A.1 to A.4](#)) shall be factory adjusted to not exceed 50 °C.
- (d) When the appliance is installed and commissioned, with any user temperature adjustment set to the maximum value, the steady-state delivery temperature shall not exceed 50 °C.

NOTE The installation instructions include clear and detailed instructions on how to install and commission the appliance.

7.3.2.2 Delivery temperature stability

A 50 °C-limited water heater shall conform to the following:

- (a) During the initial 60 s following a change in test conditions when tested in accordance with [Clauses A.5.2 to A.5.4](#) and [Clause A.5.6.2](#), the delivery temperature profile shall be such that the cumulative scald factor does not exceed a value of 1.0, determined in accordance with [Appendix C](#).

NOTE For information on background of scalding effect, see [Appendix D](#).

- (b) After the initial 60 s following a change in conditions when tested in accordance with [Clauses A.5.2 to A.5.4](#) and [Clause A.5.6.2](#), the delivery temperature shall —
 - (i) not fluctuate by more than ± 3 °C from the set temperature; and
 - (ii) not exceed 50 °C.
- (c) For appliances fitted with an installer temperature adjustment in excess of 50 °C, after the initial 60 s following a start-up from cold conditions when tested in accordance with [Clause A.5.6.3](#), the delivery temperature shall not exceed 55 °C.

7.3.3 Endurance

After endurance testing in accordance with [Appendix B](#):

- (a) A 45 °C-limited water heater shall conform to the requirements of [Clause 7.3.1](#).
- (b) A 50 °C-limited water heater shall conform to the requirements of [Clause 7.3.2](#).

7.3.4 Confirmation of control strategy

A 45 °C-limited water heater and a 50 °C-limited water heater shall operate safely or fail in a safe mode under the conditions specified in [Clause A.5.7](#).

7.3.5 Required tests and testing sequence

The applicable tests and testing sequence for 45 °C-limited water heaters and 50 °C-limited water heaters shall be as specified in [Table A.1](#).

7.4 Unvented storage water heaters

Each unvented storage water heater shall be fitted with the following protective devices:

- (a) A thermostat, to control the energy input (e.g. gas, electricity) in accordance with the relevant Australian Standard(s) listed in [Clause 2](#).
- (b) A non-self-resetting temperature-limiting device, to control the energy input (e.g. gas, electricity) in accordance with the relevant Australian Standard(s) listed in [Clause 2](#).
- (c) One or more temperature/pressure relief valves conforming to AS 1357.1, having:
 - (i) a total thermal relief capacity of not less than the maximum available energy input to the appliance; and
 - (ii) a set pressure of not more than the rated working pressure of the container.

7.5 Unvented instantaneous water heaters

Each unvented instantaneous water heater shall be fitted with protective devices, as required by the relevant Australian Standard(s) listed in [Clause 2](#).

7.6 Vented storage water heaters

Each vented storage water heater shall be fitted with:

- (a) such temperature control and temperature protection devices as required by the relevant Australian Standard(s) listed in [Clause 2](#); and