

AS 4032.1:2024



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Australia



Water supply — Valves for the control of heated water supply temperatures

Part 1: Thermostatic mixing valves — Materials design and performance requirements



AS 4032.1:2024

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Water supply — Valves for the control of heated water supply temperatures

Part 1: Thermostatic mixing valves — Materials design and performance requirements

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Preface

This Standard was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee WS-026, Valves primarily for use in Warm and Hot Water Systems, to supersede AS 4032.1:2005.

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 document is to specify requirements for the design, construction, testing and performance for thermostatic mixing valves, which give a level of protection to users against exposure to high or excessive fluctuations in mixed-water temperatures caused by variations, including shut-off, in the cold or hot water supply.

This document is part of a series of Standards that cover valves for the control of hot water temperatures. A list of all parts in the AS 4032 series can be found in the Standards Australia online catalogue.

The major changes in this edition are as follows:

- (a) Removal of the requirement for the body of the valve to be only metallic.
- (b) Additional testing requirements for a valve body manufactured of polymer material.

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

This document necessarily deals with existing conditions, but is not intended to discourage innovation or to exclude material, equipment and methods that may be developed in the future. Revisions will be made from time to time in view of such developments, and amendments to this edition will be made only when absolutely necessary.

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Australian Standard®

Water supply — Valves for the control of heated water supply temperatures

Part 1: Thermostatic mixing valves — Materials design and performance requirements

1 Scope and general

1.1 Scope

This document specifies requirements for the design, construction, testing performance and means of conformance for thermostatic mixing valves —

- (a) of nominal sizes not larger than DN 50;
- (b) for use with hot water at a supply temperature not exceeding 90 °C; and
- (c) for use with hot and cold water with working pressures not exceeding 1400 kPa.

Thermostatic mixing valves conforming to this document prevent scalding caused by variations of pressure and temperature of the hot and cold water supplies, including shut-off of either the cold or hot water supply.

Thermostatic mixing valves, when adjusted to an outlet temperature not exceeding 45 °C, are intended for use in health and aged care facilities, childcare centres, for people with disabilities or other vulnerable groups.

Thermostatic mixing valves, when adjusted to an outlet temperature not exceeding 50 °C, may be used for other applications.

Product conformity requirements are provided in [Appendix A](#).

NOTE AS 4032.3 covers routine maintenance and performance testing requirements for thermostatic mixing valves.

1.2 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 referenced for informative purposes are listed in the Bibliography.

AS 1199 (all parts), *Sampling procedures for inspection by attributes*

AS 1432, *Copper tubes for plumbing, gasfitting and drainage applications*

AS 1565, *Copper and copper alloys—Ingots and castings*

AS 1572, *Copper and copper alloys—Seamless tubes for engineering purposes*

AS 1769, *Welded stainless steel tubes for plumbing applications*

AS 1834.1, *Material for soldering, Part 1: Solder alloys*

AS 2345, *Dezincification resistance of copper alloys*

AS 2738, *Copper and copper alloys—Compositions and designations of refinery products, wrought products, ingots and castings*

AS 3558.5, *Methods of testing plastics and composite materials sanitary plumbing fixtures, Method 5: Determination of degradation by ultraviolet light*

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

AS 3718, *Water supply — Tap ware*

AS 4032.3, *Water supply — Valves for the control of heated water supply temperatures, Part 3: Requirements for field-testing, maintenance or replacement of valves, taps and devices*

AS/NZS 1567, *Copper and copper alloys — Wrought rods, bars and sections*

AS/NZS 1568, *Copper and copper alloys — Forging stock and forgings*

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

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

AS ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

AS/NZS ISO 17672, *Brazing — Filler metals*

NZS 3501, *Specification for copper tubes for water, gas and sanitation*

ASTM A269, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*

ASTM A276, *Standard Specification for Stainless Steel Bars and Shapes*

ASTM A313, *Standard Specification for Stainless Steel Spring Wire*

ASTM B127, *Standard Specification for Nickel-Copper Alloy Plate, Sheet, and Strip*

ASTM B163, *Standard Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes*

ASTM B164, *Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire*

ASTM B165, *Standard Specification for Nickel-Copper Alloy Seamless Pipe and Tube*

ISO 1167 (all parts), *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure*

ISO 3459, *Plastic piping systems — Mechanical joints between fittings and pressure pipes — Test method for leaktightness under negative pressure*

ISO 3503, *Plastics piping systems — Mechanical joints between fittings and pressure pipes — Test method for leaktightness under internal pressure of assemblies subjected to bending*

ISO 7686, *Plastics pipes and fittings — Determination of opacity*

ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*

ISO 17885, *Plastics piping systems — Mechanical fittings for pressure piping systems — Specifications*

1.3 Terms and definitions

For the purpose of this document, the terms and definitions given in AS/NZS 3500.0 and the following apply.

1.3.1**cyclic actuator**

device capable of activating the valve under test through the cycles of movements specified in this document, to simulate normal usage over a relatively short period of time

1.3.2**dynamic pressure ratio**

ratio at the hot and cold inlets of the higher to the lower dynamic pressures under flow conditions

1.3.3**may**

indicates an option

1.3.4**plastics-bodied valves**

device with major structural components that are non-metallic

1.3.5**shall**

indicates a mandatory requirement

1.3.6**should**

indicates a recommendation

1.3.7**special tools**

specifically designed mechanism or method that prevents unauthorized adjustment of the temperature control

Note 1 to entry: Screwdrivers, cross-head screwdrivers and conventional spanners are not considered special tools.

1.3.8**temperature control**

feature used to adjust the temperature of mixed hot and cold water

Note 1 to entry: The temperature control is an integral part of a thermostatic mixing valve.

1.3.9**thermal shut-off**

operating safety feature that minimizes the risk of scalding or cold shock to the person(s) exposed to the mixed water if the hot or cold water supply is shut off from the thermostatic mixing valve

1.3.10**thermostatic mixing valve****TMV**

mixing valve that controls the temperature of the water released from the mixed water outlet to a pre-selected temperature suitable for direct contact with skin

1.4 Designation

Thermostatic mixing valves shall be designated by the —

- (a) nominal size of the water inlet connections; and
- (b) operating function(s) and ancillary options.

1.5 Product data

Product data shall be supplied with the valve. It shall be in the English language, and current versions readily available from the manufacturer or agent. Product data shall comprise the following:

- (a) General information that includes —
 - (i) minimum and maximum specified dynamic pressures at the inlets, in kilopascals;
 - (ii) minimum and maximum permitted operating temperatures of the inlet hot and cold water, in degrees Celsius;
 - (iii) minimum and maximum temperature settings of the mixed water, in degrees Celsius;
 - (iv) maximum dynamic pressure ratio;
 - (v) whether suitable for one or more water outlet fixtures;
 - (vi) whether provided with integral isolating valves; and
 - (vii) details of any other relevant data.
- (b) Specified values, with equal dynamic pressures (dynamic pressure ratio equal to or less than 1.1:1), for the minimum and maximum —
 - (i) dynamic pressures at the inlets, in kilopascals; and
 - (ii) flow rates at the outlet, in litres per minute, together with the pressure requirements for each when producing mixed water at the required temperature.

NOTE Values specified in Items (a) and (b) are applicable to [Tables E.1](#) and [E.2](#).

- (c) Overall block dimensions and the type, e.g. surface mounted, concealed, single or multiple outlets.
- (d) Details of the end connectors.
- (e) Nominated factory pre-set temperature.
- (f) Warranty for the product provided by manufacturer or agent.

1.6 Marking

Products shall be marked with the following information:

- (a) Manufacturer's name, trademark or symbol.
- (b) Name or model number of the product.
- (c) Identification for traceability in the form of either —
 - (i) batch identification; or
 - (ii) individual serial number.
- (d) WaterMark or Certification mark.
- (e) Method of outlet temperature adjustment
- (f) The letter "H", the word "HOT", or a red indicator for the hot water inlet. The letter "C", the word "COLD", or a blue indicator for the cold water inlet.
- (g) Designation of this document (i.e. AS 4032.1).

- (h) Maximum working pressure.
- (i) For electronic valves:
 - (i) Electrical supply information, including the operating voltage and the rating in amperes, or the loading in watts or volt-amperes. Any limitation to the operation of the product shall also be marked (AC, DC, frequency, etc).
 - (ii) A warning that the valve requires connection to electrical power and that it will not operate without power.

This information shall be permanently marked on the valve body or shown on a rating plate affixed to the valve.

NOTE Permanent marking should remain legible for at least 5 years under normal conditions of use.

1.7 Instructions

Each valve shall be accompanied by installation, commissioning, field-testing and maintenance instructions, in English, in accordance with [Appendix B](#).

NOTE Field-testing and maintenance should be carried out in accordance with AS 4032.3.

2 Materials

2.1 Scope of section

This section specifies requirements for the materials for valves and component parts of valves.

2.2 Corrosion-resistant metallic materials

The parts of the valves in contact with water shall be made from the following corrosion-resistant materials:

- (a) Copper, as specified in [Clause 2.3](#).
- (b) Copper alloy, as specified in [Clause 2.4](#) and [Clause 2.5](#).
- (c) Stainless steel, as specified in [Clause 2.6](#).
- (d) Material for springs, as specified in [Clause 2.8\(c\)](#).
- (e) Other materials, as specified in [Clause 2.8](#).

NOTE Types of corrosion include, but are not limited to, erosion corrosion, pitting corrosion, chemical corrosion, Microbiologically Influenced Corrosion (MIC) and corrosion fatigue.

2.3 Copper

Copper shall conform to the following:

- (a) *Wrought products* — AS 2738.
- (b) *Tubular components* — Copper pipe shall conform to AS 1432 or NZS 3501.

2.4 Copper alloy

Copper alloy shall conform to the following:

- (a) *Castings* — AS 1565 and have a lead content of not greater than 4.5 %.

- (b) *Hot pressing* — AS/NZS 1568.
- (c) *Rod for machined parts* — AS/NZS 1567.
- (d) *Tubular components* — Copper alloy pipe shall conform to AS 1572 alloy, designation C 26130.

2.5 Dezincification-resistant (DR) copper alloy

Copper alloys in contact with water shall conform with AS 2345.

2.6 Stainless steel

Stainless steel shall conform with the following:

- (a) *Wrought components* — ASTM A276, series 300, containing not less than 8 % nickel and UNS S32750, S32304, S31803, S31500 duplex (ferritic-austenitic) stainless steels.
- (b) *Tubular components* — ASTM A269 or AS 1769 and UNS S32750, S32304, S31803, S31500 duplex (ferritic-austenitic) stainless steels.

2.7 Plastics materials

2.7.1 General

Plastics materials used in valve components shall be of a type specified by the polymer manufacturer as suitable and appropriate for use in the manufacture of the valve component. Selection of plastics materials for use in valve components shall be made considering the stability, compatibility, and resistance to variations in water quality and elevated temperatures.

NOTE Water quality includes the effects of normal dosing for the purposes of disinfection.

2.7.2 Acetal

Acetal plastics in contact with the water supply shall be copolymer.

2.7.3 UV resistance

Plastics components designed to be exposed to direct sunlight when installed shall not crack, craze or exhibit signs of any defect when tested in accordance with AS 3558.5.

2.7.4 Plastics-bodied valves

Plastics materials for device bodies shall conform to [Appendix J](#).

2.8 Other component materials

The following applies to component materials:

- (a) *Ceramics* — Ceramic materials may be used.
- (b) *Filler metals* — Filler metal shall be one of the following:
 - (i) Silver brazing alloy containing not more than 0.05 % cadmium, conforming to AS/NZS ISO 17672.
 - (ii) Copper-phosphorous brazing alloy conforming to AS/NZS ISO 17672 with a minimum of 1.8 % silver.

- (iii) Solder conforming with the requirements of AS 1834.1 and having a maximum of 0.1 % lead.
 - (c) *Material for springs* — Materials for springs shall conform to one of the following:
 - (i) Stainless steel to Grade 302, Grade 304, Grade 316.
 - (ii) Stainless steel to ASTM A313.
 - (iii) Phosphor bronze to AS 2738, and alloy C51800.
- NOTE Other grades may be used provided they meet the performance requirements of this document and have the equivalent corrosion-resistant properties.
- (d) *Nickel-copper-iron* — Nickel-copper-iron shall conform to ASTM B127, ASTM B163, ASTM B164 and ASTM B165.
 - (e) *Seat and diaphragm materials* — Diaphragm and seat materials shall have corrosion-resistant properties, and if use brings contact with hot water, they shall also have heat-resistant properties. Seat materials shall also have anti-adhesion properties for the conditions of intended use.

3 Design and manufacture

3.1 General

The body and component parts of thermostatic mixing valves shall be designed and manufactured so that, during handling, installation, commissioning, normal operation or maintenance, damage that would affect their performance does not occur.

3.2 End connectors

End connectors for connection to the piping system shall conform to AS 3688.

3.3 Limitation of temperature adjustment

The limitation of temperature adjustment shall conform to the following:

- (a) *Temperature lock-shield* — A temperature lock-shield shall —
 - (i) be capable of adjustment to the required mixed-water temperature;
 - (ii) be lockable at the required mixed-water temperature; and
 - (iii) require the use of a special tool to either access or make the adjustment.
- (b) *Maximum temperature stop* — A maximum temperature stop shall —
 - (i) be capable of adjustment to the required maximum mixed-water temperature; and
 - (ii) require the use of a special tool to either access or make the adjustment.
- (c) *Over-rideable temperature stop* — Where an over-rideable maximum temperature stop is employed, it shall not allow the mixed water temperature to be set to greater than 50 °C, without the use of a special tool.
- (d) *User temperature adjustment* — Any user-accessible temperature adjustment shall not allow the mixed-water temperature to be set to greater than 50 °C or the maximum temperature stop setting, whichever is the lower.

3.4 Electronic valves

The user control unit shall provide protection against water ingress.

NOTE 1 Refer to the relevant authority for regulations related to electrical components.

NOTE 2 Refer to the relevant authority for regulations related to electromagnetic compatibility.

3.5 Cross-flow prevention devices and strainers

Cross-flow prevention devices and strainers shall —

- (a) be provided by the manufacturer of the valve;
- (b) conform with the relevant clauses of this document;
- (c) be provided separate from or integral with the valve; and
- (d) be downstream of the isolation valves and in the order: strainer, then cross-flow prevention device.

3.6 Isolating valves

Where provided, integral isolating valves of thermostatic mixing valves shall conform with the performance requirements of the relevant Standard.

3.7 TMV with integral outlet taps

Where provided, integral outlet taps shall conform to the relevant performance requirements of AS 3718.

4 Performance requirements

4.1 General

The valve shall be tested complete with cross-flow prevention devices, strainers, and any integral isolating valves.

4.2 Products in contact with drinking water

Materials in contact with drinking water shall conform to AS/NZS 4020. Valves with an integral outlet tap shall be tested as end of line fittings. All other valves shall be tested as inline fittings. Inline valves shall be tested with a scaling factor of 0.01 and at the maximum inlet temperature specified by the manufacturer.

4.3 Torque tests

When tested in accordance with [Appendix C](#), each thermostatic mixing valve shall have no observed cracking, breaking, part separation or other failure.

4.4 Watertightness at ambient temperature

When tested in accordance with the ambient temperature hydrostatic test specified in [Clause D.4.2](#), the thermostatic mixing valve shall not leak at hydrostatic pressures up to the lesser of 2000 kPa or [1.5](#) times the manufacturer's specified maximum working pressure.

4.5 Thermal shut-off

4.5.1 General

All TMVs shall be in accordance with [Clauses 4.5.2](#) and [4.5.3](#).

4.5.2 Cold water isolation

When tested in accordance with [Appendix E](#), the thermal shut-off under cold water isolation of each thermostatic mixing valve shall not exceed the temperature rises and durations given in [Table 4.8](#) when —

- (a) pre-adjusted to supply mixed water at temperatures of 38 ± 1 °C, 45 ± 1 °C,
- (b) using the manufacturer's nominated maximum setting, and
- (c) during both the period of shut-off of the cold water supply and immediately following the restoration of the cold water supply.

The mixed water shall stabilize to within 2 °C of the pre-set temperature, in not more than 20.0 s following restoration of the cold water supply.

4.5.3 Hot water isolation

When tested in accordance with [Appendix E](#), the thermal shut-off under hot water isolation of each thermostatic mixing valve shall not exceed the temperature rises and durations given in [Table 4.8](#) when —

- (a) pre-adjusted to supply mixed water at temperatures of 38 ± 1 °C, 45 ± 1 °C; and
- (b) using the manufacturer's nominated maximum setting.

The amount of water discharged following thermal shut-off under hot water isolation of each thermostatic mixing valve shall not exceed 0.75 L in the period 5 s to 35 s following hot water supply isolation.

The mixed water shall stabilize to within 2 °C of the pre-set temperature in not more than 20 s following restoration of the hot water supply.

4.5.4 Electronic valves — Power failure

If electrical power is not available when outlet water flow commences the outlet water temperature shall not exceed 50 °C.

If electrical power failure occurs while the valve is delivering water, the outlet water temperature shall not exceed 50 °C under steady supply pressures and temperatures (see [Appendix F](#)).

4.6 Sensitivity of temperature adjustment

The sensitivity of the valve's temperature adjustment over its operating range shall be as follows:

- (a) For valves with rotational temperature adjustment, an outlet temperature variation of no more than 2 °C when rotated through 10°, in when tested according to [Appendix F](#).
- (b) For electronic-controlled valves, the maximum temperature increments shall be 1°C.

4.7 Mixed water temperature overshoot on starting from ambient

When tested in accordance with [Appendix G](#), the mixed water temperature overshoot when starting from ambient for each thermostatic mixing valve shall not exceed the temperature rises and durations given in [Table 4.8](#) when —

- (a) pre-adjusted to supply mixed water at temperatures of 38 ± 1 °C, 45 ± 1 °C; and
- (b) using the manufacturer's nominated maximum setting.

4.8 Temperature stability of mixed water

When tested in accordance with [Appendix H](#) at the prescribed flow rates (see [Table E.1](#)) the temperature of the mixed water shall stabilize to within 2 °C of the pre-set temperature in not more than 20 s following a change in the water supply.

The duration of temporary rises in the temperature of the mixed water, within the 20 s stabilization period, shall not exceed the values given in [Table 4.8](#).

Table 4.8 — Maximum peak temperatures and duration

Temperature rise °C	Duration s
+4	20
+5	6.3
+6	4.0
+7	2.5
+8	1.9
+9	1.2
+10	0.75
+11	0.5
+12	0.25

4.9 Watertightness at operating temperature

When tested in accordance with the operating temperature hydrostatic test specified in [Appendix D](#), each thermostatic mixing valve and, if provided, integral isolating valves and cross-flow prevention device shall not leak at hydrostatic pressures up to the lesser of 2 000 kPa or [1.5](#) times the manufacturer's specified maximum working pressure.

4.10 Endurance of control system and operating mechanism

When tested in accordance with [Appendix I](#), each thermostatic mixing valve shall meet the requirements of [Clause 4.5](#) to [Clause 4.9](#).

4.11 Sequence

The sequence for conducting the performance tests shall be as follows:

- (a) Torque tests (see [Clause 4.3](#)).
- (b) Watertightness at ambient temperature (see [Clause 4.4](#)).
- (c) Thermal shut-off (see [Clause 4.5](#)).
- (d) Thermal shut-off — Electronic valves-power failure (see [Clause 4.5](#)).

- (e) Sensitivity of temperature adjustment (see [Clause 4.6](#)).
- (f) Mixed water temperature overshoot on starting from ambient (see [Clause 4.7](#)).
- (g) Temperature stability of mixed water (see [Clause 4.8](#)).
- (h) Endurance of control system and operating mechanism (see [Clause 4.10](#)).
- (i) Watertightness at operating temperature (see [Clause 4.9](#)).
- (j) Repeat thermal shut-off (see [Clause 4.5](#)).
- (k) Repeat thermal shut-off — Electronic valves power failure (see [Clause 4.5](#)).
- (l) Repeat sensitivity of temperature adjustment (see [Clause 4.6](#)).
- (m) Repeat mixed water temperature overshoot on starting from ambient (see [Clause 4.7](#)).
- (n) Repeat temperature stability of mixed water (see [Clause 4.8](#)).

A manufacturer may submit either one or two identical thermostatic mixing valve(s) for assessment of conformance with this document. Where two valves are submitted, the first valve shall be used for the torque test and the second valve used for the tests in [Clause 4.11](#) (b) to (n).

NOTE The submission of two identical thermostatic mixing valves eliminates the need to subject the second valve to the torque tests (see [Clause 4.3](#)) prior to other performance tests (see [Clauses 4.4](#) to [4.10](#)).

4.12 Plastics material used for plastics-bodied valves

Plastics materials for device bodies shall conform to [Appendix J](#) and to the resistance to chemical degradation test requirements of AS 3718 that are specific to plastics-bodied taps.

Appendix A (normative)

Product conformity

A.1 Scope

This appendix sets out the means by which conformance to this document is demonstrated.

A.2 Evaluation of product conformity

To claim that a product is manufactured to this Standard, it shall meet the performance requirements in this document. Product conformity shall be evaluated through—

- (a) initial type testing; and
- (b) factory production control, including a minimum sampling and testing frequency plan.

The frequency of the sampling and testing schedule as detailed in [Tables A.4.2](#) and [A.5](#), shall be used for product conformance evaluation. However, where the manufacturer can demonstrate adequate process control, the frequency of sampling and testing nominated in the manufacturer's quality plan and/or documented procedures shall take precedence for the evaluation of product conformity.

A.3 Testing

A.3.1 General

[Table A.4.2](#) sets out the requirements for type testing to demonstrate conformance of product(s) to this document. [Table A.5](#) is a schedule identifying those tests and minimum frequencies to be undertaken on a routine batch-by-batch or continuous basis.

A.3.2 Inspection and test schedule

The quality plan shall include an inspection and test schedule/plan documenting the type, frequency and results of the quality control tests performed. See [Table A.5](#) for minimum sampling and testing frequency.

A.3.3 Re-testing

In the event of a test failure, the products manufactured since the previous test(s), conforming to the requirements outlined in [Table A.4.2](#) and [A.5](#), shall be quarantined as a batch. A further set of samples shall be selected randomly from the quarantined batch using a sampling plan conforming to AS 1199 for an acceptable quality level (AQL) of [2.5](#) and an inspection level of S3. If the re-testing requirements are met, the batch may be released and conformance with this document for the quarantined batch may be claimed.

Should failure on retesting occur, then the quarantine batch shall be rejected until the cause of the failure has been identified and corrected.

A.3.4 Rejection after retest

If a quarantined batch is rejected after retesting in accordance with the procedures set out in [Clause A.3.3](#), it may be subjected to 100 % testing for the failed requirement(s). The tests set out in