

Australian Standard™

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

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



This Australian Standard was prepared by Committee WS-026, Valves Primarily for Use in Warm and Hot Water Systems. It was approved on behalf of the Council of Standards Australia on 18 November 2004.
This Standard was published on 28 January 2005.

The following are represented on Committee WS-026:

AUSTAP
Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Association of Certification Bodies
Building Research Association of New Zealand
Business New Zealand
SAI Global
Department of Health (South Australia)
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This Standard was issued in draft form for comment as DR 03576.

Australian Standard™

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

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

Originated as AS 4032—1992.
Previous edition AS 4032—2002.
Revised and redesignated as AS 4032.1—2005.

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Published by Standards Australia GPO Box 5420, Sydney, NSW 2001, Australia
ISBN 0 7337 6454 1

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS-026, Valves Primarily for Use in Warm and Hot Water Systems, to supersede AS 4032.1—2002, *Thermostatic mixing valves*.

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

This revision includes provision for electronically controlled valves, requirements for hot water shut-off performance and increased sizes up to 50 mm

This Standard is Part 1 of a suite of Standards that covers valves for the control of hot water temperatures as follows:

AS

4032 Water supply—Valves for the control of heated water supply temperatures

4032.1 Part 1: Thermostatic mixing valves—Materials, design and performance requirements (this Standard)

4032.2 Part 2: Tempering valves and end-of-line temperature-activated devices

4032.3 Part 3: Requirements for field testing, maintenance or replacement of thermostatic mixing valves, tempering valves and end-of-line temperature control devices

The objective of this Standard is to provide manufacturers, system designers, relevant authorities and others with performance requirements 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.

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.

Statements expressed in mandatory terms in notes, tables and figures are deemed to be requirements of this Standard.

This Standard 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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STANDARDS AUSTRALIA

Australian Standard

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

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

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for the design, construction, testing performance and means of compliance for metallic-bodied 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.

When used for ablutionary purposes, thermostatic mixing valves complying with this Standard provide the user with reasonable protection against scalding or excessive temperature fluctuations due to variations of pressures and temperatures of the hot and cold water supplies, including shut-off of either the cold or hot water supply.

NOTES:

- 1 Diagrams in this Standard are typical and chosen without prejudice.
- 2 Thermostatic mixing valves require routine maintenance and performance testing in accordance with AS 4032.3.

1.2 APPLICATION

The operating range of the valve shall be nominated by the manufacturer.

Thermostatic mixing valves, when adjusted to an outlet temperature not exceeding 45°C, are intended for use in health care, aged, childcare, people with disabilities or any other similar at risk situations.

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

Means for demonstrating compliance with this Standard shall be as given in Appendix A.

1.3 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix B.

1.4 DEFINITIONS

For the purpose of this Standard, the definitions in AS/NZS 3500.0 and the ones below apply.

1.4.1 Cyclic actuator

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

1.4.2 Dynamic pressure ratio.

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

1.4.3 Special tools

A specifically designed mechanism or method that would prevent the unauthorized adjustment of the temperature control.

NOTE: Screwdrivers, cross-head screwdrivers and conventional spanners are not considered special tools.

1.4.4 Temperature control

An essential feature and an integral part of a thermostatic mixing valve, which permits the user to adjust the temperature of the mixed water to suit personal needs.

1.4.5 Thermal shut-off (sudden failure of the cold or hot water supply)

An operating safety feature wherein, if a thermostatic mixing valve is subjected to shut-off of the cold or hot water supply to it, the risk of scalding or cold shock to the user or person(s) exposed to the mixed water is minimized.

1.4.6 Thermostatic mixing valve (TMV)

A mixing valve in which the temperature of the water from the mixed water outlet is automatically controlled to a pre-selected temperature that is suitable for direct contact with the skin.

1.4.7 Water volume control

A device that may be used to control the rate of discharge of the mixed water. It is an integral part of an end-of-line valve or connected to the outlet for an in-line valve, and which may incorporate a temperature control valve.

1.5 DESIGNATION

Thermostatic mixing valves shall be designated by—

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

1.6 PRODUCT DATA

The product data shall be supplied with the valve and be readily available from the manufacturer or agent and 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;
 - (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 G1 and G2.

- (c) The overall block dimensions and the type, e.g., surface mounted, concealed, single or multiple outlets.
- (d) Details of the end connectors.
- (e) The nominated factory pre-set temperature.
- (f) Manufacturer's, or agent's warranty for the product.

1.7 MARKING

Products complying with this Standard 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) Certification Mark.
- (e) Controls used to vary the temperature of the mixed water shall be permanently marked, to make the effect of movement understood by the user.
- (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) The number of this Standard (i.e., AS 4032.1).
- (h) The maximum working pressure.
- (i) For electronic valves;
 - (i) Electrical supply information—operating voltage and the rating in amperes or loading in watts or volt-amperes. Any limitation to the operation of the product shall also be marked (a.c., d.c., 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.

NOTES:

- 1 Manufacturers making a statement of compliance with this Australian Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.
- 2 The intention is to achieve permanency of the marking for the life of the product, or at least 5 years under normal conditions of use.

1.8 INSTRUCTIONS

Each valve shall be accompanied by installation, commissioning, field-testing and maintenance instructions, in English, in accordance with Appendix C.

NOTE: The field-testing and maintenance are to be carried out in accordance AS 4032.3.

SECTION 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 corrosion-resistant materials. For the purpose of this Standard, the following materials are deemed to be corrosion-resistant:

- (a) Copper, as specified in Clause 2.3.
- (b) Copper alloy, as specified in 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

2.3 COPPER

Copper shall comply with the following:

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

2.4 COPPER ALLOY

Copper alloy shall comply with the following:

- (a) *Castings*—AS 1565 and have a lead content of not greater than 4.5%.
- (b) *Hot pressing*—AS 1568.
- (c) *Rod for machined parts*—AS 1567
- (d) *Tubular components*—Copper alloy pipe shall comply with AS 1572 alloy, designation C 26130.

2.5 DEZINCIFICATION-RESISTANT (DR) COPPER ALLOY

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

2.6 STAINLESS STEEL

Stainless steel shall comply with the following:

- (a) *Wrought components*—ASTM A276 or AS 2837, 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 recommended by the polymer manufacturer as suitable and appropriate for use in the manufacture of the valve component. Characteristics to be taken into account shall include compatibility and resistance to variations in water quality and elevated temperatures.

2.7.2 Acetal

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

2.7.3 UV Resistance

Plastics components that are 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.

2.8 OTHER COMPONENT MATERIALS

The following applies:

- (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, complying with AS 1167.1.
 - (ii) Copper-phosphorous brazing alloy complying with AS 1167.1 with a minimum of 1.8% silver.
 - (iii) Solder complying with the requirements of AS 1834.1 and having a maximum of 0.1% lead.
- (c) *Material for springs* Materials for springs shall comply with one of the following:
 - (i) Stainless steel to AS 1449, Grade 302 or Grade 304, AS 2837, Grade 316.
 - (ii) Stainless steel to ASTM A313.
 - (iii) Phosphor bronze to AS 2738, Alloy C51800.

NOTE: Other grades may be used provided they meet the performance requirements of this standard and have the equivalent corrosion-resistant properties.
- (d) *Nickel-copper-iron* Nickel-copper-iron shall comply with one of the following:
 - (i) AS 2738, alloy 713; or
 - (ii) ASTM B127, ASTM B163, ASTM B164 and ASTM B165.
- (e) *Seat and diaphragm materials* Diaphragm and seat materials shall have corrosion-resistant properties and, where used in contact with hot water, heat-resistant properties. Seat materials shall also have anti-adhesion properties for the conditions of intended use

SECTION 3 DESIGN AND MANUFACTURE

3.1 GENERAL

The body and component parts of thermostatic mixing valves shall be designed and manufactured to perform their intended functions reliably so that, in the course of handling, installation, commissioning, normal operation or maintenance, damage that would prevent their continued compliance with this Standard does not occur.

3.2 END CONNECTORS

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

3.3 LIMITATION OF TEMPERATURE ADJUSTMENT

The limitation of temperature adjustment shall comply with 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

3.4.1 Electrical safety

All electrical components shall comply with the requirements of the electrical regulator.

The user control unit is to provide protection against water ingress.

3.4.2 Electromagnetic compatibility

The product shall comply with the requirements of the relevant regulator.

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) comply with the relevant clauses of this Standard; and
- (c) be provided separate from or integral with the valve.

- (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 comply with the performance requirements of the relevant Standard.

3.7 TMV WITH INTEGRAL OUTLET TAPS

Where provided, integral outlet taps shall comply with the relevant performance requirements of AS/NZS 3718.

SECTION 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 comply with AS/NZS 4020.

Valves with 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 D, 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 of Appendix E, each 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 comply with Clauses 4.5.2 and 4.5.3.

4.5.2 Cold water isolation

When tested in accordance with Appendix F, the thermal shut-off under cold water isolation of each thermostatic mixing valve, when pre-adjusted to supply mixed water at temperatures of $38 \pm 1^\circ\text{C}$, $45 \pm 1^\circ\text{C}$ and the manufacturer's nominated maximum setting, shall not exceed the temperature rises and durations given in Table 4.1 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 preset temperature, in not more than 20.0 seconds following restoration of the cold water supply.

4.5.3 Hot water isolation

When tested in accordance with Appendix F, the thermal shut-off under hot water isolation of each thermostatic mixing valve, when pre-adjusted to supply mixed water at temperatures of $38 \pm 1^\circ\text{C}$, $45 \pm 1^\circ\text{C}$ and the manufacturer's nominated maximum setting, shall not exceed the temperature rises and durations given in Table 4.1.

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 5-35 seconds following hot water supply isolation.

The mixed water shall stabilize to within 2°C of the preset temperature, in not more than 20.0 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, then the outlet water temperature shall not exceed 50°C.

If electrical power failure occurs while the valve is delivering water, then 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 not more than 2°C shall occur when the control is rotated through 10°, when tested in accordance with Appendix G.
- (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 H, the mixed water temperature overshoot on starting from ambient for each thermostatic mixing valve when pre-adjusted to supply mixed water at temperatures of $38 \pm 1^\circ\text{C}$, $45 \pm 1^\circ\text{C}$ and the manufacturer's nominated maximum setting, shall not exceed the temperature rises and durations given in Table 4.1.

4.8 TEMPERATURE STABILITY OF MIXED WATER

When tested in accordance with Appendix I, at the prescribed flow rates (see Table F1, Appendix F), the temperature of the mixed water shall stabilize to within 2°C of the preset temperature, in not more than 20.0 s following an applied change in the water supply conditions.

The duration of temporary rises in the temperature of the mixed water, within the 20.0 s stabilization period, shall not exceed the values given in Table 4.1.

TABLE 4.1
MAXIMUM PEAK TEMPERATURES
AND DURATION
(Mixed water, temperature rise and
corresponding 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 of Appendix E, 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 2000 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 J, each thermostatic mixing valve shall meet the requirements of Clauses 4.5 to 4.9.

4.11 SEQUENCE

The sequence for 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 4.9).
- (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 compliance with this Standard. Where two valves are submitted, the first valve shall be used for the torque test and the second valve used for the tests in Items (b) to (n) above.

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 4.2 to 4.10).

APPENDIX A

MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Normative)

A1 SCOPE

This Appendix sets out the means by which compliance with this Standard is demonstrated by a manufacturer for product certification.

Products covered by this Standard are required to be certified under the National Certification Scheme.

A2 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 (SANZ HB18.28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

Product certification shall be conducted by a certification body accredited by the Joint Accreditation System for Australian and New Zealand (JAS-ANZ) or by another accreditation body that is acceptable to JAS-ANZ.

The frequency of the sampling and testing schedule as detailed in Tables A1 and A2, shall be used by the certifying body for product compliance auditing. However, where the manufacturer can demonstrate adequate process control to the certifying body, the frequency of sampling and testing nominated in the manufacturer's quality plan and/or documented procedures shall take precedence for the purpose of product certification.

A3 TESTING

A3.1 General

Table A1 sets out the requirements for Type Testing for a manufacturer to demonstrate compliance of product(s) to this Standard for initial certification.

Table A2 is a schedule identifying those tests and minimum frequencies to be undertaken on a routine batch-by-batch or continuous basis.

A3.2 Inspection and test schedule

The licensee's quality plan shall include an inspection and test schedule/plan that identifies the quality control tests undertaken and their frequencies, to maintain objective evidence of ongoing compliance of product manufactured to AS/NZS 4032.1. Refer to Table A2 for minimum sampling and testing frequency.

A3.3 Re-testing

In the event of a test failure, the products manufactured since the previous test(s), conforming to the requirements outlined in Table A1 and A2, shall be quarantined as a batch. A further set of samples shall be selected randomly from the quarantined batch