

AS 1357.2:2023



STANDARDS
Australia



Valves primarily for use in heated water systems

Part 2: Control valves



AS 1357.2:2023

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- Plumbing Products Industry Group

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Part 2: Control valves

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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 1357.2:2005.

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 provide manufacturers with design, material and performance requirements for control valves that give reasonable protection to users against exposure to high or excessive fluctuations in water temperature.

The range of control valves in this document includes types to limit maximum water inlet pressures, provide vacuum relief, prevent excessive water storage temperature (in solar water heaters) and reduce the risk of scalding temperatures at delivery points.

The major changes in this edition are as follows:

- (a) The requirements for thermal switching valves have been updated to be consistent with WMTS-481, including the addition of sampling and frequency plans for these products.
- (b) [Section 10](#) and the relevant appendices have been added to cover air eliminators.

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.

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NOTES

Australian Standard®

Valves primarily for use in heated water systems

Part 2: Control valves

Section 1 Scope and general

1.1 Scope

This document sets out requirements for the design, construction, testing and performance of the following types of water valves and devices:

- (a) Vacuum relief valves.
- (b) Thermosiphon arrestor valves.
- (c) Primary temperature control valves.
- (d) Inlet pressure control valves.
- (e) Isolating valves.
- (f) Thermal switching valves.
- (g) Air eliminators.

The valves and devices specified in this document are primarily intended for use in a heated water service (refer to AS/NZS 3500.4).

1.2 Application

Conformance to this document shall be demonstrated in accordance with [Appendix A](#).

1.3 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 1349, *Bourdon tube pressure and vacuum gauges*

AS 1357.1:2019, *Valves primarily for use in warm and hot water systems, Part 1: Protection valves*

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 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 2837, *Wrought alloy steels—Stainless steel bars and semi-finished products*

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

AS/NZS 1167.1, *Welding and brazing—Filler metals, Part 1: Filler metal for brazing and braze welding*

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

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

ISO 6957:1988, *Copper alloys — Ammonia test for stress corrosion resistance*

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 (UNS N04400) 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 (UNS N04400)* Seamless Pipe and Tube*

1.4 Terms and definitions

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

1.4.1

distortion

physical change that is obvious to the eye without resorting to dimensional checking

1.4.2

hot water supply temperature differential

differential of the supply temperature of the hot water above the set temperature of a valve, which is required for efficient operation

1.4.3

manufacturer's recommended maximum supply temperature

maximum hot water supply temperature that the primary temperature control valve can accept continuously without permanent damage

1.4.4

manufacturer's specified maximum temperature setting

maximum outlet temperatures to which a primary temperature control valve can be set, as specified by the manufacturer

1.4.5

manufacturer's specified minimum temperature setting

minimum outlet temperatures to which a primary temperature control valve can be set, as specified by the manufacturer

1.4.6

may

indicates the existence of an option

1.4.7**Pressure****1.4.7.1****closing pressure**

pressure that allows a valve to close

1.4.7.2**opening pressure**

pressure that causes a valve to open

1.4.7.3**set pressure**

pressure at which a valve is designated to operate

1.4.8**shall**

indicates that a statement is mandatory

1.4.9**should**

indicates a recommendation

1.4.10**steady mixed water discharge temperature**

single temperature reading taken at $30\text{ s} \pm 5\text{ s}$ following an applied change in the water supply conditions

1.4.11**Temperature****1.4.11.1****closing temperature**

temperature at the inlet of a valve that allows it to close

1.4.11.2**set temperature**

temperature at which a valve is designated to operate

1.4.12**thermal switching valve**

valve that automatically switches the flow of water from one inlet port to either of two outlet ports, depending upon the temperature of the inlet water

1.4.13**thermosiphon arrestor valve**

temperature-actuated valve, for use with a thermosiphoning solar water heater, which automatically controls the maximum temperature of stored water by arresting the thermosiphon flow at a predetermined temperature

1.4.14**transient mixed water discharge temperature**

series of temperatures taken in 0.1 s intervals for the period 0 s to 60 s immediately following an applied change in the water supply conditions

1.5 Instrumentation

Instrument requirements shall be in accordance with [Appendix B](#).

1.6 Marking

Valves and devices conforming to this document shall be marked or supplied with the following information:

- (a) Identification of the inlet, drain, outlet or other special connections, or by an arrow indicating direction of flow.
- (b) Additional markings for valves as specified in the appropriate clause.

Unless otherwise specified, this information shall be permanently marked on the valve body (cast, stamped or engraved) or shown on a rating plate affixed to the valve.

NOTE 1 Manufacturers making a statement of conformity with this document on a product, packaging or promotional material are advised to ensure that such conformance is capable of being verified.

NOTE 2 The Manual for the WaterMark Certification Scheme includes marking requirements, which apply to all WaterMark certified products.

Section 2 Materials

2.1 General

Materials used in the construction of valves and devices shall be suitable for the conditions of use, e.g. temperature, pressure, and compatibility with any adjacent component.

Where construction or attachment involves brazing, the materials shall be suitable for brazing.

2.2 Contamination of water

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

2.3 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 document, the following materials are deemed to be corrosion-resistant:

- (a) Copper, as specified in [Clause 2.4](#).
- (b) Copper alloy, as specified in [Clause 2.5](#) and [Clause 2.6](#).
- (c) Stainless steel, as specified in [Clause 2.7](#).
- (d) Material for springs, as specified in [Clause 2.10\(c\)](#).
- (e) Other materials, as specified in [Clause 2.10](#).

2.4 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.

2.5 Copper alloy

Copper alloy shall conform to the following:

- (a) *Castings* — AS 1565 and have a lead content of less 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. Where bent or stamped in the fabrication process, the pipe shall be sufficiently stress-relieved, so that it is capable of passing the stress corrosion test specified in ISO 6957:1988 Clause 8, using a test solution of pH 9.5 without prior pickling, after all fabrication processes are completed.

2.6 Dezincification-resistant copper alloy

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

2.7 Stainless steel

Stainless steel shall conform to the following:

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

2.8 Diaphragm, materials and valve seats

Diaphragm materials and valve seats shall have corrosion-resistant properties and, where used in a hot water service, heat-resistant properties. Seat materials shall also have anti-adhesion properties for the conditions of intended application.

2.9 Temperature-sensing probe

The outer casing of the temperature-sensing probe shall not show signs of deterioration on completion of the endurance testing.

2.10 Other component materials

The following applies to materials for other components:

- (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 1167.1.
 - (ii) Copper-phosphorus brazing alloy conforming to AS/NZS 1167.1 with a minimum of 1.8 % silver.
 - (iii) Solder conforming to 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, with the corrosion resistant property of Grade 304 of AS 2837.
 - (ii) Stainless steel to ASTM A313/A313M.
 - (iii) Nickel copper alloy (monel).

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 or ASTM B165.

Section 3 General design and construction

3.1 General

The body and components of valves and devices shall be designed and manufactured to perform their intended functions reliably so that, in the course of handling, installation, normal operation or maintenance, damage that would prevent their continued conformity to this document does not occur.

Unless otherwise specified, all valves shall be provided with a minimum of two parallel wrench flats.

NOTE Guidelines for the acoustic evaluation of valves are given in [Appendix C](#).

3.2 Strength

3.2.1 Torque test

When tested in accordance with Appendix E of AS 1357.1:2019, the valve under test shall be capable of withstanding, without permanent distortion or breakage, the applied torque, as appropriate. This test is not applied where elastomeric seals are used on connections for assembly of combination valve bodies.

3.2.2 Leakage

When valves are tested in sequence, first in accordance with Appendix E of AS 1357.1:2019, and second in accordance with [Appendix D](#) of this document, there shall be no leakage from the valve body.

3.3 End connections

Valves shall be provided with end connections or adaptors with end connections, conforming to AS 3688, where the end is intended to be connected to pipework.

3.4 Components and valve seats

Components and assemblies, including inserted valve seats, shall be positively secured by screw threads, riveting or other durable mechanical means.

3.5 Repair

The means of field repair for a valve shall be limited to the replacement of a pre-set cartridge assembly that contains all the operating components.

NOTE The inclusion of all the operating components excludes the dismantling of any operating component.

3.6 Instructions

Valves shall be accompanied by comprehensive installation instructions in the English language.

Section 4 Vacuum relief valves

4.1 General

Vacuum relief valves conforming to this document are intended to protect water heaters from damage caused by vacuum.

In addition to the requirements of [Section 4](#), vacuum relief valves shall conform to the relevant requirements of [Sections 1, 2](#) and [3](#).

Vacuum relief valves shall operate at —

- (a) a continuous operating temperature not exceeding 85 °C; and
- (b) temperatures under emergency conditions not exceeding 99 °C.

NOTE Vacuum relief valves are not intended to prevent backflow or back-siphonage.

4.2 Design

A vacuum relief valve may be either a separate device or combined with another valve.

4.3 Inlet and outlet

4.3.1 Inlet

The inlet to a vacuum relief valve is that part of the valve open to atmosphere.

4.3.2 Outlet connection

Except where fitted direct to, or integral with, the body of another valve, the outlet connection to a vacuum relief valve shall be not smaller than DN 15.

4.4 Protection against blockage

The inlet to a vacuum relief valve shall be shrouded.

4.5 Flow passages

The cross-sectional area of any flow passage shall be not less than 7 mm² on the inlet side of the valve, and not less than 28 mm² on the outlet side of the valve.

4.6 Opening pressure test

When tested in accordance with [Appendix E](#), the opening pressure shall be not less than atmospheric pressure by more than 3.5 kPa.

4.7 Closing pressure test

When tested in accordance with [Appendix D](#), the closing pressure shall be not greater than atmospheric pressure by more than 7 kPa.

4.8 Air-passing capacity test

When tested in accordance with [Appendix E](#), the flow rate of air, under a differential pressure of 7 kPa ± 0.5 kPa, shall be not less than 25 L/min.

4.9 Resistance to hot water

Valves shall conform to [Clauses 4.6, 4.7](#) and [4.8](#) after exposure to water at $120\text{ °C} \pm 2\text{ °C}$ for 60_0^{+5} min in an autoclave.

4.10 Marking

In addition to the general marking requirements specified in [Clause 1.6](#), each valve shall be marked with the air-passing capacity, in litres per minute, e.g. 25 L/min.

Section 5 Thermosiphon arrestor valves

5.1 General

Thermosiphon arrestor valves conforming to this document are intended to seal only against the thermosiphon flow, resulting in very low-pressure differentials.

In addition to the requirements of [Section 5](#) thermosiphon arrestor valves shall also conform to the relevant requirements of [Sections 1, 2](#) and [3](#).

Thermosiphon arrestor valves shall operate at —

- (a) a continuous operating temperature not exceeding 85 °C;
- (b) temperatures under emergency conditions not exceeding 99 °C; and
- (c) a continuous working pressure not exceeding 1 400 kPa.

5.2 Flow area

The net cross-sectional area of the seat orifice and total cross-sectional thermosiphon flow area, at any point between the inner ends of the inlet and the outlet of the valve body, shall be not less than 100 mm².

5.3 Flow passage

The width of any flow passage of fixed cross-sectional area, excluding cold-water inlet passages, shall be not less than 3.5 mm.

5.4 Closing temperature

When tested in accordance with [Appendix J](#), the closing temperature of a thermosiphon arrestor valve shall be within ±4 °C of the nominated temperature.

5.5 Valve operating characteristics

When tested in accordance with [Appendix J](#), at a temperature 5 °C below the actual closing temperature, the calculated flow area shall be not less than 100 mm².

5.6 Endurance

After testing in accordance with [Appendix G](#), the valve shall conform to the requirements of [Clauses 5.4](#) and [5.5](#).

5.7 Temperature endurance

After testing in accordance with [Appendix H](#), the valve shall conform to the requirements of [Clauses 5.4](#) and [5.5](#).

5.8 Marking

In addition to the general marking requirements specified in [Clause 1.6](#), valves shall be marked with the nominated temperature setting, in degrees Celsius.

Section 6 Primary temperature control valves

6.1 General

Primary temperature control valves conforming to this document are intended to automatically temper a primary supply of hot water in order to limit the temperature of the water delivered to a downstream device or process up to DN 32. They may be either a separate valve or combined with another valve(s).

In addition to the requirements [Section 6](#), primary temperature control valves shall conform to the relevant requirements of [Sections 1, 2 and 3](#).

NOTE 1 It is assumed that the maximum supply temperature and set temperatures will be negotiated between the valve supplier and the customer, to suit the intended application of the primary temperature control valve.

NOTE 2 Primary temperature control valves are typically used at the outlet of boilers, uncontrolled water heaters, solar water heaters, etc., to provide a controlled water temperature to down-stream controllers.

NOTE 3 Primary temperature control valves are not intended to directly supply water for personal hygiene purposes.

NOTE 4 For temperature control of water for personal hygiene purposes, refer to AS/NZS 3500.4.

6.2 Inlet and outlet connections

End connections shall conform to [Clause 3.3](#).

Capillary connections shall not be used.

6.3 Design requirements

Adjustable primary temperature control valves shall include tamper-resistant means to ensure that the maximum on-site temperature setting is not exceeded.

6.4 Mixed water discharge test — Tempered water range

When tested in accordance with [Appendix F](#), the temperature of the mixed water discharged from the valve shall not vary from the set temperature by more than ± 5 °C under steady-state conditions.

Under transient conditions, a temperature of 5 °C greater than the set temperature shall not be exceeded for a period greater than 15 s. A temperature of 10 °C above the set temperature shall not be exceeded.

When tested in accordance with [Clause F.5](#), the volume of water collected from the mixed water discharge shall not exceed 1.0 L in the period from 6 s to 66 s following cold water supply isolation.

For primary temperature control valves with a set temperature adjustment, the tests in [Clause 6.4](#) shall be conducted at the manufacturer's stated maximum and minimum adjustable set temperatures.

6.5 Endurance

When tested in accordance with the endurance test outlined in [Appendix G](#), the valves shall conform to the requirements of [Clause 6.4](#).

6.6 Minimum flow requirement

When tested in accordance with [Appendix I](#), the flow from the outlet of the valve shall be not less than the manufacturer's nominated flow capacity, at a pressure differential of 100 kPa.

6.7 Marking

In addition to the general marking requirement of [Clause 1.6](#), each valve shall be marked with the following information:

- (a) For preset valves, the set temperature, in degrees Celsius.
- (b) For adjustable valves, the minimum and maximum set temperatures in degrees Celsius.
- (c) Appropriate identification of hot, cold and outlet connections.

The following markings shall appear on the valve or on the packaging:

- (i) The maximum supply temperature, in degrees Celsius.
- (ii) The manufacturer's nominated flow capacity, in litres per minute.

6.8 Manufacturer's instructions

The manufacturer's instructions, included with each primary temperature control valve, shall cover at least the following:

- (a) Name and address of the manufacturer and the relevant agent in the country of intended sale.
- (b) Full and comprehensive installation diagrams including the positioning, if necessary, of non-integral line strainers, cross-flow prevention devices (non-return valves) and isolating valves.

NOTE Strainers and cross-flow prevention devices should be installed downstream of any isolation valves and in the order strainer then cross-flow prevention device.

- (c) The maximum and minimum working pressure, in kilopascals, and details for the fitting of any necessary pressure control device where these pressures could be exceeded.
- (d) Full directions for the commissioning of the primary temperature control valve.
- (e) The minimum and maximum hot and cold water supply temperatures, in degrees Celsius, including the hot water supply temperature differential of the valve.
- (f) For preset valves, the set temperature, in degrees Celsius.
- (g) For adjustable valves, the minimum and maximum set temperatures, in degrees Celsius, and the method of adjustment.
- (h) Any operating limits the manufacturer has specified for the valve.
- (i) A statement that all valves are to be commissioned and the mixed water discharge temperature set on site and verified with a thermometer.
- (j) Comprehensive instructions for the procedures that are to be carried out to verify the performance of the valve in service.
- (k) A cautionary statement that valves not installed and serviced in accordance with the manufacturer's instructions may result in unsafe performance.

Section 7 Inlet pressure control valves

7.1 General

Inlet pressure control valves conforming to this document shall be one of the following:

- (a) Pressure-reducing valves.
- (b) Pressure-limiting valves.
- (c) Ratio valves.

In addition to the requirements of [Section 7](#), pressure control valves shall also conform to the relevant requirements of [Sections 1, 2](#) and [3](#).

Inlet pressure control valves are required to operate at —

- (i) a continuous operating temperature not exceeding 85 °C;
- (ii) temperatures under emergency conditions not exceeding 99 °C; and
- (iii) a continuous working pressure of at least 1 400 kPa.

7.2 Outlet pressure

When tested in accordance with [Appendix K](#), the pressure at the outlet of the valve shall fall within the following limits, as appropriate:

- (a) *Pressure-reducing valves* — The greater of set pressure $\pm 10\%$ or set pressure ± 15 kPa.
- (b) *Pressure-limiting valves* — Set pressure $+35\%$, -10% .
- (c) *Ratio valves* — The pressure calculated by dividing the applied inlet pressure by the specified ratio, $+35\%$, -10% .

When tested, adjustable valves shall achieve the applicable tolerance at both maximum and minimum settings.

7.3 Set outlet pressures and ratios

For non-adjustable valves, the nominal outlet pressure or ratio shall be specified by the manufacturer.

For adjustable valves, the maximum, minimum and factory preset pressures shall be nominated by the manufacturer.

NOTE The preferred set pressures and ratios are as follows:

- (a) Pressure-reducing valves — 50 kPa, 70 kPa, 100 kPa, 140 kPa, 175 kPa, 210 kPa, 350 kPa and 500 kPa.
- (b) Pressure-limiting valves — 350 kPa, 500 kPa and 600 kPa.
- (c) Ratio valves — 2:1 and 3:1.

7.4 Flow rates

When tested in accordance with [Appendix L](#), the measured average flow rates shall be not less than the nominated flow rates.

7.5 Endurance

After testing in accordance with the endurance test outlined in [Appendix M](#), the valve shall be retested in accordance with [Clauses 7.2](#) and [7.4](#). The valve shall conform to [Clause 7.2](#) and have a flow rate not less than 90 % of the measured average flow rate determined in [Clause 7.4](#).

7.6 Marking

In addition to the general marking requirements of [Clause 1.6](#), each inlet pressure control valve shall be marked with the following:

- (a) For non-adjustable valves, the following information:
 - (i) For pressure-limiting and pressure-reducing valves, the set pressure, in kilopascals; and for ratio valves, the specified ratio.
 - (ii) Maximum inlet pressure, in kilopascals.
 - (iii) Nominated flow rate in litres per minute.
 - (iv) Specified maximum operating temperature, in degrees Celsius.
- (b) For adjustable valves, the following information:
 - (i) The maximum and minimum outlet pressures, in kilopascals.
 - (ii) Maximum inlet pressure, in kilopascals.
 - (iii) Nominated flow rates in litres per minute at the maximum and minimum settings.
 - (iv) Specified maximum operating temperature, in degrees Celsius.

Section 8 Isolating valves

8.1 General

Isolating valves conforming to this document are intended primarily for use in the installation of water heaters. They may be combined integrally with another valve or valve assembly that is intended to be fitted to the inlet of a water heater.

In addition to the requirements of [Section 8](#), isolating valves shall also conform to the relevant requirements of [Sections 1, 2](#) and [3](#).

Isolating valves are required to operate at continuous working pressure of at least 1 400 kPa.

8.2 Minimum flow area

The net cross-sectional area at any point within the valve body between the inner end of an inlet connection and the inner end of an outlet connection shall be not less than 75 mm².

8.3 Width of passages

The width of the flow passages between the inner ends of an inlet connection and the inner end of an outlet connection shall be not less than 3.5 mm.

8.4 Strength of operating mechanism

When tested in accordance with [Appendix N](#), isolating valves shall be capable of withstanding, without distortion or permanent deformation, the applied torque as appropriate.

8.5 Endurance

When tested in accordance with the endurance test outlined in [Appendix O](#), the valve assembly shall be capable of passing the following tests:

- (a) Leakage test in accordance with [Appendix D](#).
- (b) Test appropriate to the other valve or valve assembly, if any.
- (c) When combined with a non-return valve, the test as specified in AS 1357.1:2019 Clause 6.4.

Where it can be reliably demonstrated that the continued operation test does not affect the function of the other valve or valve assembly, it is not required to retest against Item (b).

Section 9 Thermal switching valves

9.1 General

Thermal switching valves conforming to this document are intended to automatically switch the flow of water from one inlet port to either of two outlet ports, depending upon the temperature of the inlet water.

In addition to the requirements of [Section 9](#), thermal switching valves shall conform to the relevant requirements of [Sections 1](#), [2](#) and [3](#).

Thermal switching valves shall operate at —

- (a) a continuous operating temperature not exceeding 85 °C;
- (b) temperatures under emergency conditions, not exceeding 99 °C; and
- (c) a continuous working pressure not exceeding 1 400 kPa.

9.2 Inlet and outlet connections

End connectors for connection to either copper or copper alloy metallic pipes or fittings shall conform to AS 3688 with the exception that capillary connectors shall not be used. Other connection ends shall conform to the requirements of the standard relevant to the connection.

9.3 Design requirements

Thermal switching valves shall incorporate tamper-resistant means to ensure that the operating temperature is not adjusted inadvertently without the use of non-standard tools.

9.4 Performance requirements

9.4.1 Flow capacity

When a thermal switching valve is tested in accordance with [Appendix P](#) —

- (a) the flow rate to the cold outlet port shall be not less than the nominated water flow capacity when the water temperature is at the lower switching temperature; and
- (b) the flow rate to the hot outlet port shall be not less than the nominated water flow capacity when the water temperature is at the upper switching temperature.

9.4.2 Leakage rate

When a thermal switching valve is tested in accordance with [Appendix P](#) —

- (a) the flow rate to the hot outlet port shall be not greater than the nominated leakage rate when the water temperature is at the lower switching temperature; and
- (b) the flow rate to the cold outlet port shall be not greater than the nominated leakage rate when the water temperature is at the upper switching temperature.

9.4.3 Switching time

When a thermal switching valve is tested in accordance with [Appendix P](#) —

- (a) the time taken for the flow rate from the cold outlet port to switch to the hot outlet port and fall below the nominated leakage rate shall be less than the nominated switching time; and

- (b) the time taken for the flow rate from the hot outlet port to switch to the cold outlet port and fall below the nominated leakage rate shall be less than the nominated switching time.

9.5 Endurance

When tested in accordance with the endurance test outlined in [Appendix Q](#), a thermal switching valve shall conform to [Clause 9.4](#).

9.6 Marking

In addition to the requirements specified in [Clause 1.6](#), each thermal switching valve shall be marked with the following:

- (a) The lower switching temperature, in degrees Celsius.
- (b) The upper switching temperature, in degrees Celsius.
- (c) Appropriate identification of the inlet, cold outlet and hot outlet connections.

9.7 Manufacturer's instructions

The manufacturer's instructions included with each thermal switching valve shall include the following:

- (a) Name and address of the manufacturer and the relevant agent in the country of intended sale.
- (b) Valve performance characteristics, including at least —
 - (i) the lower switching temperature, in degrees Celsius;
 - (ii) the upper switching temperature, in degrees Celsius;
 - (iii) the water flow capacity, in litres per minute;
 - (iv) the leakage rate, in litres per minute; and
 - (v) the switching time, in secs.
- (c) Full and comprehensive installation instructions.
- (d) Any operating limits the manufacturer has specified for the valve.
- (e) Comprehensive instructions for the procedures that are to be carried out to verify the performance of the valve in service.

Section 10 Air eliminators

10.1 General

Air eliminators conforming to this standard are intended to protect plumbing systems from damage caused by air entrapment.

In addition to the requirements of [Section 10](#), air eliminators shall conform to the relevant requirements of [Sections 1, 2](#) and [3](#).

Air eliminators are required to operate at —

- (a) a continuous operating temperature not exceeding 88 °C; or
- (b) where used for solar water heating applications, temperatures up to 180 °C.

10.2 Inlet and outlet connections

10.2.1 Inlet

The inlet to the air eliminator is defined as that part of the valve connected to the pipework. The inlet shall be no smaller than DN10.

10.2.2 Outlet

The outlet of the air eliminator/vent valve is defined as that part of the valve open to atmosphere.

10.3 Protection against blockage

The outlet of the air eliminator shall be designed to prevent entry of foreign matter.

10.4 Flow passages

The cross-sectional area of any flow passage shall not be less than 7 mm² on the outlet side of the valve, and not less than 28 mm² on the inlet side of the valve.

10.5 Opening and closing test

When tested in accordance with the opening and closing test outlined in [Appendix R](#), the opening of the valve shall occur once water has drained from the valve, and close once water refills the valve.

10.6 Pressure test

When tested in accordance with the leakage test outlined in [Appendix D](#) the valve shall not leak water.

10.7 Endurance test

Following testing in accordance with [Appendix R](#) for a minimum 100 cycles, the valve shall conform to [Clause 10.6](#).

10.8 Resistance to hot water

The valve shall conform to the requirements of [Clauses 10.5](#) and [10.6](#) after exposure to water at 120 °C ± 2 °C for 60₀⁺⁵ min in an autoclave.

10.9 Marking

In addition to the requirements specified in [Clause 1.6](#), each air eliminator shall be marked with the maximum operating temperature, in degrees Celsius.

Appendix A (normative)

Demonstrating conformity to this document

A.1 Scope

This appendix sets out the means for demonstrating product conformity to this document.

A.2 Relevance

The long-term performance of plumbing systems is critical to the durability of building infrastructure, protection of public health and safety, and protection of the environment.

A.3 Terms and definitions

For the purpose of this appendix, the definitions below apply.

A.3.1 batch release test BRT

test performed on a batch of components, which is completed before the batch is released

A.3.2 production batch

clearly identifiable collection of units, manufactured consecutively or continuously under the same conditions, using material or compound to the same specification

A.3.3 sample

one or more units of product drawn from a batch, selected at random without regard to quality

Note 1 to entry: The number of units of product in the sample is the sample size.

A.3.4 sampling plan

specific plan that indicates the number of units of components or assemblies to be inspected

A.3.5 type test TT

testing performed to demonstrate that the material, component, joint or assembly is capable of conforming to this document

A.3.6 type test batch

schedule of units of the same type, identical dimensional characteristics, all the same nominal diameter and wall thickness, from the same compound

A.4 Sampling and testing plan

The sampling and testing plan, as detailed in [Clause A.5](#) and [Tables S.1, T.1, U.1, V.1, W.1, X.1](#) and [Y.1](#) shall be used. Where a batch release testing program is required it shall be carried out as detailed in [Clause A.5](#) and [Tables S.2, T.2, U.2, V.2, W.2, X.2](#) and [Y.2](#).

A.5 Testing

A.5.1 Type testing

[Tables S.1, T.1, U.1, V.1, W.1, X.1](#) and [Y.1](#) specify requirements for type testing and frequency of reverification.

A.5.2 Batch release testing

[Tables S.2, T.2, U.2, V.2, W.2, X.2](#) and [Y.2](#) specify minimum sampling and testing frequency plans for the purpose of demonstrating product conformity to this document on an ongoing basis.

A.5.3 Retesting

In the event of a test failure, products within the batch shall be retested at an appropriate acceptable quality level (AQL). Only batches found to conform may be claimed and/or marked as conformant to this document.

A.6 Sampling and frequency plans

The sampling and frequency plans for each type of valve shall be as follows:

- (a) Vacuum relief valves — See [Appendix S](#).
- (b) Thermosiphon arrestor valves — See [Appendix T](#).
- (c) Primary temperature control valves — See [Appendix U](#).
- (d) Inlet pressure control valves — See [Appendix V](#).
- (e) Isolating valves — See [Appendix W](#).
- (f) Thermal switching valves — See [Appendix X](#).
- (g) Air eliminators — See [Appendix Y](#).