WMTS-481:2016
Thermal switching valves

WaterMark Technical Specification

2016

ABCB

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Thermal switching valves

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IMPORTANT NOTICE AND DISCLAIMER

On 25 February 2013 management and administration of the WaterMark Certification Scheme transferred to the Australian Building Codes Board (ABCB). From this date all new technical specifications will be named WaterMark Technical Specifications (WMTS). Within two years all existing ATS will be renamed WMTS. During this initial period both terms may be used and accepted. All new and recertified Certificates of Conformity will reference WMTS. Certificates of Conformity that currently reference ATS will be re-issued referencing the equivalent WMTS during this initial period. The WaterMark Schedule of Specifications lists all current WMTS and, where appropriate, the former ATS name.

This Technical Specification supersedes Standards Australia ATS 5200.481 – 2006.

The rebranding of this Technical Specification has included additional information about the transition as well as changes to specific details including replacing references to Standards Australia and the National Plumbing Regulators Forum (NPRF) with the ABCB, changing the term Australian Technical Specification (ATS) to WaterMark Technical Specification (WMTS), replacing references to technical committees WS-014 and WS-031 with the WaterMark Technical Advisory Committee (WMTAC).

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The ABCB welcomes suggestions for improvement in the WMTS, and encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact the ABCB via phone on 1300 134 631, email at watermark@abcb.gov.au or write to the WaterMark Administering Body, ABCB, GPO Box 9839, Canberra ACT 2601.

PREFACE

WaterMark Technical Specification WMTS-481: 2016 Technical Specification for plumbing and drainage products, Thermal switching valves was originally prepared by the Joint Standards Australia/Standards New Zealand Committee WS-031, Technical Procedures for Plumbing and Drainage Products Certification as ATS 5200.481 – 2006.

The objective of this Technical Specification is to enable product certification in accordance with the requirements of the Plumbing Code of Australia (PCA).

The word 'VOID' set against a clause indicates that the clause is not used in this Technical Specification. The inclusion of this word allows a common use clause numbering system for the WaterMark Technical Specifications.

The term 'normative' has been used in this Technical Specification to define the application of the appendices to which they apply. A 'normative' appendix is an integral part of a Technical Specification.

The test protocol and information in this Technical Specification was arranged by committee members to meet the authorization requirements given in the PCA.

The WaterMark Schedule of Specifications and List of Exempt Products are dynamic lists and change on a regular basis. Based on this function, these lists have been removed from the WaterMark Certification Scheme document known as Technical Specification for Plumbing and Drainage Products and are now located on the ABCB website (www.abcb.gov.au). These lists will be version controlled with appropriate historic references.

ACKNOWLEDGEMENTS

Australian Technical Specification ATS 5200.481 – 2006, on which this technical specification is based, was prepared by Standards Australia Committee WS-031, Technical Procedures for Plumbing and Drainage Products Certification. It was approved on behalf of the Council of Standards Australia on 29 May 2006.

The following organisations were represented on Committee WS-031 in the preparation of Australian Technical Specification ATS 5200.481 – 2006.

- AUSTAP
- Australian Electrical and Electronic Manufacturers Association
- Australian Industry Group
- Australian Stainless Steel Development Association
- Building Officials Institute of New Zealand
- Building Research Association New Zealand
- Certification Interests (Australia)
- Copper Development Centre – Australia
- Master Plumbers, Gasfitters and Drainlayers New Zealand
- National Fire Industry Association
- Plastics Industry Pipe Association of Australia
- Plumbing Industry Commission
- South Australian Water Corporation
- Water Services Association of Australia

TABLE OF CONTENTS

1 SCOPE

This Technical Specification sets out requirements for metallic-bodied thermal switching valves. These valves 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.

Thermal switching valves are required to operate at—

(a) continuous operating temperature not exceeding 85°C;

(b) temperatures under emergency conditions not exceeding 99°C; and

(c) continuous working pressure not exceeding 1400 kPa.

2 APPLICATION

This Technical Specification will be referenced on the WaterMark Certification Scheme Schedule of Specifications.

Appendix A sets out the means by which compliance with the Specification shall be demonstrated by a manufacturer for the purpose of product certification.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Technical Specification:

AS

1357 Valves primarily for use in heated water systems

1357.1 Part 1: Protection valves

1357.2 Part 2: Control valves

1432 Copper tubes for plumbing, gasfitting and drainage applications

1565 Copper and copper alloys—Ingots and castings

1572 Copper and copper alloys—Seamless tubes for engineering purposes

1646 Elastomeric seals for waterworks purposes

1646.1 Part 1: General requirements

1646.2 Part 2: Material requirements for pipe joint seals used in water and wastewater applications—Specifies by prescription formulation

1646.3 Part 3: Material requirements for pipe used in water and waste water applications with the exception of natural rubber and polyisoprene compounds

1646.4 Part 4: Material requirements for pipe used in water and waste water applications—Thermoplastic elastomers and vulcanizates

2136 Method for detecting the susceptibility of copper and its alloys to stress corrosion cracking using the mercurous nitrate test

2345 Dezincification resistance of copper alloys

2738 Copper and copper alloys-Compositions and designations of refinery products, wrought products, ingots and castings

3688 Water supply—Metallic fittings and end connectors

AS/NZS

1567 Copper and copper alloys—Wrought rods, bars and sections

1568 Copper and copper alloys—Forging stock and forgings

3500 Plumbing and drainage

3500.0 Part 0: Glossary of terms

3500.1 Part 1: Water supply

3500.4 Part 4: Heated water services

4020 Testing of products for use in contact with drinking water

4 DEFINITIONS

For the purpose of this Technical Specification, the definitions given in AS/NZS 3500.0, AS 1357.1 and AS 1357.2 apply.

5 MATERIALS

5.1 General

This Clause specifies requirements for materials utilized in the construction of the product.

5.2 Metallic materials

Metallic materials in contact with water shall be corrosion resistant. For the purposes of this Technical Specification, the following materials are considered to be suitable:

(a) Copper, as specified in Clause 5.2.2.

(b) Copper alloy, as specified in Clause 5.2.3 and 5.2.4.

(c) Stainless steel, as specified in Clause 5.2.5.

5.2.2 *Copper*

Copper shall comply with the following:

(a) *Wrought products* AS 2738.

(b) *Tubular components* Copper tube shall comply with AS 1432.

5.2.3 *Copper alloy*

Copper alloy shall comply with the following:

(a) *Castings* AS 1565 or capable of passing the requirements of Clause 5.2.3 provided the alloy contains not less than 58% copper and not more than 1% aluminium.

(b) *Hot pressings* AS/NZS 1568.

(c) *Rod for machined parts* AS/NZS 1567 or an alloy complying with AS 2345.

(d) *Tubular components* Copper alloy tube shall comply with AS 1572 alloy designation C26130. Where bent or stamped in the fabrication process, the tube shall be sufficiently stress-relieved so that it is capable of passing the mercurous nitrate test specified in AS 2136 after all fabrication processes are complete.

5.2.4 *Dezincification-resistant (DR) copper alloy*

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

5.2.5 *Stainless steel*

Stainless steel shall be grade 304 or 316 complying with the relevant ASTM Standard for the product form.

5.3 Elastomeric Materials

The materials used for seals or gaskets shall comply with AS 1646.1 and AS 1646.2 or AS 1646.3 or AS 1646.4.

6 MARKING

Each valve shall be permanently and legibly marked with the following:

(a) Manufacturer's name, brand or trademark.

(b) Model identification.

(c) Identification for traceability in the form of batch identification or individual serial number.

(d) Appropriate identification of the inlet and outlet.

(e) The lower switching temperature, in degrees Celsius.

(f) The upper switching temperature, in degrees Celsius.

(g) WaterMark.

(h) Licence number.

(i) The number of this Technical Specification, i.e., WMTS-481.

NOTE: Where space is limited, the number of the Technical Specification may be in abbreviated form i.e., S481.

7 PACKAGING

The valve shall be packaged in such a manner so as to avoid damage in transit.

8 DESIGN

8.1 Temperature adjustment

The valve shall be pre-set to a nominal temperature and shall incorporate tamper-resistant means to ensure that the operating temperature is not adjusted inadvertently or by unauthorised persons.

8.2 End connectors

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

9 PERFORMANCE REQUIREMENTS AND TEST METHODS

9.1 Products in contact with drinking water

Products in contact with drinking water shall comply with AS/NZS 4020. Products shall be tested as 'in line' with an applied scaling factor of 0.1.

9.2 Leakage test

When tested in accordance with the leakage test of AS 1357.2, using criteria as identified in Table 1, there shall be no signs of weeping, cracks leakage or other failure.

TABLE 1
HYRDROSTATIC PRESSURE AND APPLICATION

Applied pressure	Where applied	Special conditions
7kPa and 2000 kPa	Hot inlet	Outlets closed

9.3 Torque test

When tested in accordance with the strength torque test of AS 1357.1, the valve shall withstand the torque without permanent damage.

9.4 Valve flow performance tests

9.4.1 *Flow capacity*

When a thermal switching valve is tested in accordance with Appendix B—

(a) with the water temperature at the lower switching temperature, the flow rate to the cold outlet port shall be not less than the nominated water flow capacity; and

(b) with the water temperature at the upper switching temperature, the flow rate to the hot outlet port shall be not less than the nominated water flow capacity.

9.4.2 *Leakage rate*

When a thermal switching valve is tested in accordance with Appendix B—

(a) with the water temperature at the lower switching temperature, the flow rate to the hot outlet port shall be not greater than the nominated leakage rate; and

(b) with the water temperature at the upper switching temperature, the flow rate to the cold outlet port shall be not greater than the nominated leakage rate.

9.4.3 *Switching time*

When a thermal switching valve is tested in accordance with Appendix B—

(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 of operating mechanism

After a thermal switching valve is tested in accordance with Appendix C, it shall comply with the requirements of Clause 9.4.

10 TEST SEQUENCE AND TEST SAMPLE PLAN

A valve of each design representing routine production shall be tested in the following sequence:

(a) Torque test.

(b) Leakage test.

(c) Valve performance test.

(d) Endurance test.

(e) Valve performance test.

NOTE: A valve's design is considered to be related to its operating mechanism.

11 PRODUCT DOCUMENTATION

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 seconds.

(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.

Appendix A MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS TECHNICAL SPECIFICATION

(Normative)

A.1 SCOPE

This Appendix sets out the means by which compliance with this Technical Specification can be demonstrated by a manufacturer under the WaterMark Certification Scheme.

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 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with this Technical Specification.

The certification scheme serves to indicate that the products consistently conform to the requirements of this Technical Specification.

The frequency of the sampling and testing plan, as detailed in Paragraph A5, shall be used by the WaterMark Conformity Assessment Body. Where a batch release testing program is required it shall be carried out by the manufacturer as detailed in Paragraph A5 and Table A2.

A.4 DEFINITIONS

A.4.1 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. The batch is defined by the manufacturer.

A.4.2 Sample

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

NOTE: The number of units of product in the sample is the sample size.

A.4.3 Sampling plan

A specific plan, which indicates the number of units of components or assemblies to be inspected.

A.4.4 Type testing

Testing performed to demonstrate that the material, component, joint or assembly is capable of conforming to the requirements given in this Technical Specification.

A.5 TESTING

A.5.1 Type testing

Table A1 sets out the requirements for type testing and frequency of re-verification.

A.5.2 Batch Release Testing

Table A2 sets out the minimum sampling and testing frequency plan for a manufacturer to demonstrate compliance of product(s) to this Technical Specification on an ongoing basis. However where the manufacturer can demonstrate adequate process control to the WaterMark Conformity Assessment Body, the frequency of the sampling and testing nominated by the manufacturer's quality plan and/or documented procedures shall take precedence for the purposes of WaterMark product certification.

A.5.3 Retesting

In the event of a batch release test failure, the products within the batch may be retested at a frequency agreed to with the WaterMark Conformity Assessment Body and only those batches found to comply may be claimed and/or marked as complying with this Technical Specification.

Table A1—TYPE TESTS

Characteristic	Clause	Requirement	Test method	Frequency
Materials	5	Relevant Standard	Review materials parts lists and relevant data/test reports	At any change in materials specification
Marking	6	Labelling/marking	Visual examination	At any change in design/specification
Packaging	7	Protection from transit damage	Review of documentation/physical examination	
Design	8.2	End connectors	AS 3688, AS or ATS relevant to the piping system	
Performance	9.1	Products in contact with drinking water	AS/NZS 4020	At any change in materials, formulation or design or every five years whichever occurs first
	9.2	Leakage test	AS 1357.2	At any change in design or manufacturing process
	9.3	Torque test	AS 1357.1	
	9.4	Valve flow performance tests	Appendix B	
	9.5	Endurance test	Appendix C	
Product documentation	11	Manufacturer's instructions	Documentation review	At any change factors that require a change in documentation e.g., amendments to AS/NZS 3500.1 and AS/NZS 3500.4

Table A2— BATCH RELEASE TESTS

Characteristic	Clause	Requirement	Test method	Frequency
Materials	5	Relevant Standard	Delivery acceptance tests or supplier's quality certificate	Each delivery batch
Marking	6	Marking	Visual examination	Once per batch
Performance	9.2	Leakage test	AS 1357.2	100%
	9.4	Valve flow performance tests	Appendix B	

Note: the method used shall be based on the relevant appendix, and reflect the general intent of the particular method.

Appendix B FLOW CAPACITY, LEAKAGE RATE AND SWITCHING TIME – THERMAL SWITCHING VALVE

(Normative)

B.1 SCOPE

This Appendix sets out the method for testing the flow switching performance of a thermal switching valve.

B.2 PRINCIPLE

The valve under test is supplied with water at the lower and upper switching temperatures, as specified by the manufacturer. For each supply temperature, the flow rate to the open outlet port and the leakage rate to the closed port are measured.

B.3 APPARATUS

The following apparatus is required:

(a) Test rig for thermal switching valve test, including—

  (i) pressure gauge to measure water pressure at inlet of valve under test; and

  (ii) pipework with same nominal size as outlet port, connected to each outlet port of valve under test and directed to waste.

(b) Devices to measure the water flow rate from the outlets of valve under test.

(c) Devices to measure time.

(d) Supply of water at a temperature equal to the lower switching temperature of the valve under test (−3, +0°C) and a pressure of 500 ±50 kPa.

(e) Supply of water at a temperature equal to the upper switching temperature of the valve under test (−0, +3°C) and a pressure of 500 ±50 kPa.

B.4 PROCEDURE

The procedure shall be as follows:

(f) Install the valve under test in the test rig, in accordance with the manufacturer's instructions.

(g) Commence flowing water at the lower switching temperature to the test rig and purge all air from test rig.

(h) Allow the water to run through the valve for 10 ±2 s.

(i) Record the rate of water flowing from the cold outlet (cold outlet maximum flow) and the rate of water flowing from the hot outlet (hot outlet leak rate).

(j) Within a period of 2 ±1 s, isolate the water supply at the lower switching temperature, and commence flowing water at the upper switching temperature to the test rig. Start time measurement from the moment the water supplies are changed.

(k) Continue recording the time until the rate of water flowing from the cold outlet falls below the nominated leakage rate.

(l) Wait for a period of 10 ±2 s.

(m) Record the rate of water flowing from the hot outlet (hot outlet maximum flow) and the rate of water flowing from the cold outlet (cold outlet leak rate).

(n) Within a period of 2 ±1 s, isolate the water supply at the upper switching temperature, and commence flowing water at the lower switching temperature to the test rig. Start time measurement from the moment the water supplies are changed.

(o) Continue recording the time until the rate of water flowing from the hot outlet falls below the nominated leakage rate.

B.5 REPORT

The report shall include the following information:

(a) Manufacturer, model, type and size of valve under test.

(b) The nominated upper and lower switching temperatures.

(c) The measured maximum flow rates from the cold and hot outlets.

(d) The measured leakage rates from the cold and hot outlets.

(e) The measured switching times.

(f) Compliance or non-compliance with the requirements of this Technical Specification.

(g) Reference to this test method, i.e., Appendix B, WMTS-481.

Appendix C ENDURANCE TEST – THERMAL SWITCHING VALVE

(Normative)

C.1 SCOPE

This Appendix sets out the method for endurance testing a thermal switching valve.

C.2 PRINCIPLE

The valve under test is alternately supplied with water at a temperature 5°C below the lower switching temperature and 5°C above upper switching temperature, for a total of 50 000 cycles. The flow performance of the valve is then verified.

C.3 APPARATUS

The following apparatus is required:

(a) Test rig for thermal switching valve test, including—

(i) pressure gauge to measure water pressure at inlet of valve under test;

(ii) solenoid valves, under the control of a cyclic timing device, to connect the inlet of the valve under test to either of the controlled temperature water supplies; and

(iii) needle valves, connected to each outlet port of valve under test and with outlets of needle valves directed to waste.

(b) Water flow meter to measure the water flow rate into the inlet of the valve under test.

(c) Supply of water at a temperature equal to 5°C less than the lower switching temperature of the valve under test (−5, +0°C) and a pressure of 500 ±50 kPa (cold supply).

(d) Supply of water at a temperature equal to 5°C greater than the upper switching temperature of the valve under test (−0, +5°C) and a pressure of 500 ±50 kPa (hot supply).

(e) Stopwatch or suitable timing device.

C.4 PREPARATION FOR TESTING

The following steps shall be carried out before testing:

(a) Install the valve under test in the test rig, in accordance with the manufacturer's instructions.

(b) Open both outlet valves fully.

(c) Connect the hot and cold water supplies to the test rig and purge all air from test rig.

(d) Open the solenoid valve on the low temperature supply and adjust the cold outlet valve to give a flow rate of 5 ±0.5 L/min or the water flow capacity of the valve under test, whichever is the smaller. Close the solenoid valve on the low temperature supply.

(e) Open the solenoid valve on the high temperature supply and adjust the hot outlet valve to give a flow rate of 5 ±0.5 L/min or the water flow capacity of the valve under test, whichever is the smaller.

(f) Close the solenoid valve on the high temperature supply, open the solenoid valve on the low temperature supply and simultaneously start the stopwatch.

(g) Record the time, t_C, until the flow switches to the cold outlet.

(h) Close the solenoid valve on the low temperature supply, open the solenoid valve on the high temperature supply and simultaneously start the stopwatch.

(i) Record the time, t_H, until the flow switches to the hot outlet.

(j) Close all solenoid valves.

C.5 PROCEDURE

The procedure shall be as follows:

(a) Open the solenoid valve on the low temperature supply.

(b) Wait for a time $2 \times t_C$ then close the solenoid valve.

(c) Open the solenoid valve on the high temperature supply.

(d) Wait for a time $2 \times t_H$ then close the solenoid valve.

(e) Repeat Steps (a) to (d) for 50 000 ±500 cycles.

(f) Test the valve in accordance with Appendix B.

C.6 ALTERNATIVE TEST METHOD

C.6.1 Preparation

An alternate test method may be used where the valve under test is immersed fully and prepared in water—

(a) at a temperature equal to 5°C less than the lower switching temperature of the valve under test (−5, +0°C); and

(b) at a temperature equal to 5°C greater than the upper switching temperature of the valve under test (−0, +5°C).

C.6.2 Procedure

A second alternative method may be used, as follows:

(a) Immerse the valve in the low temperature supply.

(b) Wait for a time $2 \times t_C$.

(c) Transfer the valve to the high temperature supply, within 10 s.

(d) Wait for a time $2 \times t_H$.

(e) Transfer the valve to the low temperature supply, within 10 s.

(f) Repeat Steps (a) to (e) for 50 000 ±500 cycles.

(g) Test the valve in accordance with Appendix B.

C.7 REPORT

The report shall include the following information:

(a) Manufacturer, model, type and size of valve under test.

(b) The actual flow rates set for hot and cold supplies, or the actual temperatures of the hot and cold supplies used to immerse the valve.

(c) The actual times $2 \times t_C$ and $2 \times t_H$ used for the cyclic testing.

(d) The actual number of cycles completed.

(e) Reference to this test method, i.e., Appendix C, WMTS-481.

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