WMTS-534:2021

Metallic pressure differential bypass valves used in heated water systems

WaterMark Technical Specification

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PREFACE

This WaterMark Technical Specification (WMTS) was prepared in accordance with the Manual for the WaterMark Certification Scheme, Appendix 4, Protocol for Developing Product Specifications.

The objective of this WaterMark 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 WaterMark 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 WaterMark Technical Specification to define the application of the appendices to which they apply. A 'normative' appendix is an integral part of a WaterMark Technical Specification.

The test protocol and information in this WaterMark Technical Specification was arranged to meet the authorisation requirements given in the PCA.

The WaterMark Schedule of Products and the WaterMark Schedule of Excluded Products are dynamic lists and change on a regular basis. Based on this function, these schedules are now located on the ABCB website (www.abcb.gov.au). These lists will be version controlled with appropriate historic references.

ACKNOWLEDGEMENTS

WaterMark Technical Specification WMTS-534:2021 was prepared by industry and was approved by the Administering Body on XX XX 2021

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1 SCOPE

This Technical Specification sets out the requirements for metallic pressure differential bypass valves used in heated water systems up to DN32. They are for continuous operating temperatures not exceeding 85°C and pressures not exceeding 1000 kPa.

This specification shall be read in conjunction with AS 1357.2.

2 APPLICATION

The pressure differential bypass valves covered by this WaterMark Technical Specification are intended for use in a heated water system.

Appendix A sets out the means by which compliance with this WaterMark Technical 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	
1357.1	Valves primarily for use in heated water systems Part 1: Protection valves
1432	Copper tubes for plumbing, gasfitting and drainage application
1565	Copper and copper alloys – Ingots and castings
1572	Copper and copper alloys – Seamless tubes for engineering purposes
1646	Elastomeric seals for waterworks purposes
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 and Gas supply – Copper and copper alloy body compression and capillary fittings and threaded-end connectors
1357.2	Valves primarily for use in heated water systems Part 2: Control valves
AS/NZS	
1568	Copper and copper alloys – Forging stock and forgings
3500.0	Plumbing and drainage Part 0: Glossary of terms
3500.4	Plumbing and drainage Part 4: Heated water services
4020	Testing of products for use in contact with drinking water
NCC	
PCA	Plumbing Code of Australia
ASTM	
A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A276	Standard Specification for Stainless Steel Bars and Shapes
CEN/TS	
13388	Copper and copper alloys
ISO	
6957	Compendium of compositions and products – Copper alloys – Ammonia test for stress corrosion resistance

4 DEFINITIONS

For the purpose of this WaterMark Technical Specification, the definitions given in the WaterMark Scheme Rules, Plumbing Code of Australia and AS/NZS 3500.0 and those below apply.

4.1 Pressure differential bypass valve

This is a valve plumbed within a heated water system, used to control system pressure by diverting a portion of the flow so as to achieve optimal head pressure at the pump. This valve is typically plumbed from the pump outlet into the return line.

5 MATERIALS

5.1 General

This Clause specifies requirements for materials utilised in the construction of the product, for which it shall be suitable for the condition of use.

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 corrosion resistant:

a) Copper, as specified in Clause 5.2.1.

b) Copper alloy, as specified in Clause 5.2.2 and Clause 5.2.3.

c) Stainless steel, as specified in Clause 5.2.4.

5.2.1 Copper

Copper shall comply with the following:

a) *Wrought products* AS 2738.

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

5.2.2 Copper alloy

Copper alloy shall comply with CEN/TS 13388 or the following:

a) *Castings* AS 1565 and having a lead content no more than 4.5%.

b) *Hot pressing* AS/NZS 1568.

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

d) *Tubular components* Copper alloy tubes shall be of the designation C26130 and comply with AS 1572 alloy. 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 Clause 8, using a test solution of pH 9.5 without prior pickling, after all fabrication processes are completed.

Note: ISO 6957 requires that the entire components is tested before any coating or plating operation.

5.2.3 Dezincification-resistant (DR) copper alloy

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

5.2.4 Stainless Steel

Stainless steel shall comply with that referenced under AS 5830.1.

5.3 Elastomeric materials

The materials used for seals or gaskets shall comply with AS 1646.

6 MARKING

Markings to be placed on products or packaging shall be in accordance with the Manual for the WaterMark Certification Scheme.

In addition, each pressure differential bypass valve shall be legibly marked with the following:

a) Nominal size.

b) Pressure classification as PN or maximum operating pressure (MOP).

c) Identification of the inlet, outlet or other special connections, or by an arrow indicating direction of flow.

d) Batch identification, or individual serial number.

Note: The number of the Technical Specification may be in an abbreviated form, i.e. W534 where space is limited.

7 PACKAGING

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

8 DESIGN

8.1 End connectors

End connectors for connection to either copper or copper alloy metallic pipes or fittings shall comply with AS 3688. Other connection ends shall comply with the requirements of the Australian Standard (AS) or WaterMark Technical Specification (WMTS) relevant to the piping system.

8.2 Leakage

There shall be no leakage form the pressure differential bypass valve body when tested to the requirements of Clause 9.3.

9 PERFORMANCE CRITERIA AND TEST METHODS

9.1 Products in contact with drinking water

Materials in contact with drinking water shall comply with AS/NZS 4020 and tested as an in-line device, utilising a scaling factor of 0.01.

9.2 Body Torque

When tested in accordance with the torque test of AS 1357.1 (Appendix E), the valve under test shall be capable of withstanding, without permanent distortion or breakage, the applied torque, as appropriate.

9.3 Hydraulic strength test

When tested in accordance with AS 1357.2 Appendix E Leakage Test, the body shall not leak. Hydrostatic pressure and application for the pressure differential bypass valve body shall be to manufacturer's maximum working pressure.

9.4 Actuation control test

9.4.1 Opening Pressure

When tested in accordance with Appendix B at the manufacturer's nominated minimum and maximum operating pressure differential and the manufacturer's maximum operating temperature and pressure, the tested opening pressure shall not exceed the greater of:

a) Nominated pressure differential plus 10%; or

b) Nominated pressure differential plus 5kPa.

Whichever is the higher value.

9.4.2 Closing Pressure

When tested in accordance with Appendix B at the manufacturer's nominated minimum and maximum operating pressure differential and the manufacturer's maximum operating temperature and pressure, the tested closing pressure shall not be less than:

a) Nominated pressure differential minus 10%; or

b) Nominated pressure differential minus 5kPa.

Whichever is the lower value.

9.5 Durability Test

When tested in accordance with Appendix C, the valve shall be retested in accordance with and conform to the requirements of Clause 9.3 respectively.

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) Hydraulic strength test.

c) Actuation control test

d) Durability test.

11 PRODUCT DOCUMENTATION

Product data that identifies critical product characteristics shall be made available. Product data shall include:

a) Manufacturer's name, brand or trademark and address of the manufacturer.

b) Comprehensive installation diagrams.

c) Maximum and minimum working pressures, in kilopascals.

d) The maximum and minimum working water temperatures.

e) Any operational limitations as specified by the manufacturer.

f) Instructions on how to carry out performance verification on the valve during service.

APPENDIX A MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS PRODUCT SPECIFICATION

(Normative)

A.1 SCOPE

This appendix sets out the means by which compliance with this WaterMark Technical Specification shall 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 WaterMark Technical Specification.

The WaterMark Certification Scheme serves to indicate that the products consistently conform to the requirements of this WaterMark Technical Specification.

The sampling and testing plan, as detailed in Paragraph A5 and Table A1, 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.

Minimum annual inspection requirements, as detailed in Paragraph A5 and Table A3, shall be used by the WaterMark Conformity Assessment Body for annual product conformity surveillance.

Re-evaluation testing, as detailed in Paragraph A5 and Table A4, shall be used by the WaterMark Assessment Body in conjunction with renewal of the certification.

A.4 DEFINITIONS

A.4.1 Batch release test

A test performed by the manufacturer on a batch of components, which has to be satisfactorily completed before the batch can be released.

A.4.2 Product inspection

Examination of certified product, conducted during annual product conformity surveillance, to determine its conformity with the specific requirements of its current certification and WaterMark Licence.

A.4.3 Production batch

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

A.4.4 Re-evaluation testing

Testing carried out in conjunction with renewal of the certification.

A.4.5 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.4.6 Sampling plan

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

A.4.7 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.4.8 Type testing (TT)

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

A.5 TESTING AND INSPECTION

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 WaterMark Technical Specification on an ongoing

basis. However, where the manufacturer can demonstrate adequate process control to the certifying 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 WaterMark Technical Specification.

A.5.4 Minimum annual inspection requirements

Table A3 sets out the minimum annual inspection requirements to be undertaken.

A.5.5 Re-evaluation testing

Table A4 sets out the requirements for re-evaluation testing.

TABLE A1

TYPE TESTS

Characteristic	Clause	Requirement	Test method	Frequency
Materials	5	Materials	Review materials parts lists and compliance certificates	At any change in materials specification
	5.2.3	Dezincification-resistant (DR) copper alloy	AS 2345	At any change in materials
	5.3	Elastomeric materials	AS 1646.1 and AS 1646.2	At any change in materials
Marking	6	Marking	Visual inspection	At any change of the marking process or requirements
Design	8.1	End connectors	AS 3688 or relevant connection standard	At any change in the design
	8.2	Leakage	Clause 9.2	
Performance	9.1	Products in contact with water	AS/NZS 4020	At any change in materials, formulation or design, or every five years, whichever occurs first
	9.2	Body torque	AS 1357.1 Appendix E	
	9.3	Hydraulic strength test	AS 1357.2 Appendix E	At any change in design or manufacturing process
	9.4.1	Opening pressure	Appendix B	
	9.4.2	Closing pressure	Appendix B	
	9.5	Durability Test	Appendix C	
Product Documentation	11	Product Documentation	Visual Inspection	At any change to installation requirements

TABLE A2
BATCH RELEASE TESTS

Characteristic	Clause	Requirement	Test method	Frequency
Materials	5	Materials	Review materials parts lists and compliance certificates	Once per batch
Marking	6	Marking	Visual inspection	100%
Design	8.1	End connectors	AS 3688 or relevant connection standard	Once per batch
Performance	9.2	Body torque	AS 1357.1 Appendix E	Once per batch
	9.3	Hydraulic strength test	AS 1357.2 Appendix E	100% for cast bodies/ once per batch for others
	9.4.1	Opening pressure	Appendix B	Once per batch
	9.4.2	Closing pressure	Appendix B	Once per batch

TABLE A3
MINIMUM ANNUAL INSPECTION REQUIREMENTS BY WMCAB

Characteristic	Clause	Requirement	Verification method	Frequency
Materials	5	Materials	Review materials parts lists and compliance certificates	Sample from product family inspected annually
Marking	6	Marking	Visual inspection	
Design	8.1	End Connectors	Visual inspection for compliance with AS 3688 or relevant connection standard	
Performance	9.2	Body Torque	AS 1357.1 Appendix E	
	9.3	Hydraulic strength test	AS 1357.2 Appendix E	
	9.4.1	Opening pressure	Appendix B	
	9.4.2	Closing pressure	Appendix B	
Product Documentation	11	Product documentation	Visual inspection	

TABLE A4

RE-EVALUATION TESTING

Characteristic	Clause	Requirement	Test method
Materials	5	Materials	Review materials parts lists and compliance certificates
Design	8.1	End connections	AS 3688 or relevant connection standard
Performance	9.1	Products in contact with water	AS/NZS 4020
	9.2	Body torque	AS 1357.1 Appendix E
	9.3	Hydraulic strength test	AS 1357.2 Appendix E
	9.4.1	Opening pressure	Appendix B
	9.4.2	Closing pressure	Appendix B
Product documentation	11	Product data/Installation and maintenance instructions	Product documentation

APPENDIX B OPENING AND CLOSING PRESSURE TEST

(Normative)

B.1 SCOPE

This Appendix sets out the method for conducting a test to determine the point of actuation of the pressure differential bypass mechanism to establish functionality.

B.2 PRINCIPLE

The valve is subjected to a condition where it is actuated by increasing the pressure differential between the main line and the bypass line on which the valve is installed.

B.3 APPARATUS

The following apparatus shall be required, and shall be of an accuracy class as specified in AS 1357.2 Appendix C - Instrumentation:

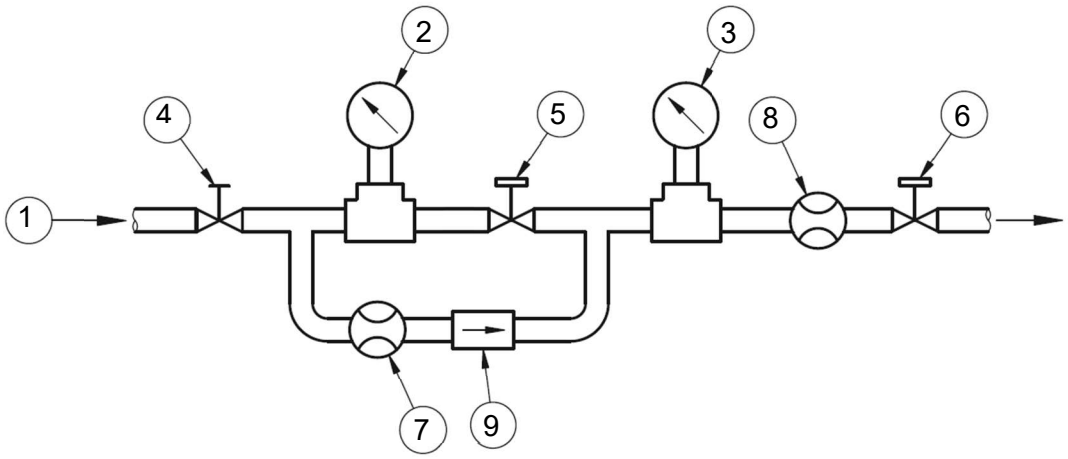
a) A hot water supply system capable of producing a constant supply of hot water.

b) Means for connecting the water supply to the valve to be tested.

c) Various valves to control the supply of water to the valve and be able to manipulate flow and pressure. A typical test rig is shown in Figure B.1.

d) Suitable measuring equipment to measure pressure and flow rate.

FIGURE B1 TYPICAL TEST RIG FOR PRESSURE DIFFERENTIAL BYPASS VALVES



LEGEND:

1 = adjustable pressure water supply

2, 3 = pressure gauges

4 = stop valve

5, 6 = control valves

7, 8 = flow meters

9 = valve under test

B.4 PROCEDURE

The procedure shall be as follows:

a) Set the valve to the manufacturer's minimum nominated operating pressure differential.

b) Install the valve under test (9) in the test rig.

c) Open stop valve (4) and both control valves (5, 6) to fill test rig with water at the manufacturer's maximum operating temperature, ±5 °C and purge air from the test rig pipework.

d) Operate the control valve (6) and adjust the supply pressure (1) to obtain steady state conditions of the manufacturer's maximum working pressure, ±10 kPa on the pressure gauge (3) and the appropriate flow rate from Table B.1 on the flow meter, ±2 L/min (8).

TABLE B.1 – APPROPRIATE FLOW RATES

Specified Size	Flow Rate (L/min)
DN15	7
DN20	16
DN25	30
DN32	49

e) Slowly close the control valve (5) until the valve under test (9) opens.

f) Record the pressures on both pressure gauges (2, 3) at the point the valve under test (9) opens. Opening of the valve shall be indicated by the flow rate on the flow meter (7) exceeding 0.1 L/min.

g) Continue to close the control valve (5) until the flow rate through the valve under test (9) is at least 50% of the appropriate flow rate and hold for 30 seconds to stabilise flow.

h) Slowly open the control valve (5) until the valve under test (9) closes.

i) Record the pressures on both pressure gauges (2) at the point the valve under test (9) closes. Closing of the valve shall be indicated by the flow rate on flow meter (7) indicating a flow of less than 0.1 L/min.

j) Repeat Steps (c) to (i) for a total of three readings.

k) Repeat Steps (b) to (j) for the manufacturer's maximum nominated operating pressure differential.

B.5 TEST REPORT

The following shall be reported:

a) Manufacturer, model identification and size of valve.

b) Test parameters, i.e. temperature, supply pressure.

c) The pressure differential at which the valve opened and the pressure differential at which the valve closed for:

   i. Valve set at manufacturer's stated minimum operating pressure differential.

ii. Valve set at manufacturer's stated maximum operating pressure differential.

d) Compliance or non-compliance with the testing criteria in this Technical Specification.

e) Reference to this test method, i.e., Appendix BWMTS-534:2021.

APPENDIX C ENDURANCE TEST

(normative)

C.1 SCOPE

This Appendix sets out the method for conducting a test to determine the point of actuation of the pressure differential mechanism to establish continued satisfactory functionality after being subjected to 100,000 operations.

C.2 PRINCIPLE

The valve is subjected to repeated cyclic operations in an endurance test where it is actuated by increasing the pressure differential between the main line and the bypass line on which the valve is installed

C.3 APPARATUS

The following apparatus shall be required, and shall be of an accuracy class as specified in AS 1357.2 Appendix C - Instrumentation:

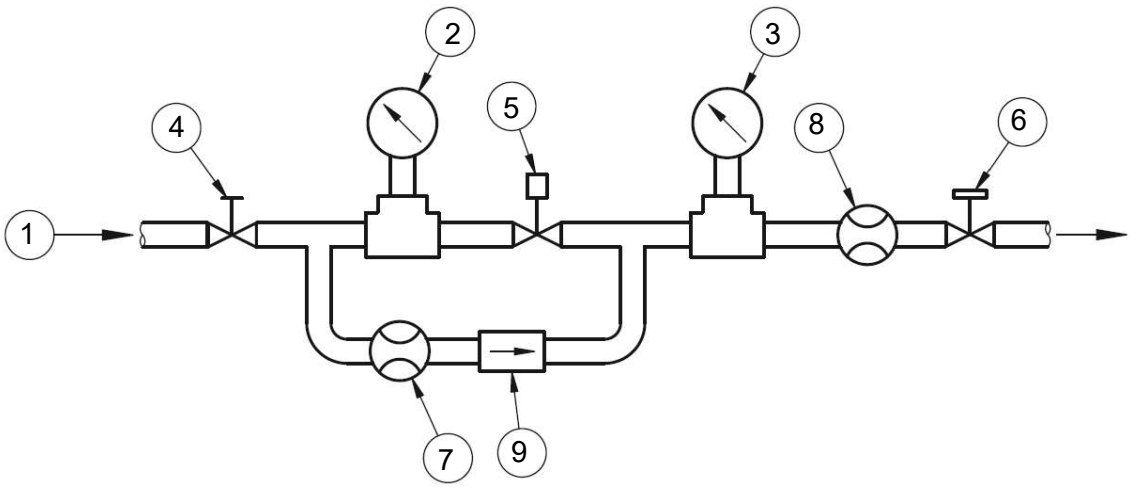
a) A hot water supply system capable of producing a constant supply of hot water.

b) Means for connecting the water supply to the valve to be tested.

c) Various valves to control the supply of water to the valve and be able to manipulate flow and pressure. A typical test rig is shown in Figure C.1.

d) Suitable measuring equipment to measure pressure and flow rate. .

FIGURE C1 TYPICAL ENDURANCE TEST RIG FOR PRESSURE DIFFERENTIAL BYPASS VALVES



LEGEND:

1 = adjustable pressure water supply

2, 3 = pressure gauges

4 = stop valve

5 = solenoid valve

6 = control valve

7, 8 = flow meters

9 = valve under test

C.4 PROCEDURE

The procedure shall be as follows:

a) Set the valve to the manufacturer's minimum nominated operating pressure differential.

b) Install the valve under test (9) in the test rig.

c) Open stop valve (4), control valve (6) and solenoid valve (5) to fill test rig with water at the manufacturer's maximum operating temperature, ±5 °C and purge air from the test rig pipework.

d) Operate the control valve (6) and adjust the supply pressure (1) to obtain steady state conditions of the manufacturer's maximum working pressure, ±10 kPa on the pressure gauge (3) and the appropriate flow rate from Table B.1 on the flow meter (8).

e) Close solenoid valve (5) for 1 ±0.5 seconds and then open solenoid valve (5) for 1 ±0.5 seconds, this constitutes 1 cycle.

f) Repeat Step (e) for 50 000 cycles.

g) After completion of the 50 000 cycles retest the valve under test (9) in accordance with Appendix B.

h) Repeat Steps (b) to (g) for the manufacturer's maximum nominated operating pressure differential.

C.5 TEST REPORT

The following shall be reported:

a) Manufacturer, model identification and size of valve.

b) Test parameters, i.e. temperature, supply pressure.

c) The pressure differential at which the valve opened and the pressure differential at which the valve closed for a:

   i. Valve set at manufacturer's stated minimum operating pressure differential.

   ii. Valve set at manufacturer's stated maximum operating pressure differential.

d) Report observations of any leakage or failure of the valve

e) Compliance or non-compliance with the testing criteria in this Technical Specification.

f) Reference to this test method, i.e., Appendix C, WMTS-534:2021.