

Australian/New Zealand Standard™

Performance of showers for bathing



AS/NZS 3662:2005

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee WS-032, Water Efficient Appliances. It was approved on behalf of the Council of Standards Australia on 16 February 2005 and on behalf of the Council of Standards New Zealand on 28 February 2005.

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The following are represented on Committee WS-032:

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Australian Industry Group
Building Research Association of New Zealand
Consumer Electronics Suppliers Association
Consumers' Federation of Australia
CSIRO Manufacturing & Infrastructure Technology
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AS/NZS 3662:2005
(Incorporating Amendment Nos 1, 2 and 3)

Australian/New Zealand Standard™

Performance of showers for bathing

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WS-032, Water Efficient Products, to supersede AS/NZS 3662:1996.

This Standard incorporates Amendment No. 1 (February 2006), Amendment No. 2 (January 2009) and Amendment No. 3 (March 2010). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The Plumbing Code of Australia requires that water efficient products be certified to WaterMark Level 2.

The objective of this Standard is to specify the requirements for showers for bathing purposes. Shower types include—

- A2 |
- (a) showerhead(s) fastened to fixed arm(s);
 - (b) showerhead(s) fastened to pivotal arm(s);
 - (c) showerheads with integral mixing valves;
 - (d) hand-held showers connected to flexible hoses—
 - (i) supported by a fixed wall handset holder;
 - (ii) attached to a slide rail; or
 - (iii) mounted on a holder attached to a bath/shower mixer.

A2 | Where showers are sold together with other components (e.g., a fixed or pivot arm, a flexible hose with or without a flow controller or mixing valve), which could affect the performance of the shower, such components will need to be attached to the shower for testing. Where showers are sold together with components that would not affect their performance (e.g., tap top assemblies, or other components), such additional components need not be attached to the shower for testing.

A2 | NOTES:

- 1 For prefabricated bathroom modules that include showerheads(s), refer to ATS 5200.050.
- 2 Showers, when sold as an assembly with tapware, may be WaterMark approved under AS/NZS 3718.

This revision includes—

- (a) an extended definition of a shower to include relevant components;
- (b) amended test procedures;
- (c) requirements for shower hoses; and
- (d) a method for determining the effective diameter of non-circular-shaped showerheads.

The term ‘normative’ has been used in this Standard to define the application of the appendix to which it applies. A ‘normative’ appendix is an integral part of a Standard.

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FOREWORD

As showers are significant consumers of water, this Standard has been revised to encourage the development of showers that will give a comfortable and effective shower even at low water flow rates.

A shower is essentially a tactile experience and what may look like a good shower may not be confirmed by use. The following factors, among others, influence the quality of a shower:

- (a) *Water flow rate*
- (b) *Temperature drop* Showers with significant temperature drops, which increase with distance from the head, could present a scalding hazard and may require greater heated water usage to achieve acceptable water temperatures. The ability of water to rinse soap is temperature sensitive; therefore, showers with a minimum temperature drop (drop in water temperature from the showerhead to the lower limbs) are more effective for ablution purposes.

The criterion for temperature drop in this Standard is based on what can be readily achieved by many showers currently on the market.

- A2 | (c) *Temperature stability* Showers with restriction in unequal pressure installations are more susceptible to fluctuations in supply pressure, which could present a scalding or thermal shock hazard to the bather.

- A2 | (d) *Spray pattern* The spray pattern of a shower has two main features. The first is the shape of the cone of water emitted and the second is the distribution of spray within the cross-sections of the cone. Showers with wide cones can display two undesirable features: if the water spray is evenly distributed throughout the cone, a significant temperature drop may be felt with increasing distance from the shower spray head; alternatively, if the spray is concentrated around the perimeter of the cone, the shower may have a hollow feel. In either case, the shower may present difficulties when washing and rinsing the lower body extremities.

This Standard maintains a requirement for the angle of spread from the shower spray head of a cone. Consumer acceptance tests on different showerheads indicated a preference for shower spray heads with a mean spray spread angle of between 3° and 7°.

- A2 | (e) *Comfort and effectiveness* Although the velocity of spray is a factor in the comfort and effectiveness of a shower, a test for velocity of spray is not included in this Standard. High velocity sprays are uncomfortable and force the bather to reduce the flow rate, which may be beneficial for water conservation, but may also result in the shower becoming ineffective.

Tests conducted on showerheads to aid in the development of this Standard indicated the following with respect to spray exit velocity:

Velocity	Effect
2–3 m/s	Comfortable spray
4–6 m/s	Stimulating spray
>10 m/s	Painful spray

No overall test for the comfort and effectiveness of a shower has yet been included in this Standard, of which velocity is a factor. Research is underway to develop such criteria, especially for showers with flow rates less than 7.5 L/m.

NOTES:

- 1 It is anticipated that the next revision of this Standard will include appropriate tests.
- 2 Showers are required to meet the requirements of the Plumbing Code of Australia and the New Zealand Building Code.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Performance of showers for bathing

1 SCOPE

This Standard specifies requirements for the performance of showers for bathing.

2 COMPLIANCE WITH THIS STANDARD

Demonstration of compliance with the requirements of this Standard shall be in accordance with Appendix A.

3 REFERENCED DOCUMENTS

The following documents are referred in this Standard:

AS/NZS

3500 Plumbing and drainage

3500.0 Part 0: Glossary of terms

6400 Water efficient products—Rating and labelling

ATS

5200 Technical Specification for plumbing and drainage products

5200.037.2 Part 037.2: Flow Controllers

DIN EN

1113 Showers hoses for (PB 10) sanitary tapware

4 DEFINITIONS

For the purpose of this Standard, the definitions below apply. Where terms are not defined in this Standard, the definitions in AS/NZS 3500.0 apply.

4.1 Shower

A showerhead through which water is intended to pass to form a spray for bathing purposes, which may include a fixed or pivot arm, a flexible hose (with or without a flow controller), tap top assemblies, or other components.

4.2 High pressure shower

A shower where both the hot water and cold water supply pressures are at 150 kPa or above.

4.3 Low pressure shower

A shower where both the hot water and cold water supply pressures are below 150 kPa.

4.4 Unequal pressure shower

A shower where the hot water supply pressure is below 150 kPa and the cold supply pressure is at or above 150 kPa.

4.5 Nominal flow rate

The water consumption of a shower at the maximum flow setting, which is measured in litres per minute, using a dynamic water pressure of—

- (a) 35 kPa in accordance with Appendix G; or

- A2 | (b) the average of 150 kPa, 250 kPa and 350 kPa in accordance with Appendix B.

5 PERFORMANCE REQUIREMENTS

5.1 Flow rate

A2 | **5.1.1 General**

Where showers are sold as an assembly with other components (e.g., a fixed or pivot arm, a flexible hose with or without a flow controller or backflow prevention device, a mixing valve), which could affect the performance of the shower, such components shall be attached to the shower for testing.

Where showers are sold together with components that would not affect their performance (e.g., tap top assemblies, or other components), such additional components need not be attached to the shower for testing.

5.1.2 High pressure

The nominal flow rate of a high pressure shower shall be determined in accordance with Appendix B, measured at pressures of 150 kPa, 250 kPa and 350 kPa, and—

- (a) the maximum difference between the highest and lowest average flow rate shall not exceed 2.0 L/min;
- (b) the highest average flow rate shall not exceed the upper limit of the flow range for the determined nominal flow rate in AS/NZS 6400 by more than 1.0 L/min; and
- (c) the lowest average flow rate shall be not less than the lower limit of the flow range for the determined nominal flow rate in AS/NZS 6400 by more than 1.0 L/min.

5.1.3 Low pressure or unequal pressure

The nominal flow rate of a low pressure or unequal pressure shower shall be determined in accordance with Appendix G, measured at a dynamic pressure of 35 kPa.

5.2 Mean spray spread angle

When determined in accordance with Appendix C, the mean spray spread angle shall be between 0° and 8°.

5.3 Temperature drop

When determined in accordance with Appendix D, the temperature drop shall not exceed 3°C.

5.4 Shower hoses

Shower hoses shall comply with Clause 5.4.1 to Clause 5.4.4 or DIN EN 1113.

5.4.1 Tensile strength and watertightness

When tested in accordance with Paragraph E2 of Appendix E, the shower hose shall not rupture, permanently deform in a manner that would affect its performance or visibly leak.

5.4.2 Temperature resistance

When tested in accordance with Paragraph E3 of Appendix E, the shower hose shall not rupture, permanently deform in a manner that would affect its performance or visibly leak.

5.4.3 Thermal shock resistance

When tested in accordance with Paragraph E4 of Appendix E, the shower hose shall not rupture, permanently deform in a manner that would affect its performance or visibly leak.

5.4.4 *Effectiveness of rotary connections*

When tested in accordance with Paragraph E5 of Appendix E, the initial torque shall not be greater than 1 Nm.

5.5 **Watertightness of end connections**

All end connections of a shower shall have a G1/2 or G1/2B type thread. When attached to a water supply, in accordance with the manufacturer's specified method of attachment, the end connections shall be watertight.

5.6 **Flow controller**

5.6.1 *General*

A2 | Where a flow controller is incorporated in a shower or a component of a shower, the controller shall be mechanically retained to prevent dislodgment and the need of a tool for removal.

Flow controllers shall comply with ATS 5200.037.2 or Clause 5.6.2.

A flow controller, tested and compliant with ATS 5200.037.2 or Clause 5.6.2, may be used in a range of showers without further endurance testing.

5.6.2 *Endurance test for flow controllers used in showers*

When tested in accordance with Appendix F—

- (a) the maximum difference between the highest and lowest average flow rate, measured at pressures of 150 kPa, 250 kPa and 350 kPa, shall not exceed 2 L/min; and
- (b) the flow rate shall be within ± 1 L/min of the nominal flow rate, as determined in Clause 5.1.

6 **MARKING REQUIREMENTS**

A2 | Showers or their packaging shall be durably and legibly marked with the following:

- (a) Certification mark, licence number, the number of this Standard (i.e., AS/NZS 3662) and the manufacturer's or supplier's name.
- (b) Suitability for use with high pressure or low and unequal pressure water supply.
- A3 | (c) For high pressure showers, a clear statement to indicate that the shower may not be suitable for use with gravity-fed water heaters, low and unequal pressure supply networks, instantaneous water heaters, tempering valves and thermostatic mixing valves.
- A2 | (d) For low and unequal pressure showers, a clear statement to indicate that the shower is not for use with high pressure systems.
- (e) Where showers incorporate flow controllers, instructions that care be exercised during installation to ensure that the male connecting threads do not damage the flow controllers.
- (f) Further installation instructions that include statements reflecting the requirements of the warranty as defined in the Plumbing Code of Australia, New Zealand Building Code and the installation requirements of AS/NZS 3500 series of Standards, covering any limitations on the product's installation and use (e.g., flow rate, maximum supply pressure, backflow prevention device where shower hoses are fitted, etc.).

APPENDIX A
MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD
 (Normative)

A1 SCOPE

This Appendix sets out the means for demonstrating compliance with this Standard.

NOTE: Plumbing Code of Australia requires that these products should be certified to WaterMark Level 2.

A2 DEFINITIONS

A2.1 Sample

One or more units of product selected at random from a production run without regard to quality.

A2.2 Type testing

Testing performed on a sample to demonstrate that the product complies with this Standard.

A2.3 Design change

Alterations to the product, which affect its performance or compliance with this Standard.

A3 TESTING

A3.1 Type testing

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

Product samples for type testing shall be of the same type, identical dimensions and characteristics, all the same nominal diameter and wall thickness, and from the same materials.

TABLE A1
TYPE TESTS

Characteristic	Requirement (Clause)	Property	Test method	Frequency of retesting
Performance	5.1	Flow rate	Appendix B or G	On change of design
	5.2	Mean spray spread angle	Appendix C	
	5.3	Temperature drop	Appendix D	
	5.4	Shower hoses	Appendix E or DN EN 1113	On change of materials or supplier or design
	5.5	G1/2 or G1/2B threads and watertightness	Visual inspection	On change of design
	5.6.1	Mechanical retention of flow controller	Visual inspection	
	5.6.2	Endurance	Appendix F or ATS 5200.037.2	
Marking	6	Marking	Visual inspection	On change of design

A2

APPENDIX B

A2 | DETERMINATION OF NOMINAL FLOW RATE FOR USE IN HIGH PRESSURE SHOWERS

(Normative)

B1 SCOPE

A2 | This Appendix sets out the method for determining the nominal flow rate of a high pressure shower.

B2 PRINCIPLE

The shower to be tested is supported in a test rig and water is passed through the shower at dynamic flow pressures of 150 kPa, 250 kPa, 350 kPa and 500 kPa; when the flow rate has stabilized it is recorded at each of these pressures at ambient water temperature.

B3 APPARATUS

The following apparatus is required:

- (a) A water supply capable of delivering water at—
 - (i) a flow rate of more than 20 L/min; and
 - (ii) a dynamic flow pressure of at least 500 kPa.
- (b) Test apparatus made from DN 15, Type B copper pipe. The branch for flow pressure measurements shall be located at least 250 mm downstream of any valve or fitting. The shower connection shall be not more than 300 mm downstream of the branch for flow pressure measurements.
NOTE: See Figure B1 for a typical test arrangement.
- (c) A pressure gauge having an accuracy of $\pm 2\%$ of the true value.
- (d) A flow meter having an accuracy of $\pm 2\%$ of the true value.

B4 PROCEDURE

The procedure shall be as follows:

- A2 | (a) Where a shower(s) is(are) supplied with other components (e.g., an arm, shower hose, elbow with a flow controller or backflow prevention device, mixing valve) assemble the shower in accordance with the manufacturer's specification and test in the assembled configuration.
- (b) For showers with adjustable spray settings, adjust the spray to the maximum flow setting.
- A2 | (c) Mount the shower in the test rig with the water supply connected to the intended inlet(s).
- (d) Condition the shower by allowing the water to flow and adjusting the control valve gradually until the dynamic flow pressure of 500 kPa is achieved. Maintain the flow until the flow and pressure remain stable for at least 1 min.
- (e) Gradually adjust the control valve to turn off the flow of water.
- (f) Gradually turn on the flow of water until a stabilized flow at a dynamic flow pressure of 150 kPa is achieved.
- (g) Observe the flow meter and record the flow rate at that dynamic flow pressure.

- (h) Repeat Steps (f) and (g) with the dynamic flow pressure increased to 250 kPa, 350 kPa and then to a 500 kPa.
- (i) Gradually adjust the control valve to turn off the flow of water.
- (j) Repeat Steps (f) to (i) to obtain a second reading of the flow rates at the range of pressures.
- (k) Calculate and record the average flow rates at each of the following dynamic pressures:
 - (i) 150 kPa.
 - (ii) 250 kPa.
 - (iii) 350 kPa.
 - (iv) 500 kPa.

A2

- (l) Calculate the mean of the average flow rates obtained in Step (k) (i) to (k) (iii), and record this value as the nominal high pressure flow rate.

NOTE: Although the shower is conditioned to 500 kPa, the recording of the average flow rate at that pressure is for data collecting purposes only.

- (m) From the averages obtained in Step (k) (i) to (k) (iii), record the highest and lowest average flow rates.
- (n) Calculate and record the maximum differences between the highest and lowest average flow rates at Step (m).

NOTE: Clause 5.1 specifies that the maximum difference between the highest and lowest average flow rates is not to exceed 2 L/min.

B5 TEST REPORT

The following shall be reported:

A2

- (a) Manufacturer, brand name, model name and model number of the shower and description of other components tested with the sample.
- (b) The average flow rate (in litres per minute) through the test sample, at the dynamic flow pressures of—
 - (i) 150 kPa;
 - (ii) 250 kPa;
 - (iii) 350 kPa; and
 - (iv) 500 kPa.

NOTE: The average flow rates as determined in Paragraph B4 (k).
- (c) The nominal flow rate.

NOTE: As determined in Paragraph B4 (l).
- (d) The highest and lowest average flow rates

NOTE: As determined in Paragraph B4 (m).
- (e) The difference between the highest and lowest average flow rates at 150 kPa, 250 kPa and 350 kPa.

NOTE: As determined in Paragraph B4 (n).

- A2 | (f) Compliance with Clause 5.1.2(b) for maximum average flow rate.
- (g) Compliance with Clause 5.1.2(c) for minimum average flow rate.
- A2 | (h) Product nominated for use with high pressure as defined in this Standard.
- (i) Reference to this test method, i.e., AS/NZS 3662, Appendix B.

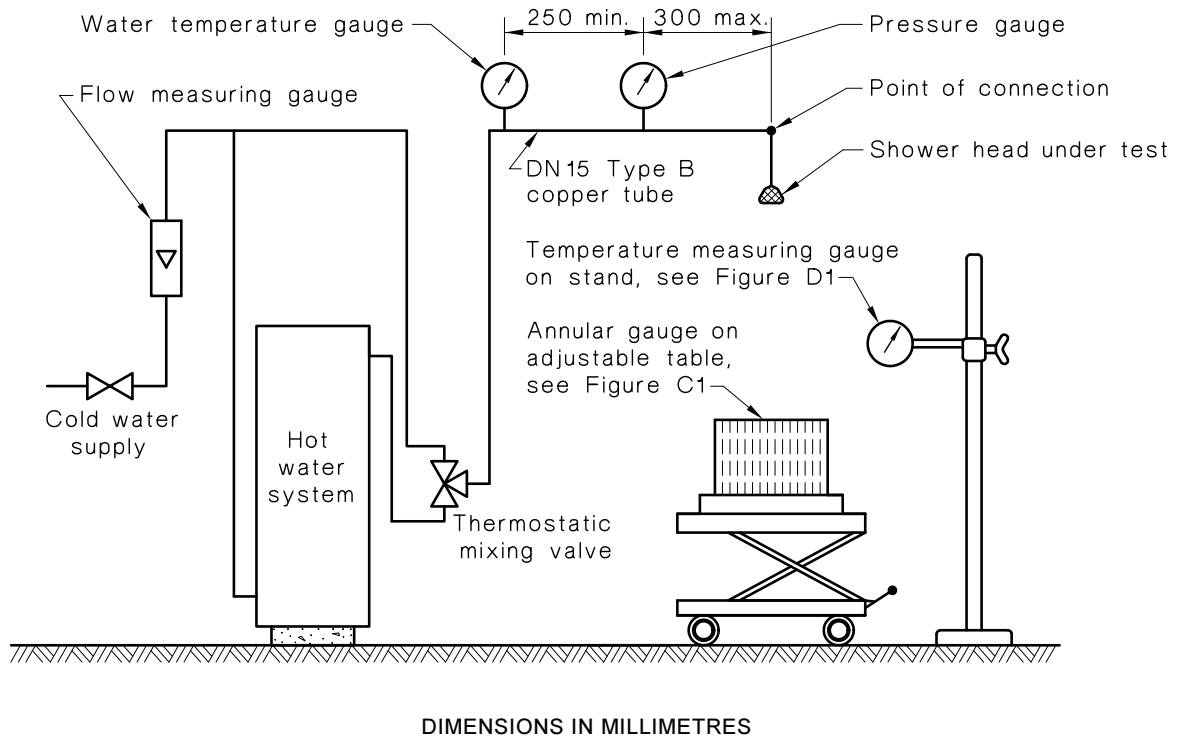


FIGURE B1 TYPICAL TEST ARRANGEMENT

APPENDIX C
DETERMINATION OF MEAN SPRAY SPREAD ANGLE
 (Normative)

C1 SCOPE

This Appendix sets out the method for determining the mean spray spread angle of a shower.

C2 PRINCIPLE

A2

The shower is supported in a test rig. Water at ambient temperature is run through the shower into an annular gauge, at a dynamic pressure of either—

- (a) 35 kPa for low and unequal pressure showers; or
- (b) 250 kPa for high pressure showers.

The water collected in each section of the gauge is then measured and the mean spray spread angle is calculated.

C3 APPARATUS

The following apparatus is required:

- (a) A water supply capable of delivering water at—
 - (i) a flow rate of more than 20 L/min; and
 - (ii) a dynamic flow pressure of at least 500 kPa.
- (b) An annular gauge as shown in Figure C1.
- (c) A flow meter to measure total flow to within $\pm 2\%$ of the true value.
- (d) Measuring cylinders to measure, within ± 5 mL/L, the volume of water collected in each annular cylinder of the annular gauge.
- (e) A stopwatch with an accuracy of ± 0.1 s.
- (f) A tape measure.

C4 PROCEDURE

The procedure shall be as follows:

- (a) Where a showerhead is supplied with other components (e.g., an arm, shower hose, elbow with a flow controller), assemble the shower in accordance with the manufacturer's specified method of assembly.
- (b) For showers with adjustable spray settings, adjust the spray to the maximum flow setting.
- (c) Mount the shower in the test rig with the water supply connected to the intended inlet with the faceplate horizontal.
- (d) Place the annular gauge underneath the shower so that the centre-line of the faceplate and the centre cylinder are in vertical alignment and the top of the annular gauge is 400 ± 5 mm from the faceplate.

- A2 | (e) Cover the top of the annular gauge and adjust the water supply to flow at a stabilized dynamic pressure of—
- (i) 35 ±1 kPa for low and unequal pressure showers; or
 - (ii) 250 ±1 kPa for high pressure showers.
- Remove the cover and allow the water to flow through the shower and into the annular gauge for at least 60 s.
- (f) Record the total flow reading on the flow meter and the time to the nearest second, ensuring that the water supply is allowed to flow through the shower and into the annular gauge.
- (g) Collect, measure and record the volume of water in each annular cylinder. Determine the total flow collected by all annular cylinders.
- (h) If the total flow collected by all annular cylinders and the total flow recorded on the flow meter vary by more than ±5%, repeat Steps (e) to (g).
- (i) If the total flow collected by all annular cylinders and the total flow recorded on the flow meter do not vary by more than ±5%, determine the percentage of water collected in each of the annular cylinders.
- (j) Calculate the effective diameter of the shower as indicated in Paragraph C5.
- (k) Calculate the mean spray spread angle of the shower using the following equation—

A1 |

$$\text{Mean spray spread angle} = \text{Tan}^{-1} \left\{ \frac{\sum_1^N [X_N(2N - 1)] - 4ED}{3200} \right\}$$

where—

ED = effective diameter of showerhead, in millimetres (see Clause C5 to calculate this variable)

X_N = percentages of the total flow collected by the individual annular cylinders, as determined in Step (i) above

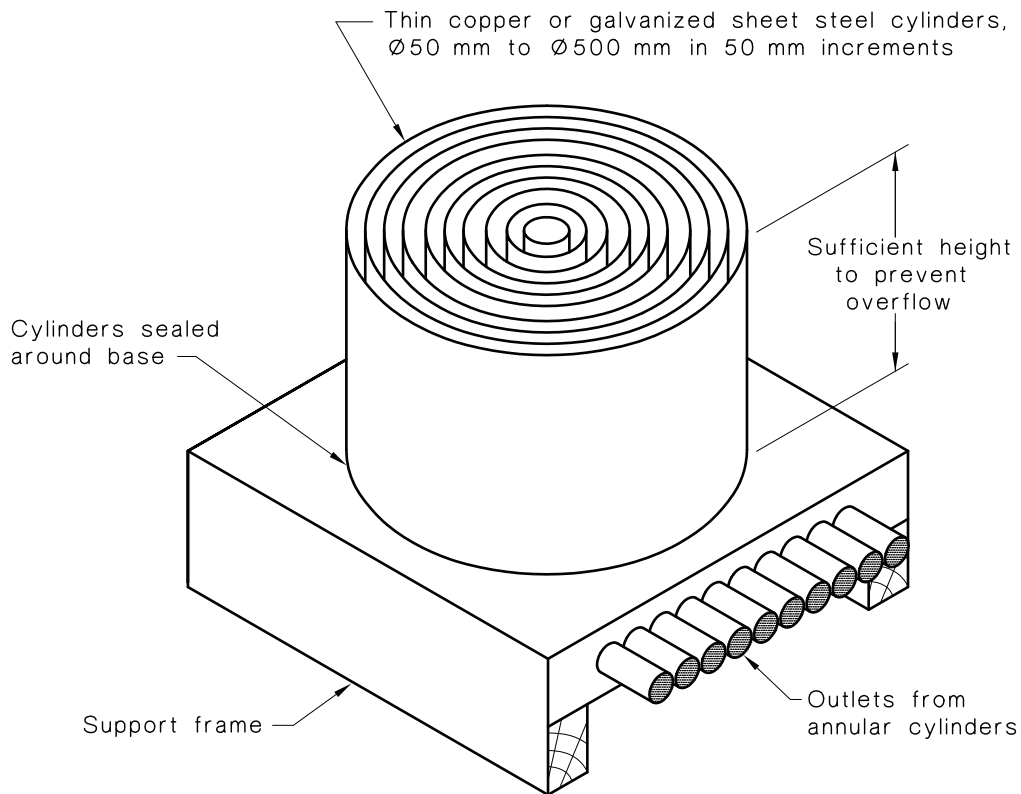
N = number of the annular cylinder, counting from the centre out, i.e.,

- = 1 (i.e., the 50 mm diameter cylinder)
- = 2 (i.e., the 100 mm diameter cylinder)
- = 3 (i.e., the 150 mm diameter cylinder)
- =
- =
- = 10 (i.e., the 500 mm diameter cylinder)

as such,

X₁ = percentage of the total flow collected by the 50 mm diameter cylinder

X₂ = percentage of the total flow collected by the 100 mm diameter cylinder



NOTE: Cylinders with wall thickness in excess of 1 mm should be bevelled inwards to relevant cylinder.

FIGURE C1 TYPICAL ANNULAR GAUGE

C5 CALCULATION OF EFFECTIVE DIAMETER

C5.1 Case 1—Showerhead with a circular pattern of holes on single diameter

For a showerhead with a faceplate that has a circular pattern of holes along a single diameter pattern, calculate the effective diameter (ED) using the following equation:

$$ED = D \quad \dots C1$$

where

D = projected diameter along which the holes lie (see Figure C2, Case 1)

C5.2 Case 2—Showerhead with a circular pattern of holes on several diameters

For a showerhead with a faceplate that has a circular pattern of holes along several circular patterns of varying diameters, calculate the effective diameter (ED) using the following equation:

$$ED = \frac{[(H_1 \times D_1) + (H_2 \times D_2) + (H_3 \times D_3) + (H_4 \times D_4) + (H_5 \times D_5) + (\dots)]}{H_1 + H_2 + H_3 + H_4 + H_5 + \dots} \quad \dots C2$$

where

D_1 = projected diameter along which the innermost holes lie

D_2 = projected diameter along which the second innermost holes lie

D_3 = projected diameter along which the third innermost holes lie etc.

and

H_1 = number of holes that lie along the innermost projected diameter

- H_2 = number of holes that lie along the second innermost projected diameter
 H_3 = number of holes that lie along the third innermost projected diameter, etc.
 (see Figure C2, Case 2)

C5.3 Case 3—Showerhead with holes on evenly spaced pattern

For a showerhead with a faceplate that has an evenly spaced pattern of holes that can be approximated to a circular pattern, calculate the effective diameter (ED) using the following equation:

$$ED = \frac{D}{\sqrt{2}} \quad \dots C3$$

where

D = maximum distance between the outermost holes (see Figure C2, Case 3)

C5.4 Case 4—Showerhead with non-circular patterns of holes

For a showerhead with a non-circular pattern of holes (see Figure C2, Case 4)

Option 1

Rectangular shaped spray patterns

$$ED = \sqrt{\left\{ \frac{(W \times B \times 4)}{\Pi} \right\}} \quad \dots C4$$

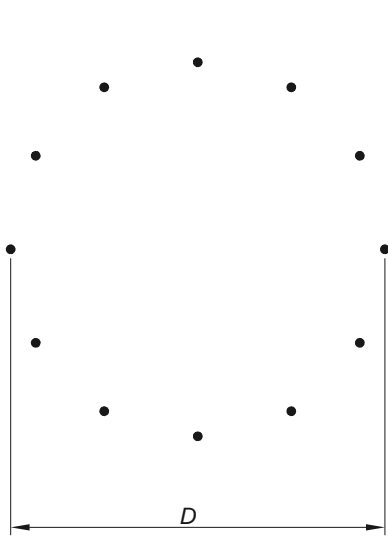
where—

B = breadth of the spray pattern

W = width of the spray pattern

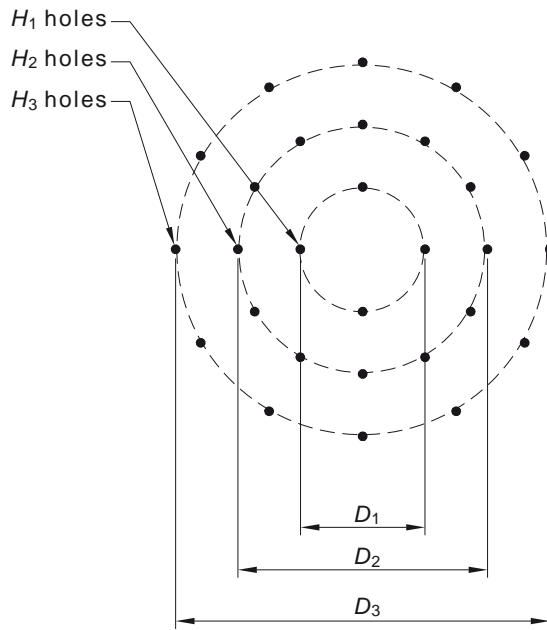
Option 2

Rectangular or other shaped spray patterns (circularizing parameters of spray pattern) use Equation C2.



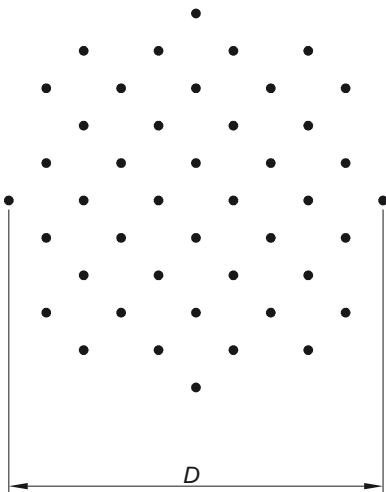
Case 1

Showerhead with a circular pattern of holes on single diameter



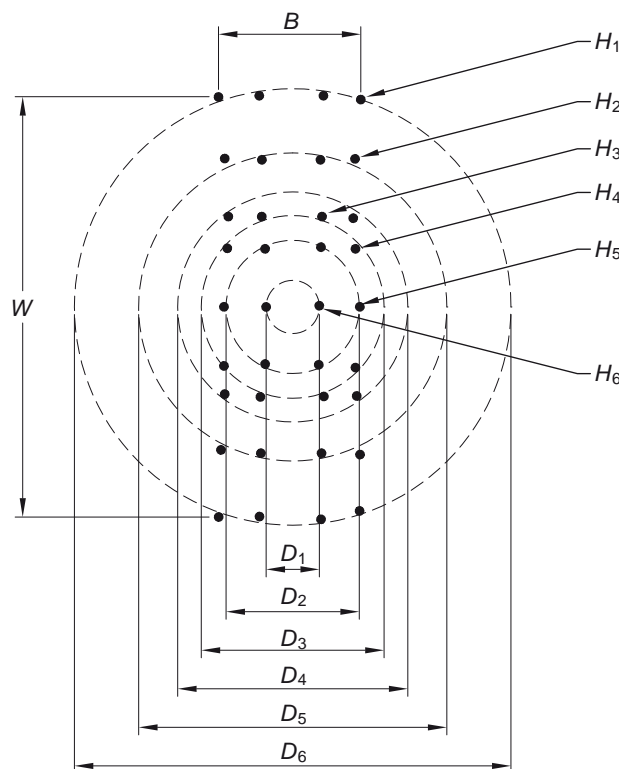
Case 2

Showerhead with a circular pattern of holes on several diameters



Case 3

Showerhead with a pattern of evenly spaced holes



Case 4

Showerhead with a non-circular pattern of holes

FIGURE C2 VARIOUS SHAPED SHOWERHEADS FOR CALCULATING THE EFFECTIVE DIAMETER

C6 TEST REPORT

The following shall be reported:

- A2 |
- (a) Manufacturer, brand name, model name and model number of the shower and description of other components tested with the sample.
 - (b) The dynamic flow test pressure.
 - (c) Total flow rate (L/min) for all the annular cylinders.
 - (d) Percentage of the total flow collected by each annular cylinder.
 - (e) The calculated mean spray spread angle.
 - (f) Reference to this test method, i.e., AS/NZS 3662, Appendix C.

APPENDIX D
MEASUREMENT OF TEMPERATURE DROP
 (Normative)

D1 SCOPE

This Appendix sets out the method for measuring the temperature drop of water flowing from a shower.

D2 PRINCIPLE

A2 | Heated water is passed through a shower at a dynamic pressure of—

- (a) 35 kPa for low and unequal pressure showers; or
- (b) 250 kPa for high pressure showers.

The temperature of the water flow is measured at 150 mm and at 750 mm below the faceplate and the temperature drop determined.

D3 APPARATUS

The following apparatus is required:

- (a) A water supply capable of delivering heated water at—
 - (i) a temperature of $20 \pm 3^\circ\text{C}$ above ambient;
 - (ii) flow rate of more than 20 L/min; and
 - (iii) a dynamic flow pressure of at least 250 kPa.
- (b) A temperature gauge as shown in Figure D1, having a differential temperature accuracy of $\pm 0.5^\circ\text{C}$.
- (c) A pressure gauge having an accuracy of $\pm 2\%$ of the true value.
- (d) A flow meter to measure total flow to within $\pm 2\%$ of the true value.
- (e) A tape measure.

D4 PROCEDURE

The procedure shall be as follows:

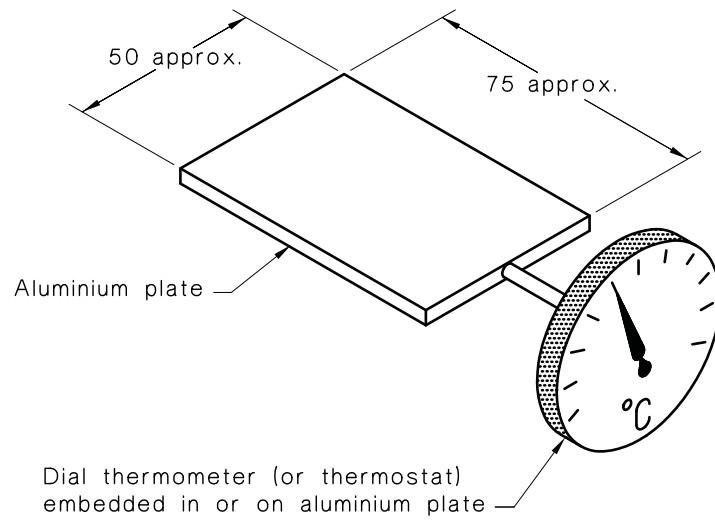
- (a) Where a showerhead is supplied with other components (e.g., an arm, shower hose, elbow with a flow controller), assemble the shower in accordance with the manufacturer's specified method of assembly.
- (b) For showers with adjustable spray settings, adjust the spray to the maximum flow setting.
- (c) Mount the shower in the test rig with the water supply connected to the intended inlet with the faceplate horizontal and 150 ± 5 mm vertically above the temperature gauge.
- (d) Measure ambient air temperature.
- (e) Adjust the water supply temperature to $20 \pm 3^\circ\text{C}$ above ambient temperature.

- A2
- (f) Allow the water to flow and adjust the control valve gradually until the dynamic flow pressure of—
 - (i) 35 ± 1 kPa for low and unequal pressure showers; or
 - (ii) 250 ± 1 kPa for high pressure showers is achieved.
 Maintain the flow until the flow and pressure remain stable for at least 1 min.
 - (g) Allow the temperature on the gauge to stabilize and record the reading.
 - (h) Lower the temperature gauge to a position 750 ± 5 mm below the faceplate. Move the gauge in its horizontal plane to find the most advantageous location to maximize the temperature reading on the gauge. Allow the temperature on the gauge to stabilize and record the reading.
 - (i) Raise the temperature gauge to its original position. Allow the temperature on the gauge to stabilize and record the reading.
 - (j) If the temperatures recorded in Steps (g) and (i) vary by more than $\pm 0.5^\circ\text{C}$, repeat Steps (d) to (i).
 - (k) If the temperatures recorded in Steps (g) and (i) do not vary by more than $\pm 0.5^\circ\text{C}$, record the reading in Steps (i).
 - (l) Calculate the difference in the temperatures measured in Steps (g) and (h) and record this as the temperature drop of the shower.

D5 TEST REPORT

The following shall be reported:

- A2
- (a) Manufacturer, brand name, model name and model number of the shower and description of other components tested with the sample.
 - (b) The dynamic flow test pressure.
 - (c) Ambient air temperature.
 - (d) Supply heated water temperature.
 - (e) Water temperatures measured when the faceplate was 150 mm from the temperature gauge, as recorded in Paragraph D4 (g).
 - (f) Water temperatures measured when the faceplate was 750 mm from the temperature gauge, as recorded in Paragraph D4 (h).
 - (g) Water temperatures measured when the faceplate was returned to its initial position of 150 mm from the temperature gauge, as recorded in Paragraph D4 (i).
 - (h) Temperature drop, as recorded in Paragraph D4 (l).
 - (i) Reference to this test method, i.e., AS/NZS 3662, Appendix D.



DIMENSIONS IN MILLIMETRES

FIGURE D1 TYPICAL TEMPERATURE MEASURING GAUGE

APPENDIX E
INTEGRITY OF SHOWER HOSES
(Normative)

E1 SCOPE

This Appendix sets out the methods for assessing the integrity of shower hoses.

E2 TENSILE STRENGTH AND WATERTIGHTNESS**E2.1 Principle**

The shower hose is connected to a fixture, in a vertical orientation; and a specified tensile force is applied for a specified time.

E2.2 Apparatus

The following apparatus is required:

- (a) A suitable fixture for securely connecting a shower hose in a vertical orientation.
- (b) A means of applying a tensile force of at least 500 N.
- (c) The apparatus specified in Appendix B.

E2.3 Procedure

The procedure shall be as follows:

- (a) Connect one end of the hose to the fixture specified in Paragraph E2.2 (a) so that the hose hangs vertically.
- (b) Connect the tensile force means specified in Paragraph E2.2 (b) to the free end of the hose and apply a vertical force of 500 N for 5 min \pm 10 s.
NOTE: Figure E1 illustrates a typical test arrangement.
- (c) Observe and record whether the hose ruptured or permanently deformed in a manner that would affect the performance of the hose.
- (d) If the hose did not rupture or permanently deform in a manner that would affect its performance, remove the force and disconnect the hose from the fixture.
- (e) Attach the intended showerhead to the shower hose in accordance with the manufacturer's intended method of attachment.
- (f) Mount the shower hose and showerhead assembly in the test rig as specified in Paragraph B4 of Appendix B.
- (g) Gradually turn on the flow of water until a stabilized flow at a dynamic flow pressure of 250 kPa is achieved.
- (h) Maintain the flow for 2 min \pm 10 s, then observe and record whether the assembly has remained watertight.

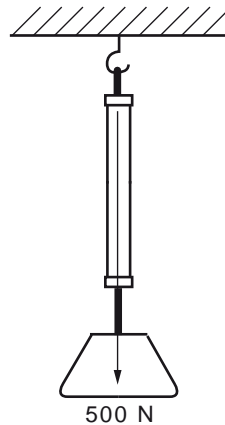


FIGURE E1 TENSILE FORCE TEST ARRANGEMENT

E2.4 Test report

The test report shall specify whether the hose ruptured, was permanently deformed in a manner that would affect its performance or leaked as observed in Paragraph E2.3 (h).

E3 TEMPERATURE RESISTANCE

E3.1 Principle

The shower hose is supported to ensure that flow through it is unrestricted and heated water is passed through the hose at dynamic flow pressures of 250 kPa for a specified time.

E3.2 Apparatus

The apparatus shall be as specified in Appendices B, C and D and include a—

- water supply, at a temperature of $55 \pm 3^\circ\text{C}$;
- means for measuring the temperature of the heated water; and
- adjustment valve.

NOTE: Figure E2 illustrates a typical test arrangement.

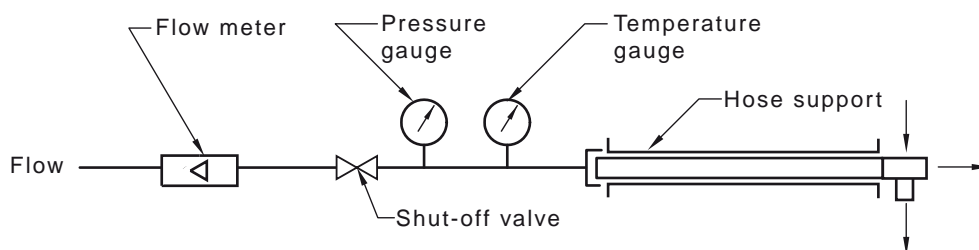


FIGURE E2 TEMPERATURE RESISTANCE TEST ARRANGEMENT

E3.3 Procedure

The procedure shall be as follows:

- With the hose in a horizontal orientation, connect one end of the hose to the heated water supply (a pipe or other means may be used to maintain the hose horizontally so that the flow is unrestricted).
- Heat the shower hose to the heated water temperature by passing the supply heated water through the hose at a rate of 6 L/min for at least 5 min.

- (c) Adjust the valve at the outlet of the apparatus to give a flow that will maintain the temperature of the hose.
- (d) Adjust the valve gradually until the dynamic flow pressure of 250 kPa is achieved. When the flow rate and pressure have stabilized, maintain the flow for at least 5 min.
- (e) Observe and record whether the hose ruptured, permanently deformed in a manner that would affect its performance, or leaked.

E3.4 Test report

The test report shall note whether the hose ruptured, was permanently deformed in a manner that would affect its performance or leaked, as observed in Paragraph E3.3 (e).

E4 THERMAL SHOCK RESISTANCE

E4.1 Principle

The shower hose is subjected to alternating cold and heated water passes, at specified static flow pressures, for 240 cycles and it is then examined.

E4.2 Apparatus

The apparatus shall be as specified in Appendices B, C and D and include a means for alternating the supply of heated (i.e., $55^{\circ} \pm 3^{\circ}\text{C}$) and cold (i.e., ambient) water through the shower hose at a dynamic flow pressure of 250 kPa.

NOTE: Figure E3 illustrates a typical test arrangement.

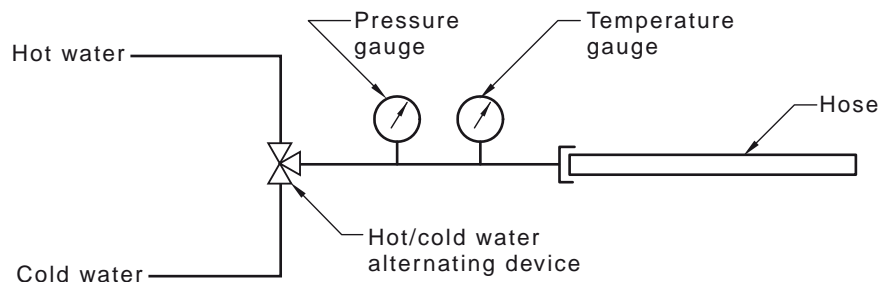


FIGURE E3 THERMAL SHOCK RESISTANCE TEST ARRANGEMENT

E4.3 Procedure

The procedure shall be as follows:

- (a) Connect the hose to the water supplies and subject it to a cycle of 2 min of cold water then 2 min of heated water, each at a dynamic flow pressure of 250 kPa.
- (b) Repeat the cycle in Step (a) above for 240 cycles.
- (c) Observe and record whether the hose ruptured, permanently deformed in a manner that would affect its performance, or leaked.

E4.4 Test report

The test report shall specify whether the hose ruptured, was permanently deformed in a manner that would affect its performance or leaked, as observed in Paragraph E4.3 9(c).

E5 EFFECTIVENESS OF ROTARY CONNECTION

E5.1 Principle

The shower hose is pressurized and prevented from rotating. A torque is applied to the rotary connection end of the hose and the force required to initiate rotation is observed.

E5.2 Apparatus

The following apparatus is required:

- (a) The apparatus specified in Appendix B.
- (b) Means for clamping the hose.
- (c) A plug to seal the end of the hose with the rotary connection.
- (d) Means of applying and measuring a torque of at least 1 Nm to the plug in Item (c).

NOTE: Figure E4 illustrates a typical test arrangement.

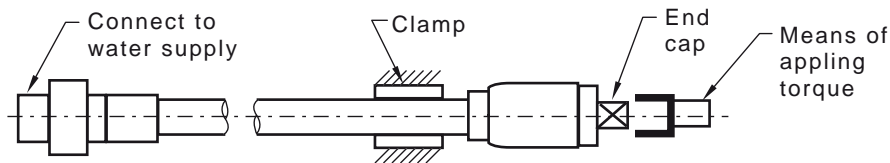


FIGURE E4 EFFECTIVENES OF ROTARY CONNECTION TEST ARRANGEMENT

E5.3 Procedure

The procedure shall be as follows:

- (a) Secure the plug specified in Paragraph E5.2 (c) to seal the end of the hose with the rotary connection.
- (b) Connect the free end of the hose to the cold water supplies specified in Appendix B.
- (c) Clamp the hose so that it is prevented from rotating.
- (d) Gradually turn on the flow of water until a static pressure of 250 kPa is achieved.
- (e) Apply a torque to the plug to initiate rotation.
- (f) Measure and record torque required to initiate rotation.

E5.4 Test report

The test report shall specify the torque necessary to initiate rotation as observed in Paragraph E5.3 (f).

APPENDIX F
ENDURANCE TEST FOR FLOW CONTROLLERS USED IN SHOWERS
(Normative)

F1 SCOPE

This Appendix sets out the method by which flow controllers used in showers are measured for their ability to operate satisfactorily under normal opening and closing operations with heated and cold water applications, for the expected life of the flow controller.

F2 PRINCIPLE

The flow controller, mounted in the same housing (test sample) as used in the shower, is held in a test rig and connected to a temperature-controlled heated and cold water supply at a given pressure. A cyclic mechanism is used to open and close the valve providing water to the test sample. A device to monitor the system for inconsistencies and breakdown is integrated in the mechanism. On completion of the pressure cycles, the test sample is retested in accordance with Appendix B.

F3 TEST RIG APPARATUS

A test rig fitted with a counter to count complete cycles, and capable of—

- (a) operating the test sample through $10\,000 \pm 100$ cycles from 0 kPa to 350 kPa;
- (b) delivering heated water at a temperature of $55 \pm 3^\circ\text{C}$;
- (c) delivering a flow rate of 20L/min at 350 kPa;
- (d) providing 12 ± 1 cycles per min; and
- (e) alternating ambient and heated water every 55 ± 5 cycles.

F4 PROCEDURE

The procedure shall be as follows:

- (a) Test the sample in accordance with Appendix B to determine and record the initial nominal flow rate and average flow rates at 150 kPa, 250 kPa, 350 kPa of the test sample.
- (b) Connect the test sample to the test rig.
- (c) Adjust the supply pressures with each water supply and check that the pressures and water temperatures are as specified.
- (d) Commence the opening and closing operations of the valves supplying water to the test sample.
- (e) Reset the cycle counter to zero.
- (f) Commence the cycles at 12 ± 1 cycles per minute for $10\,000 \pm 100$ cycles between 0 kPa and 350 kPa and alternate ambient and heated water every 55 ± 5 cycles.
- (g) At the completion of Step (f), retest the test sample in accordance with Appendix B to determine and record the final nominal flow rate and average flow rates at 150 kPa, 250 kPa, 350 kPa of the test sample.
- (h) Calculate the difference between the nominal flow rates of the test sample determined in Step (a) and Step (g).

F5 TEST REPORT

The following shall be reported:

- (a) Manufacturer, model, size, and type of the housing and flow controller.
- (b) Number of cycles completed.
- (c) Initial nominal flow rate and average flow rates of the test sample determined in Paragraph F4 (a)
- (d) Final nominal flow rate and average flow rates of the test sample determined in Paragraph F4 (g).
- (e) The difference between the nominal flow rates of the test sample determined in Paragraph F4 (h)
- (f) Reference to this test method, i.e., Appendix F, AS/NZS 3662.

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APPENDIX G

DETERMINATION OF NOMINAL FLOW RATE FOR USE IN LOW AND UNEQUAL PRESSURES

(Normative)

G1 SCOPE

This Appendix sets out the method for determining the nominal flow rate of a shower suitable for use with low and unequal pressures.

G2 PRINCIPLE

The shower to be tested is supported in a test rig and water is passed through the shower at dynamic flow pressure of 35 kPa; when the flow rate has stabilized it is recorded at ambient water temperature.

G3 APPARATUS

The following apparatus is required:

- (a) A water supply capable of delivering water at—
 - (i) a flow rate of more than 20 L/min; and
 - (ii) a dynamic flow pressure of at least 150 kPa.
- (b) Test apparatus made from DN 15, Type B copper pipe. The branch for flow pressure measurements shall be located at least 250 mm downstream of any valve or fitting. The shower connection shall be not more than 300 mm downstream of the branch for flow pressure measurements.
NOTE: See Figure B1 for a typical test arrangement.
- (c) A pressure gauge having an accuracy of $\pm 2\%$ of the true value.
- (d) A flow meter having an accuracy of $\pm 2\%$ of the true value.

G4 PROCEDURE

The procedure shall be as follows:

- (a) Where a showerhead is supplied with other components (e.g., an arm, shower hose, elbow with a flow controller and mixing valve) assemble the shower in accordance with the manufacturer's specified method of assembly.
- (b) For showers with adjustable spray settings, adjust the spray to the maximum flow setting.
- (c) Mount the shower in the test rig with the water supply connected to the intended inlet.
- (d) Condition the shower by allowing the water to flow and adjusting the control valve gradually until the dynamic flow pressure of 150 kPa is achieved. Maintain the flow until the flow and pressure remain stable for at least 1 min.
- (e) Gradually adjust the control valve to turn off the flow of water.
- (f) Gradually turn on the flow of water until a stabilized flow at a dynamic flow pressure of 35 ± 1 kPa is achieved.
- (g) Observe the flow meter and record the flow rate at that dynamic flow pressure.
- (h) Gradually adjust the control valve to turn off the flow of water.

A2

- (i) Repeat Steps (f) to (h) to obtain a second reading of the flow rate.
- (j) Calculate and record the average flow rate and record this value as the nominal flow rate.

G5 TEST REPORT

The following shall be reported:

- (a) Manufacturer, brand name, model name and model number of the shower and description of other components tested with the sample.
- (b) Product tested for low or unequal pressure applications as defined in this Standard.
- (c) The nominal flow rate of the test sample (in litres per minute).
- (d) The average flow rates as determined at Step (j) of Paragraph G4.
- (e) Reference to this test method i.e., AS/NZS 3662, Appendix G.

AMENDMENT CONTROL SHEET

AS/NZS 3662:2005

Amendment No. 1 (2006)

CORRECTION

SUMMARY: This Amendment applies to Appendix C.

Published on 2 February 2006.

Amendment No. 2 (2009)

REVISED TEXT

SUMMARY: This Amendment applies to the Preface, Foreword, Clauses 4.2 (new), 4.3 (new), 4.4 (new), 4.5 (new), 5.1, 5.6.1 and 6, and Appendices A, B, C, D and G (new).

Published on 21 January 2009.

Amendment No. 3 (2010)

REVISED TEXT

SUMMARY: This Amendment applies to Clause 6(c).

Published on 24 March 2010.

NOTES

NOTES

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