

AS/NZS 2040.1:2021



Australian/New Zealand Standard™

Performance of household electrical appliances — Clothes washing machines

Part 1: Methods for measuring performance, energy and water consumption



AS/NZS 2040.1:2021

This Joint Australian/New Zealand Standard™ was prepared by Joint Technical Committee EL-059, Dishwashers, Clothes Washers and Dryers. It was approved on behalf of the Council of Standards Australia on 24 November 2020 and by the New Zealand Standards Approval Board on 03 February 2021.

This Standard was published on 19 February 2021.

The following are represented on Committee EL-059:

- Australian Industry Group
- Business New Zealand
- CHOICE
- Consumer Electronics Suppliers Association
- Consumers' Federation of Australia
- Department of Agriculture, Water and the Environment (Australian Government)
- Department of Industry, Science, Energy and Resources (Australian Government)
- Electrical Compliance Testing Association of Australia
- Energy Efficiency and Conservation Authority of New Zealand
- Energy Safe Victoria

This Standard was issued in draft form for comment as DR AS/NZS 2040.1:2019.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

www.standards.govt.nz

ISBN 978 1 76113 210 0

Australian/New Zealand Standard™

Performance of household electrical appliances — Clothes washing machines

Part 1: Methods for measuring performance, energy and water consumption

Originated as AS 2040—1977.
Jointly revised and redesignated AS/NZS 2040.1:1998.
Fifth edition 2021.

© Standards Australia Limited/the Crown in right of New Zealand, administered by the New Zealand Standards Executive 2021

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth) or the Copyright Act 1994 (New Zealand).

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-059, Dishwashers, Clothes Washers and Dryers, to supersede AS/NZS 2040.1:2005, *Performance of household electrical appliances — Clothes washing Machines Part 1: Methods for measuring performance, energy and water consumption*.

The objective of this Standard is to specify test procedures and minimum performance criteria for determining the performance characteristics of electric household clothes washing machines that are within the scope of the relevant legislation.

This Standard does not specify safety requirements.

The AS/NZS 2040 series comprises two parts, as follows:

AS/NZS 2040.1, *Performance of household electrical appliances — Clothes washing machines, Part 1: Methods for measuring performance, energy and water consumption* (this Standard)

AS/NZS 2040.2, *Performance of household electrical appliances — Clothes washing machines, Part 2: Energy efficiency labelling requirements*

The parts of this series are summarized as follows:

- (a) *Part 1* — Specifies performance test procedures and minimum performance criteria for clothes washing machines.
- (b) *Part 2* — Includes algorithms for the calculation of the energy efficiency star rating and comparative energy consumption, performance requirements, details of the energy rating label and information on the requirements for the valid application for registration for energy efficiency labelling. It also includes information for registration for water efficiency labelling. Part 2 is to be used in conjunction with Part 1.

The overall objective of the AS/NZS 2040 series is to promote high levels of performance, energy efficiency and water efficiency in clothes washing machines.

The main changes in this Standard are as follows:

- (i) Extension of the loading table from 10 kg up to 20 kg, aligning with market offerings and AS/NZS 2442 series, *Performance of household electrical appliances — Rotary clothes dryers*.
- (ii) Definition and test procedure for multi-compartment clothes washing machines.
- (iii) The test voltage is specified as 230 V.
- (iv) The relevant legislation is described.

As documented in ISO 80000-1, *Quantities and units — Part 1: General*, the SI unit for litres may be either “L” or “l”. For the purpose of this document, and in conformance with Australian and New Zealand Standards, “L” is used as the unit for litres.

This Standard has been developed in consultation with regulatory authorities and is intended to be considered with reference to the relevant legislation. It refers to AS/NZS 2040.2 for energy efficiency labelling requirements. AS/NZS 6400, *Water efficient products — Rating and labelling*, references this Standard for water efficiency labelling requirements.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

Contents

Preface	ii
Introduction	v
Section 1 Scope and general	1
1.1 Scope	1
1.2 Application	1
1.3 Normative references	1
1.4 Terms and definitions	2
1.5 Rounding	6
Section 2 Test requirements and measurements	7
2.1 General	7
2.2 Test conditions, instrumentation and materials	7
2.3 Preparation of a clothes washing machine for testing	7
2.4 General test procedures	7
2.5 Check of rated capacity	7
2.6 Preparation and loading of loads	7
2.7 Percentage soil removal	7
2.8 Energy consumption, water consumption and standby power	7
2.9 Water extraction index	7
2.10 Severity of washing action index (W_sI)	7
2.11 Vibration	7
2.12 Spectrophotometer used for percentage soil removal	7
2.13 Reference machine	8
2.14 Whiteness retention	8
2.15 Rinse performance	8
Section 3 Use of reference machine	9
3.1 General	9
3.2 Program	9
3.3 Test conditions	9
3.4 Reference machine	9
3.5 Reference machine log	9
3.6 Record of results	9
3.7 Checks and repairs	9
Section 4 Performance requirements	10
4.1 General	10
4.2 Water pressure	10
4.3 Rated capacity	10
4.4 Washing index	10
4.5 Water consumption	10
4.6 Water extraction index	10
4.7 Severity of washing action index (W_sI)	10
4.8 Vibration during water extraction (spin drying)	11
4.9 Rinse performance	11
4.10 Wool wash program	11
Section 5 Requirements for accompanying information	12
5.1 General	12
5.2 Rated load capacity	12
5.3 Water consumption	12
5.4 Program	12
5.5 Additional requirements	12
Appendix A (normative) Test conditions, instrumentation and materials	13
Appendix B (normative) Preparation of clothes washing machine for testing and general test procedures	13

Appendix C (normative) Preparation and method of loading standard test loads	24
Appendix D (normative) Percentage soil removal	36
Appendix E (normative) Energy and water consumption, time and standby power	40
Appendix F (normative) Water extraction index	47
Appendix G (normative) Severity of washing action index	49
Appendix H (normative) Vibration walking test	51
Appendix I (normative) Spectrophotometer requirements, measurements and calculation of percentage soil removal	54
Appendix J (normative) Requirements for reference machines	59
Appendix K (informative) Percentage whiteness retention	60
Appendix L (normative) Clothes washing machine test report	63
Appendix M (normative) Rinse performance	67
Appendix N (normative) Measurement of PBIS concentration in the supply water and extracted liquor samples	74
Appendix O (informative) Examples of standby modes	80
Bibliography	82

Introduction

For comparative testing, the most reliable results will be obtained from the methods of measurement given in this Standard when the measurements are conducted in the same laboratory, at one time, by the same operators. Conformance to the performance and test requirements of this Standard should ensure that a clothes washing machine will give satisfactory performance in service.

This Standard is based on concepts initially published in IEC 60456:2003 (Edition 4), *Clothes washing machines for household use — Methods for measuring the performance*. This Standard has differences from and similarities to IEC 60456 Ed. 5:2003, as follows [with differences with IEC 60456: 2010 (Edition 5) noted in square brackets like this, if any]:

- (a) Specific minimum performance requirements for washing, spinning, rinsing and severity of washing are included in this standard. IEC does not specify minimum performance requirements.
- (b) Water hardness is specified as 0.45 mmol/L (45 ppm CaCO₃ equivalent) in this standard. IEC 60456: 2003 specifies 2.5 mmol/L (250 ppm). [IEC 60456:2010 permits both 2.5 mmol/L (hard water) and 0.5 mmol/L (soft water)].
- (c) Cold water temperature is 20 °C in this standard while IEC 60456 specifies 15 °C.
- (d) Ambient temperature for testing is 20 °C in this standard. [IEC 60456:2010 specifies an ambient temperature for testing of 23 °C].
- (e) Only IEC Type B phosphate-based detergent is used for drum type machines in this standard. IEC 60456:2003 does not cover non-drum machines and nominates Type A detergent for drum machines, while Type B was deleted. [IEC 60456:2010 specifies detergent Type A* for all machines].
- (f) AS9 soil swatches are used in this standard. IEC 60456:2003 specifies four separate soil swatches which include carbon, blood, red wine and chocolate. [IEC 60456:2010 specifies an additional soil swatch with sebum, making a total of 5 soil swatches].
- (g) A mixed cotton is used in this standard made up of nine representative load items (one load item (shirt) is a cotton/polyester blend). IEC specifies only sheets, hand-towels and pillowcases for a cotton load.
- (h) Each AS9 soil batch is calibrated against a reference batch in this standard. IEC does not specify soil batch calibration but there are other performance controls on each batch.
- (i) The laboratory **reference machine** is not used to normalize results in this standard. IEC specifies a Wascator reference machine to normalize washing performance results. [IEC 60456:2010 more tightly defines the specifications for a reference machine].
- (j) The water extraction (spin) index is based on bone-dry mass in this standard. IEC remaining moisture content (RMC) index is based on normalized mass with a nominal 6 % moisture content at equilibrium. The IEC Standard permits bone-dry method as a method of conditioning the load to determine the mass of load items.
- (k) Whiteness retention test (informative) is included in this standard. IEC does not specify this performance parameter.
- (l) Rinse performance testing in this standard relies on measurement of an added chemical marker (PBIS) remaining in the rinse liquor extracted from the damp clothes load at the end of the program. IEC measure residual alkalinity of the rinse liquor extracted as an indicator of rinse performance.
- (m) There is a separate IEC Standard for noise.
- (n) Standby power measurements are required on a number of low power modes in this standard which are measured in accordance with IEC 62301. IEC 60456:2003 does not specify

power modes. [IEC 60456:2010 does specify low power modes (measured in accordance with IEC 62301) and while the modes defined are very similar, there are some minor differences].

- (o) Spectrophotometer specification is broader in this standard in that it allows D/8° geometry as well as 0°/45° and 45°/0°. IEC only allow D/8 geometry. However, other aspects of the spectrophotometer specification are comparable in both standards, such as the UV-filter specification and the aperture size.

Australian/New Zealand Standard

Performance of household electrical appliances — Clothes washing machines

Part 1: Methods for measuring performance, energy and water consumption

Section 1 Scope and general

1.1 Scope

This Standard specifies test procedures and minimum performance criteria for determining the performance characteristics of electric household **clothes washing machines** that are within the scope of the **relevant legislation**.

NOTE Examples of appliances covered by this Standard are top loading non-drum type washers (usually impeller or agitator), front and top loading drum type washers, **multi-compartment clothes washing machines** and the washer function of combination washer/dryer units.

In particular, this Standard specifies the following:

- (a) States and defines the principal performance characteristics of electric **clothes washing machines**, which are —
 - (i) soil removal;
 - (ii) water extraction;
 - (iii) severity of washing;
 - (iv) energy and water consumption;
 - (v) degree of vibration;
 - (vi) rinse performance; and
 - (vii) **standby power**.
- (b) Specifies methods of measuring these characteristics.
- (c) Sets levels of acceptable performance.

1.2 Application

This Standard **shall** be read in conjunction with AS/NZS 2040.2.

1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 2706, *Numerical values — Rounding and interpretation of limiting values*

AS/NZS 2040.2, *Performance of household electrical appliances — Clothes washing machines, Part 2: Energy efficiency labelling requirements*

AS/NZS 2442.1, *Performance of household electrical appliances — Rotary clothes dryers, Part 1: Methods for measuring performance, energy and water consumption*

AS/NZS 62301, *Household electrical appliances — Measurement of standby power (IEC 62301, Ed. 1.0 (2005) MOD)*

ISO/CIE 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

IEC 60456, *Clothes washing machines for household use — Methods for measuring the performance*

CIE 015, *Colorimetry*, 4th Edition

1.4 Terms and definitions

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

NOTE The following defined terms have been bolded throughout this Standard.

1.4.1

automatic clothes washing machine(s)

clothes washing machine in which the load is fully treated by the machine without the need for user intervention at any point during the **program** prior to its completion

Note 1 to entry: All **automatic clothes washing machines** have at least one **program** that meets all the performance requirements specified in this Standard without user intervention.

Note 2 to entry: Examples of user intervention include manual fill (non-automatic water level), transfer of the load between a washing drum and spin extractor drum or manual draining. A machine that stops in response to an abnormal operating condition (e.g. out of balance) **should** still be considered as automatic under normal use.

1.4.2

check test

test to determine whether an appliance complies with the **relevant legislation**, which is intended to verify claims about a model in relation to one or more of the following:

- (a) *Energy consumption* — Indicated on the **energy rating label**.
- (b) *Water consumption* — Indicated on the water rating label in accordance with AS/NZS 6400.
- (c) *Product performance*.

1.4.3

clothes washing machine(s)

appliance designed to wash textile materials in water by mechanical and chemical action, and extract water therefrom, usually by centrifugal action

1.4.4

cycle

series of **operations** and other activities that occur within the **cycle time**

1.4.5

cycle time

duration of time measured from the initiation of the **program** (excluding any user programmed delay) until all activity ceases

Note 1 to entry: Activity is considered to have ceased when the power consumption reverts to a steady-state condition that persists indefinitely without user intervention. If there is no activity after the end of the **program**, the **cycle time** is equal to the **program time**.

Note 2 to entry: **Cycle time** includes any activity that **may** occur after the **program** is completed until a steady-state condition is reached. This could include fans, any electronic activity or any additional mechanical activity that occurs for a limited period after any end of **program** indicator. Any cyclic event that occurs indefinitely is considered to be steady-state, see [Appendix Q](#) for examples.

1.4.6**delay start mode**

mode where the model has a user option used to delay the commencement of the **program**

Note 1 to entry: See also [Clause E.6.3](#).

1.4.7**drum type machine(s)**

a **clothes washing machine** in which the textile material is contained in one or more horizontal or inclined drum(s) (up to and including 45° from the horizontal) and in which the mechanical action is produced by a rotation of the drum about its axis, the movement being either continuous or periodically reversed

Note 1 to entry: For the purposes of this Standard, all types of machine not conforming to this definition are classified as “other than drum type”.

1.4.8**end of cycle mode**

state that the appliance enters at the end of the **cycle**, during which appliance power is in a steady state condition that persists indefinitely

Note 1 to entry: **End of cycle mode** is applicable to all products, see also [Clause E.6.2](#).

Note 2 to entry: In some products this mode **may** be an equivalent power to **off mode** while in some products **end of cycle mode** will persist until **off mode** is initiated by the user via a power switch.

1.4.9**energy rating label**

label that provides consumers with information concerning the energy consumption and energy efficiency of household **clothes washing machines**

Note 1 to entry: The **energy rating label** displays the product's **CEC**, **star rating**, **rated load capacity** and the **program** nominated for energy efficiency testing.

1.4.10**laboratory**

facility that tests products for conformance to the requirements of this document

1.4.11**manufacturer's instructions**

information that is provided with the product in the form of a user manual, instruction sheet, information affixed to the product itself or information that is available on a public website

Note 1 to entry: **Manufacturer's instructions** do not include any special directions provided by the product supplier to the test **laboratory** especially for testing purposes.

Note 2 to entry: See [Clause A.17](#) for additional sources of information for testing in accordance with this Standard.

1.4.12**may**

indicates the existence of an option

1.4.13**multi-compartment clothes washing machine(s)**

clothes washing machine with more than one **washing compartment**, each of which —

- (a) would fall within the scope of this Standard if it were a single compartment machine; and
- (b) **may** differ in volume and washing method; and
- (c) **may** operate with the same or differing **programs**, either —
 - (i) independently; or

- (ii) concurrently, either using fresh water in each compartment or re-using water from one compartment to another.

Note 1 to entry: A **washing compartment** in a **clothes washer** is a compartment or chamber in which the cleaning **operation** takes place.

1.4.14

non-automatic clothes washing machine(s)

clothes washing machine in which all possible **programs** require user intervention at one or more points during the **program** to enable the machine to proceed to the next operation

1.4.15

off mode

mode present on appliances that have a power or off switch that is operated via controls intended to be normally accessible to the user, and activated where the appliance remains connected to the mains electricity **supply** and where the power or off switch is activated to put the appliance into a state where it is not in use and no short duration **operations** are in progress

Note 1 to entry: **Off mode** is a state that persists until the user activates the product via the power or on switch, see also [Clause E.6.4](#).

Note 2 to entry: In some products, some short-term duration **operations may** be present for a period after **off mode** is initiated. An off or power switch **may** be present as a separate user-operated control or **may** be integrated into another device operated by the user such as a door.

1.4.16

operation(s)

each event that occurs during the **clothes washing machine cycle**, such as washing, rinsing or spinning

1.4.17

program(s)

series of **operations** pre-defined within the **clothes washing machine**, for washing specified types of loads

1.4.18

program time

duration of time measured from the initiation of the **program** (excluding any user programmed delay) until the end of **program**

Note 1 to entry: If the end of **program** is not indicated, the **program time** is equal to the **cycle time**.

Note 2 to entry: The end of the **program** is intended to be the earliest point where the consumer would normally be able to access the load, which at this time meets all performance requirements for the **program**.

Note 3 to entry: In some machines there **may** be a short delay from an end of **program** indicator until the load is accessible by the user.

1.4.19

rated load capacity

maximum mass of textile material, stated by the manufacturer for the applicable load material, in multiples of 0.5 kg, including an 8 % allowance for moisture in a cotton load, which the manufacturer claims can be treated in all **operations** by a **clothes washing machine**, in accordance with the requirements of this Standard

Note 1 to entry: See also [Clause 5.2](#).

1.4.20

reference machine

clothes washing machine of specified repeatable performance against which the performance of **clothes washing machines** under test is compared

Note 1 to entry: See also [Section 3](#) and [Appendix I](#).

1.4.21

relevant legislation

legislative requirements governing the **supply** of electric household **clothes washing machines** in Australia and New Zealand

Note 1 to entry: For Australia, the **relevant legislation** is *Greenhouse and Energy Minimum Standards (Clothes washing machines) Determination* (GEMS Determination) and *Greenhouse and Energy Minimum Standards Act 2012* (Cth) (GEMS Act), which can be accessed at www.legislation.gov.au. The GEMS Determination covers **clothes washing machines** that are ordinarily supplied and used for household or similar use. The GEMS Determination covers household **clothes washing machines** irrespective of the context in which they are used. For example, the GEMS Determination applies to household **clothes washing machines** used in a commercial context.

Note 2 to entry: For New Zealand, the **relevant legislation** is *Energy Efficiency (Energy Using Products) Regulations 2002* (New Zealand Regulations), which can be accessed at www.legislation.govt.nz/regulation/public/2002/0009/latest/DLM108730.html.

1.4.22

rinse liquor

liquor extracted in the separate spin extractor from the damp load at the end of the **program**

1.4.23

severity of washing action swatch

specified piece of open weave textile material with cut edges, which is attached to items of the standard test load to indicate, by the fraying of its edges, the severity of the action of a **clothes washing machine** on its wash load

Note 1 to entry: See also [Clause A.11](#).

1.4.24

shall

indicates that a statement is mandatory

1.4.25

should

indicates a recommendation

1.4.26

soil swatch(es)

specified piece of cloth pre-impregnated with soiling agents, which is attached to items comprising the standard test load, and used for the determination of soil removal

Note 1 to entry: See also [Clause A.10](#).

1.4.27

standby power

power consumption that **may** occur while the **clothes washing machine** is not performing its main function

Note 1 to entry: The main modes specified in this Standard where **standby power** occurs are **off mode**, **end of cycle mode** and **delay start mode** (other modes **may** be present in some machines).

1.4.28

supply

supplying (or offering to **supply**) electric household **clothes washing machines** that are that are within the scope of the **relevant legislation**

Note 1 to entry: For Australia, **supply** covers sale, exchange, gift, lease, loan, hire or hire purchase. **Supply** is defined in the **relevant legislation**.

Note 2 to entry: For New Zealand, **supply** is offered for sale, lease, hire or hire purchase. **Supply** is defined in the **relevant legislation**.

1.4.29**test load mass**

nominal mass of the load to be used in the test, as specified by the client commissioning or requesting the test

1.4.30**test program**

program to be used in the test, as specified by the client commissioning or requesting the test

Note 1 to entry: Any **program** can be tested to this Standard, but the performance requirements in [Section 4](#) only apply to the **program** recommended for a normally soiled cotton load at **rated load capacity**.

1.4.31**tested energy consumption**

E_t

sum of the **program** energy (including electrical and water energy components used during the **program**) and, if applicable, the post **program** energy (energy consumed during the period from the end of the **program** to the end of the **cycle**)

1.4.32**twin tub washing machine**

type of **non-automatic clothes washing machine** which has separate drums for washing/rinsing and spinning

Note 1 to entry: The user is required to transfer the load between drums for some subsequent **operations**.

1.5 Rounding

Unless otherwise stated, calculated numbers **shall** be rounded and recorded to not less than five significant figures in accordance with AS 2706.

NOTE Spreadsheets carry more than five significant figures in their calculations so specific adjustments to spreadsheets to conform to the rounding requirements of this Standard are not required.

Section 2 Test requirements and measurements

2.1 General

This Section sets out the requirements for testing a **clothes washing machine** and reporting test results. [Clauses 2.2 to 2.14](#) also serve as a key to the intended use of [Appendices A to M](#).

2.2 Test conditions, instrumentation and materials

All tests **shall** be carried out using a test room, instrumentation and associated materials, and under the conditions specified in [Appendix A](#).

2.3 Preparation of a clothes washing machine for testing

Prior to carrying out any tests on a **clothes washing machine**, it **shall** be prepared as specified in [Appendix B](#).

2.4 General test procedures

All tests **shall** be carried out according to the relevant procedures specified in [Appendix B](#).

2.5 Check of rated capacity

The **clothes washing machine** **shall** be loaded to the **rated capacity** and inspected for conformance with [Clause 4.3](#).

2.6 Preparation and loading of loads

The preparation and loading of a test load **shall** be as specified in [Appendix C](#).

2.7 Percentage soil removal

The determination of soil removal **shall** be in accordance with [Appendix D](#).

2.8 Energy consumption, water consumption and standby power

The determination of energy consumption, water consumption and **standby power** **shall** be in accordance with [Appendix E](#).

2.9 Water extraction index

The determination of the water extraction index **shall** be in accordance with [Appendix F](#).

2.10 Severity of washing action index (W_sI)

The determination of the severity of washing action index (W_sI) **shall** be in accordance with [Appendix G](#).

2.11 Vibration

The determination of the performance in terms of vibration **shall** be in accordance with [Appendix H](#).

2.12 Spectrophotometer used for percentage soil removal

The spectrophotometer used to —

- (a) read soil levels on swatches;

- (b) the method to be used when reading the swatches; and
 - (c) the method for calculating the percentage soil removal relevant to a test run or series of runs,
- shall** be in accordance with [Appendix I](#).

2.13 Reference machine

The requirements that **shall** be met by a **clothes washing machine** prior to being used as a **reference machine** with respect to a particular machine under test are set out in [Appendix J](#).

2.14 Whiteness retention

A method for determining the whiteness retention of a test machine is set out in [Appendix K](#).

NOTE The determination of whiteness retention is not a requirement of this Standard.

2.15 Rinse performance

The determination of rinse performance **shall** be in accordance with [Appendix M](#).

Section 3 Use of reference machine

3.1 General

The purpose of the **reference machine** is to ensure that tests performed on **clothes washing machines** in accordance with [Appendices A](#) to [H](#) and [M](#) of this Standard are valid, that is variations in test materials, water hardness, calibration and **operation** of test equipment, and practices of testing personnel have not appreciably affected the accuracy of the test results.

This validity check is achieved by comparing the test results from the **laboratory reference machine** during a series of tests on **clothes washing machines** with those obtained from it in previous tests.

Each **reference machine** shall meet the requirements of [Appendix J](#).

3.2 Program

The **program** to be used on a **reference machine** for any series of tests shall be as specified by the manufacturer of that machine for a normally soiled cotton load.

3.3 Test conditions

For each test run, the test conditions, **clothes washing machine** preparation and general test procedures for the **reference machine** shall be the same as for **clothes washing machines** under test specified in [Appendices A](#), [B](#) and [C](#).

3.4 Reference machine

The **reference machine** shall be tested in accordance with this Standard and as required to demonstrate conformance to [Appendix J](#), under the following circumstances:

- (a) If there has been a break in continuous testing.
- (b) If any of the test conditions are known to have changed (e.g. test personnel, source of water) or if a test machine yields results contrary to expectations.

The number of runs to be performed when the machine is first brought to the **laboratory** shall be a minimum of three.

In all other cases one run shall be conducted and if the results are not normal for the machine, then a further two runs shall be performed to confirm the results.

3.5 Reference machine log

A log shall be kept with each **reference machine** recording all calibration checks and relevant results, as well any changes or repairs undertaken to the **reference machine**.

3.6 Record of results

A record shall be kept of the results for every test run performed on the **reference machine** in conjunction with a series of tests. This record can be associated with the **reference machine** log but shall be separable.

3.7 Checks and repairs

A **reference machine** shall be checked and repaired, as appropriate, if the machine yields a significantly unusual result.

Section 4 Performance requirements

4.1 General

When tested on the **program**, including all associated settings recommended for a normally soiled cotton load equal to the **rated load capacity** in the product literature (i.e. operating manual or user instructions), a **clothes washing machine shall** conform to [Clauses 4.3 to 4.8](#).

NOTE Refer to AS/NZS 2040.2 for requirements regarding energy consumption are given.

The supplier **shall** declare if there is a water/energy saving feature in the appliance. The test **laboratory should** indicate if any water/energy saving feature was active for each test run.

4.2 Water pressure

The test **clothes washing machine shall** be capable of operating at the maximum and minimum of the water pressure range stated by the **manufacturer's instructions**.

4.3 Rated capacity

When loaded to the **rated capacity** in accordance with the **manufacturer's instructions** and loading diagram, the load items **shall** be supported.

4.4 Washing index

When tested in accordance with [Appendix D](#) at **rated load capacity**, over one or more test runs, a **clothes washing machine shall** meet the following requirements:

- (a) $SR_r - 2 \times SD_r \geq 72 \%$ (for each test run).
- (b) $SR_{av} \geq 80 \%$.

where

SR_r = soil removal calculated for one test run

SD_r = standard deviation relevant to the reflectance measurements for one test run

SR_{av} = average of the values of SR_r calculated for all relevant test runs

4.5 Water consumption

The claimed water consumption **shall** be not less than the average water consumption of representative **clothes washing machines** when each is tested in accordance with [Appendix E](#) at its **rated load capacity**, with the loading pattern specified in [Clause 5.2](#).

4.6 Water extraction index

When tested in accordance with [Appendix F](#) at **rated load capacity**, a **clothes washing machine shall** achieve an average water extraction index not exceeding 1.1.

4.7 Severity of washing action index (W_sI)

When tested in accordance with [Appendix G](#) at **rated load capacity**, a **clothes washing machine shall** achieve an average severity of washing action index (W_sI)_r not exceeding 0.3.

4.8 Vibration during water extraction (spin drying)

When tested in accordance with [Appendix H](#), a **clothes washing machine** not intended to be moved by the operator **shall** conform to the following criteria:

- (a) *15 % out of balance* — With 15 % out-of-balance load, the machine **shall** conform to one of the following:
 - (i) If the machine has no automatic load redistribution facility, or if it has such a facility but this does not operate, the machine **shall** complete the **cycle**. Upon completion of the **cycle** the machine **shall** not be displaced by more than 5 mm closer to or further away from either of the datum lines relative to its starting position.
 - (ii) If the machine initiates an automatic load redistribution facility, the test **shall** be terminated and the completion of the **operation** **shall** not be required. However, the machine **shall** not be displaced by more than 5 mm closer to or further away from either of the datum lines relative to its starting position. The stoppage **shall** be recorded on the test report.
- (b) *25 % out of balance* — With 25 % out-of-balance load, if the out-of-balance mechanism stops the machine or if the machine initiates an automatic load redistribution facility, the test **shall** be deemed concluded. Whether the **program** completes all of its **operations** or not, at the conclusion of the test the machine **shall** not be displaced by more than 5 mm closer to or further away from either of the datum lines relative to its starting position.

Machines intended to be moved by the operator **shall** conform to the above requirements, except that the distance displaced **shall** not exceed 20 mm.

4.9 Rinse performance

When tested in accordance with [Appendix M](#) at **rated load capacity**, the rinse performance score **shall** not exceed 2.25 mg of phenyl-benzimidazole-sulfonic acid (PBIS) per kilogram of rated load.

4.10 Wool wash program

When operated in accordance with the **manufacturer's instructions** for a wool wash, and tested in accordance with IEC 60456, a **clothes washing machine** **shall** be deemed to conform to the requirements of this Standard for washing woollen materials if it achieves the following:

- (a) An area felting shrinking rate not greater than 2 %.
- (b) A felting severity for the wool wash **program** not greater than 6 %.

Section 5 Requirements for accompanying information

5.1 General

The information specified in [Clauses 5.2 to 5.5](#) **shall** be marked on the **clothes washing machine** or stated in the accompanying product literature, i.e. operating manual or user instructions.

5.2 Rated load capacity

The **rated load capacity** applicable to a normally soiled cotton load **shall** be stated.

5.3 Water consumption

The total water consumption for the **program** claimed by the manufacturer for a normally soiled cotton load equal to the **rated load capacity** **shall** be stated.

5.4 Program

The **program**, including all associated specific settings, to be used for a normally soiled cotton load equal to the **clothes washing machine's rated load capacity**, **shall** be stated.

5.5 Additional requirements

The following **shall** also be supplied with the **clothes washing machine**:

- (a) Installation instructions.
- (b) Minimum and maximum water pressure requirements, if applicable.
- (c) Information on the type, quantity and method of adding detergent.

Appendix A (normative)

Test conditions, instrumentation and materials

A.1 General

This Appendix specifies the test conditions, instrumentation accuracies, and associated materials required to complete tests to determine the performance of a **clothes washing machine** in accordance with [Appendices D](#) to [I](#), and [M](#).

NOTE 1 [Appendix M](#) specifies additional test conditions, instrumentation accuracies and associated test materials required to complete tests for the determination of rinse performance.

NOTE 2 For further information on determination of uncertainty, refer to ISO/IEC 98-3, and R. R. Cook, *Assessment of Uncertainties of Measurement for Calibration and Testing Laboratories*, see Bibliography.

A.2 Accuracy and precision of measurements

The tolerances specified for parameters within this Standard, using the symbol “±”, indicate the allowable limits of variation from the specified parameter outside which the test or results **shall** be invalid. In each case, the tolerance has been chosen to allow for factors such as —

- (a) drift of ambient conditions;
- (b) instrument error;
- (c) reading error;
- (d) uncertainty of instrument calibration; and
- (e) other influences.

The statement of tolerance does not permit the deliberate variation of these specified parameters.

NOTE While it is required that test parameters remain within the stated tolerance, transient effects do not necessarily render a test invalid.

A.3 Ambient conditions

The ambient conditions of the room in which the performance is measured **shall** be maintained throughout all elements of the test process at the following levels:

- (a) *Temperature* — $20\text{ °C} \pm 2\text{ K}$.
- (b) *Relative humidity* — Not specified.

A.4 Water supply

The water supplied to the **clothes washing machine** under test **shall** be maintained at the following levels at the **clothes washing machine** inlet:

- (a) *Cold water temperature* — $20\text{ °C} \pm 2\text{ K}$.
- (b) *Hot water temperature* — $60\text{ °C} \pm 2\text{ K}$.

(c) *Gauge pressure during water intake (hot and cold)* — 320 ± 20 kPa.

If the **manufacturer's instructions** do not include the pressure range of 320 kPa, the **clothes washing machine shall** be tested at the pressure within that range that is nearest to 320 kPa.

A.5 Water hardness

Inlet water **shall** have total hardness (CaCO_3 equivalent) adjusted (if necessary) to (45 ± 5) ppm by mass, at a temperature of $20\text{ }^\circ\text{C} \pm 2\text{ K}$.

NOTE For water hardness less than 40 ppm, calcium sulfate and calcium chloride are suitable additives to achieve the specified hardness.

A.6 Electricity supply

The electricity **supply** to the **clothes washing machine** point of connection during all tests **shall** be maintained within the following limits:

- (a) *Voltage* — $230\text{ V} \pm 2\%$.
- (b) *Frequency* — $50\text{ Hz} \pm 1\%$ in all cases.

Where the **supply** is provided from sources other than mains **supply** in Australia or New Zealand, then the source of the electricity **supply shall** be noted in the test report.

A.7 Measurement accuracies and instruments

A.7.1 Mass

Measurements of mass **shall** be made using instruments having a resolution and an overall uncertainty of measurement of 2 % at the 95 % confidence level, for each of the items specified in [Table A.1](#).

Table A.1 — Mass measurement resolution

Item	Typical mass	Resolution
Full load	1 kg to 20 kg	10 g or better
Load items	up to 1 kg	1 g or better
Detergent	30 g to 400 g	0.5 g or better
PBIS	200 mg to 2 000 mg	0.1 mg or better
Sodium hydroxide	30 mg to 400 mg	0.1 mg or better

A.7.2 Temperature

Measurements of temperature **shall** be made using devices with a resolution of not more than $0.1\text{ }^\circ\text{C}$ and an overall uncertainty of measurement of better than $\pm 0.6\text{ K}$ at the 95 % confidence level. Temperature measurements **shall** be recorded to the nearest $0.1\text{ }^\circ\text{C}$ or better.

A.7.3 Electrical energy consumption

Measurements of energy consumption **shall** be made with an instrument with a resolution of not more than 1 W-hour (Wh) and with an overall uncertainty of measurement of better than 2 % at the 95 % confidence level. Energy measurements **shall** be recorded to the nearest 1 Wh or better.

Measurements of **standby power shall** be made with instruments in accordance with AS/NZS IEC 62301.

A.7.4 Length

Measurements of length **shall** be made using instruments with an accuracy and resolution of ± 1.0 mm or better. All lengths **shall** be recorded to the nearest 1 mm.

A.7.5 Time

Measurements of the time **shall** be made using instruments with a resolution of 1 s or better and with an overall uncertainty of measurement of better than 1 % at the 95 % confidence level. Time measurements **shall** be recorded to the nearest 1 s or better.

A.7.6 Water consumption

Water consumption **shall** be measured using instruments with a resolution of 0.1 L or better and with an overall uncertainty of measurement better than 2 % at the 95 % confidence level. Water consumption measurements **shall** be recorded to the nearest 0.1 L or better with separate metering for hot and cold inlets, where applicable.

A.8 Detergent

A.8.1 Detergent for drum type machines

The detergent **shall** comprise the IEC base powder specified in [Table A.2](#) (without perborate) with the addition of 5 % sodium perborate. The sodium perborate **shall** be added and thoroughly mixed immediately prior to use.

Table A.2 — Detergent composition

Ingredients	%
Linear sodium alkyl benzene sulfonate (mean length of alkane chain: C11.5)	7.6
Ethoxylated tallow alcohol (14 EO)	2.73
Sodium soap (chain length C12-16: 13 %-26 %; C18-22: 74 %-87 %)	3.33
Sodium tripolyphosphate	41.56
Sodium silicate ($\text{SiO}_2:\text{Na}_2\text{O} = 3.3:1$)	7.12
Magnesium silicate	1.78
Carboxymethylcellulose	1.19
Ethylenediamine-tetra-acetic-sodium-salt	0.24
Optical whitener for cotton (dimorpholinostilbene type)	0.24
Sodium sulfate	19.95
Water	9.26
Sodium perborate tetrahydrate (supplied separately)	5.0
NOTE 1 The perborate is supplied separately and is mixed with the basic powder immediately before use.	
NOTE 2 The detergent for machines specified in Table A.2 is equivalent to IEC reference detergent B base powder (without perborate), as defined in IEC 60456 ED 3.0:1998. This base powder is different to the current detergent A* specified in IEC 60456.	

A.8.2 Source of detergent

See [Clause A.13](#) for recommended sources of detergent.

A.8.3 Storage and maximum age

Sodium perborate tetrahydrate **shall** not be used if more than 1 year old. If the date of the manufacture is not provided with the sodium perborate, the age **shall** be measured from the date of purchase.

NOTE Detergents **should** be stored in a cool, dark, dry place in small airtight containers.

A.9 Anti-sudsing agent

Where an anti-sudsing agent is required, (see [Clause B.8](#)), the following type **shall** be used:

A commercially available silicone based anti-sudsing agent. This **shall** be an emulsion consisting of nominal 10 % silicone oil and the balance of water and emulsifiers. The maximum content of emulsifiers **shall** be 0.5 %. The dose **shall** not exceed 2 g per kilogram of clothes load.

A.10 Soil removal swatches

Soil removal swatches **shall** consist of pieces of standard soil cloth type AS 9 from a batch that has been approved for use with this Standard. Each swatch **shall** have dimensions of 140 ± 5 mm (along the warp) $\times$ 110 ± 5 mm (along the weft). Each swatch **shall** be marked for individual identification, with the markings on all swatches on the same side of the cloth relative to the side on which soil was applied.

NOTE For sources of material, see [Clauses A.13](#) and [I.3](#).

Soil removal swatches are supplied in a vacuum sealed package and have an indefinite life if unopened and stored refrigerated. The date of opening **shall** be marked on the packet. Swatches **shall** be used within 12 months of that date. Unused swatches **shall** be resealed in the original packaging and stored refrigerated when not in use.

A.11 Severity of washing swatches

Each swatch **shall** be cut as a square of side 100 ± 2 mm from an open-weave, 100 % cotton, unsized fabric woven from dual threads in both directions.

NOTE 1 Cosmo embroidery fabric, Article No. 1100-11 is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by Standards Australia of this product.

NOTE 2 For sources of material, See [Clause A.13](#).

A.12 Standard test load

The items used to make up a mixed cotton test load **shall** be as specified in Table C.1.

NOTE For sources of material, see [Clause A.13](#).

A.13 Sources of materials

To minimize variations in test results, it is recommended that test materials used for evaluating machines under test be obtained from the sources referred to in "Factsheet: sources of test materials" available at www.energyrating.gov.au. For the purpose of **check testing** appliances, the test materials **should** be obtained from those sources.

A.14 Built-in clothes washing machine test enclosure

A.14.1 General

Where **manufacturer's instructions** require a **clothes washing machine** be installed under a bench or in a similarly enclosed position for correct **operation**, then all tests **shall** be carried out with the machine installed in an enclosure conforming to [Clauses A.14.2](#) to [A.14.4](#).

A.14.2 Materials

The enclosure **shall** be constructed either of water-resistant grade particleboard or medium density fibreboard, neither painted nor veneered, or of untreated plywood of a thickness not less than 18 mm. The material **shall** have a density between 600 kg/m³ and 700 kg/m³.

A.14.3 Dimensions

The minimum internal dimensions of the test enclosure **shall** conform to the **manufacturer's instructions** where so documented.

If dimensions are not provided by the manufacturer, the inner dimensions of the test enclosure **shall** be as follows:

- (a) The inner depth **shall** exceed the outer depth of the appliance by not less than 100 mm.
- (b) The inner width **shall** exceed the outer width of the appliance by not more than 20 mm.
- (c) The inner height of the test enclosure **shall** exceed the outer height of the appliance by not more than 10 mm.

In the rear corner of the left or the right side wall of the test enclosure, an opening of height 100 mm and of width 75 mm **shall** be provided for water **supply**, drainage, pipework, and electric **supply** cord. This opening **shall** not be sealed after installation of the appliance.

A.14.4 Construction

The enclosure **shall** consist of a top, back and sides, as shown in [Figure A.1](#).

All joints, including that between the sides and the floor that the enclosure is placed on, **shall** be close-fitting, with gaps a maximum of 1 mm wide.

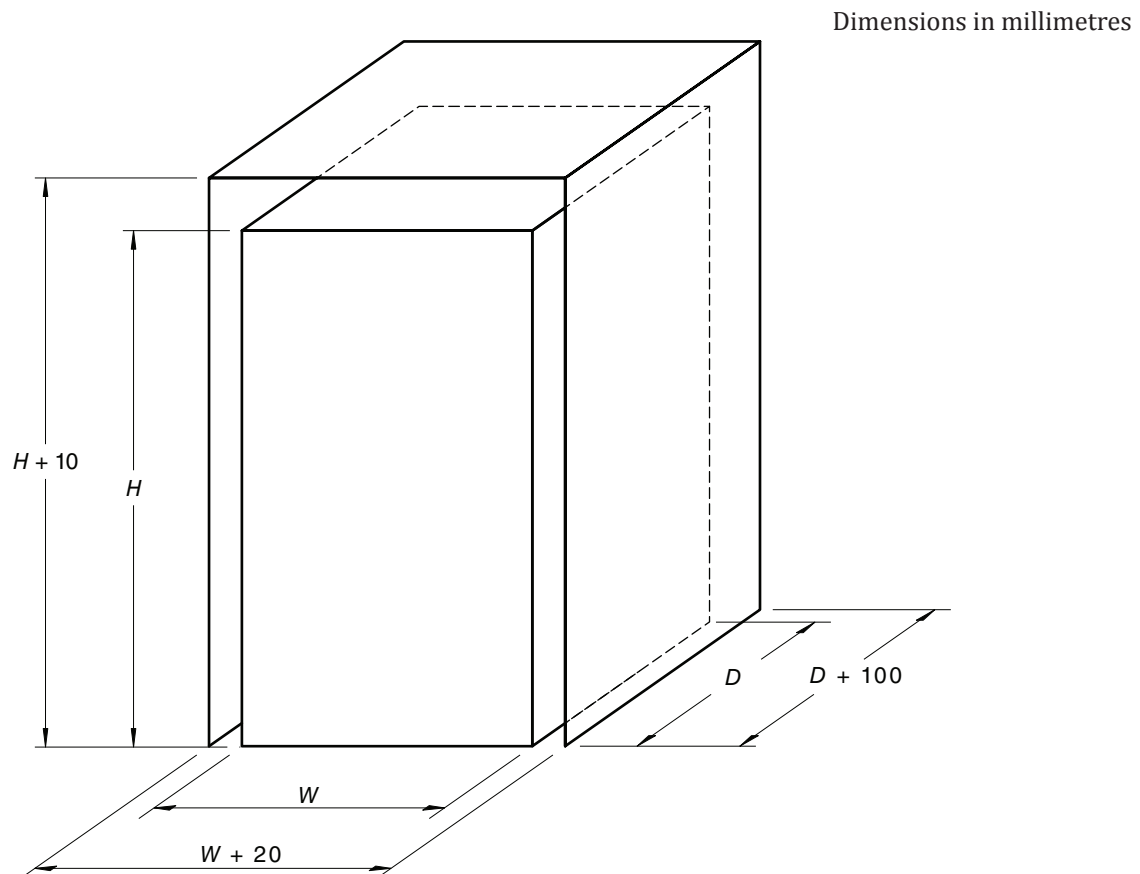
NOTE To achieve this condition, any appropriate fasteners such as screws, nails, clamps or adhesives **may** be used.

The enclosure **shall** be weighed down with one or more masses, totalling a minimum 12 kg, placed on top of the enclosure and located in such a way that approximately equal force is applied to the sides and back, and the top undergoes a maximum 5 mm deflection.

Where specified, the test enclosure **shall** be provided with ventilating openings in accordance with the **manufacturer's instructions**.

The **clothes washing machine** **shall** be built in or placed in the test enclosure in accordance with the **manufacturer's instructions**.

Solid or resilient material provided for closing the gap between the contours of the **clothes washing machine** and the cabinet **may** be used where supplied with the appliance. Where such materials are not provided, the gaps between the test enclosure and the **clothes washing machine** **shall** be left open.



NOTE The dimensions $H + 10$, $W + 20$, $D + 100$ are the inside dimensions of the enclosure.

Figure A.1 — Test enclosure for built-in-type appliances

A.15 Vibration walking test surface

The vibration walking test surface **shall** be in accordance with the requirements of [Appendix H](#).

A.16 Sandbags for vibration walking test

Sandbags for the vibration walking test **shall** be in accordance with the requirements of [Appendix H](#).

A.17 Additional requirements for testing

The details for each parameter **shall** be recorded in the test report.

NOTE 1 These parameters will be replicated when conducting a **check test**, provided they are consistent with the specifications and requirements below.

The sources of additional requirements for testing in accordance with this Standard shall be as follows:

- (a) *Installation* — Installation **shall** be in accordance with the **manufacturer's instructions**, except where otherwise specified in the Standard.
- (b) *Water connections* — Connection **shall** be to hot and/or cold **supply** inlets where present (irrespective of **manufacturer's instructions**).

- (c) *Water supply pressure* — Water **supply** pressure **shall** be 320 kPa except where the **manufacturer's instructions** stated **supply** pressure range does not include 320 kPa, then the pressure that is closest to 320 kPa **shall** be used, see [Clause A.4](#).
- (d) *Program* — **Program** **shall** be as specified by the **manufacturer's instructions**, see [Clause B.4](#). For energy labelling, the **program** **shall** be as specified in the **manufacturer's instructions** for a normally soiled cotton load at rated capacity and meet the relevant performance requirements of [Section 4](#).

NOTE 2 Refer to AS/NZS 2040.2 for details of **program** for energy efficiency labelling.

- (e) *Detergent type* — All machines **shall** use drum detergent, see [Clause A.8.1](#).
- (f) *Detergent quantity* — Detergent quantity **shall** be as specified in the **manufacturer's instructions** but not exceed the amount specified in [Clause B.7.2](#). The default quantity **shall** be as specified in [Clause B.7.2](#), provided none is specified in the **manufacturer's instructions**. No detergent **shall** be used if **manufacturer's instructions** state that no detergent is to be used.
- (g) *Adding detergent* — Detergent **shall** be added as dry powder in a detergent dispenser where this is specified in the **manufacturer's instructions**. Where there is no dispenser or where there is no information in the **manufacturer's instructions** about detergent placement and/or the point of the wash **operation** that the detergent is added, the detergent **shall** be dissolved and added in accordance with [Clause B.7.3](#).
- (h) *Anti-sudsing agent* — The amount of anti-sudsing agent **shall** be as specified by the **manufacturer's instructions**, but not exceed the amount specified in [Clause A.9](#). Default amount **shall** be zero if no value is specified by the **manufacturer's instructions**.
- (i) *Test load mass* — Cotton load **shall** be equal to the capacity stated by the **manufacturer's instructions**, see Note.

The load items used for testing **shall** be as specified in [Clause C.2](#) (irrespective of **manufacturer's instructions**).

NOTE 3 For the purposes of energy labelling, this is the rated capacity for a cotton load as stated in the **manufacturer's instructions**.

- (j) *Water consumption* — For the **program** specified in AS/NZS 2040.2, the claimed water consumption **shall** be the value registered for energy and water labelling.

NOTE 4 See also [Clause 4.5](#).

- (k) *Use of separately switched user operated heater* — A separately switched user-operated heater **shall** be used, provided this is specified in the **manufacturer's instructions**.

NOTE 5 See [Clause D.6](#).

- (l) *Built-in enclosure* — If the **manufacturer's instructions** require an enclosure, the enclosure **shall** be as specified in [Clause A.14](#). No enclosure **shall** be used where an enclosure is not specified or **manufacturer's instructions** provide for use as a freestanding appliance.

Appendix B (normative)

Preparation of clothes washing machine for testing and general test procedures

B.1 General

This Appendix specifies requirements for preparing a **clothes washing machine** for testing, and the test conditions that apply when determining its performance in accordance with [Appendices C to I](#) and [M](#).

B.2 Condition, installation and use of machine

The **clothes washing machine** under test **shall** be installed and used in accordance with the **manufacturer's instructions** except where specified otherwise by this Standard. Before measurements are commenced, the **clothes washing machine** **shall** be checked to ensure that it has no defects that could affect the **operation** of the unit.

Where separate inlets are supplied for both hot and cold water, they **shall** each be connected to an appropriate water **supply** for testing.

B.3 Filters

All filters **shall** be thoroughly cleaned before each test run.

B.4 Test program

B.4.1 General

The **test program** to be used, including all associated specific settings, **shall** be the one stated by the **manufacturer's instructions** for the test. The details of this **program**, including all associated settings, **shall** be recorded on the test report.

NOTE Refer to AS/NZS 2040.2 for details of **program** for energy efficiency labelling.

B.4.2 Washing machines with pre-set programs

B.4.2.1 Setting

The **clothes washing machine** **shall** be set for the **test program**. If the machine settings provide for a choice of rinse water temperatures, a cold rinse **shall** be selected unless otherwise specified.

B.4.2.2 Wash program

The wash **program** **shall** consist of complete wash, rinse and water extraction (i.e. spin) **operations** unless otherwise stated by the manufacturer.