AS/NZS 4012:2014
(Incorporating Amendment No. 1)

AS/NZS 4012:2014

Australian/New Zealand Standard™

Domestic solid fuel burning appliances—Method for determination of power output and efficiency





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The following are represented on Committee CS-062:

Australasian Fire and Emergency Service Authorities Council
Australian Building Codes Board
Australian Chamber of Commerce and Industry
Australian Home Heating Association
Australian Industry Group
Bioenergy Association of New Zealand
Clean Air Society of Australia and New Zealand
Consumers Federation of Australia
CSIRO
Department of Environment Regulation, WA
Department of Environment (Australian Government)
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CS-062, Solid Fuel Burning Appliances, to supersede AS/NZS 4012:1999.

This Standard incorporates Amendment No. 1 (April 2015). 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 Standard sets out sufficiently comprehensive specifications and instructions to enable all interested organizations with appropriate test facilities to determine the power output and efficiency of solid fuel burning appliances.

It is intended that the results of testing to this method will be of use to consumers during selection of solid fuel burning appliances.

This revision of the Standard incorporates a change to the labelling requirements for test results.

In this edition, the following changes have occurred:

(a) Changes to the use of fans during testing (Clause 6.7.3).

(b) Measurement of heat collected for hot water has been included in efficiency measurement.

(c) A method for measuring heat collected by water heating facilities has been included as an appendix.

(d) Minimum efficiency requirements have been included.

(e) In Australia, appliances previously exempt from testing because heat output rates exceeded 25kW will now be tested with smaller fuel loads.

The relevant regulators have indicated that they will mandate the levels of appliances in Clause 9.1.1(a) one year from publication of this Standard. The relevant regulators have indicated that they will mandate the levels of appliances in Clause 9.1.1(b) five years from publication of this Standard.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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CONTENTS

Page

SECTION 1 SCOPE AND GENERAL
1.1 SCOPE 5
1.2 APPLICATION 5
1.3 REFERENCED DOCUMENTS 5
1.4 DEFINITIONS 6
1.5 PRINCIPLE 7

SECTION 2 APPARATUS
2.1 AMBIENT TEMPERATURE MEASUREMENT SYSTEM 8
2.2 APPLIANCE TEMPERATURE MEASUREMENT SYSTEM 8
2.3 WEIGHT DETERMINATION EQUIPMENT 8
2.4 MASS FLOW MEASUREMENT SYSTEM 8
2.5 AMBIENT AIR PRESSURE MEASUREMENT SYSTEM 8
2.6 ANEMOMETER 8

SECTION 3 TEST ENCLOSURE AND FLUE
3.1 GENERAL 9
3.2 ROOM INSULATION 9
3.3 LENGTH OF FLUE 9
3.4 EXPOSED FLUE WITHIN CALORIMETER ROOM 9
3.5 AIR TEMPERATURES 9
3.6 AIR PRESSURE 10
3.7 WALL TEMPERATURES 10
3.8 AIR FLOW 10
3.9 CALIBRATION 10

SECTION 4 MEASUREMENT ACCURACY
4.1 TEMPERATURE AND MASS FLOW 13
4.2 CALORIMETER ROOM SCALES 13
4.3 UNCERTAINTY OF MEASUREMENT OF EFFICIENCY CALCULATION 13

SECTION 5 TEST FUEL
5.1 GENERAL 14
5.2 FUEL CHAMBER USABLE VOLUME 14
5.3 TEST FUEL LOAD 14
5.4 FIREWOOD PIECE DIMENSIONS 15

SECTION 6 TEST PROCEDURE
6.1 PREPARATION BEFORE TESTING 17
6.2 FUEL LOADING 18
6.3 BURN RATES 18
6.4 BURN CYCLE 19
6.5 NUMBER OF BURN CYCLES 19
6.6 DATA-RECORDING INTERVAL 19
6.7 OPERATION OF THE APPLIANCE 19
6.8 APPLIANCES WITH A WATER-HEATING FACILITY 20
6.9 DUCTED APPLIANCES 20
6.10 POST-BURN APPLIANCE AIR-FLOW TEST 20

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AVA Documents Document Sharing Hub

Full document details: AS NZS 4012-2014 (2015)

SECTION 7 CALCULATION AND REPORTING OF RESULTS
7.1 CALCULATIONS 21
7.2 REPORT 22

SECTION 8 MARKING
8.1 GENERAL 23
8.2 COMPULSORY PERMANENT MARKING 23
8.3 FUEL TYPES 23
8.4 ADDITIONAL MARKING 23
8.5 RETESTING EXEMPTION 24

SECTION 9 MINIMUM ALLOWABLE HEATING EFFICIENCY LEVEL
9.1 GENERAL 26
9.2 VALID TESTS 26

APPENDICES
A FIREWOOD DETERMINATION—WORKED EXAMPLE 27
B METHOD FOR DETERMINATION OF WATER HEATING HEAT OUTPUT AND POWER 29

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

Domestic solid fuel burning appliances—Method for determination of power output and efficiency

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out a method for the determination of the average efficiency and average thermal power output from a batch-fed domestic solid fuel burning appliance and the associated efficiency acceptance criteria/ion.

1.2 APPLICATION

1.2.1 General

This Standard applies to domestic solid fuel burning appliances.

1.2.2 Included appliances

Appliances within the scope of this Standard include—

(a) space-heating appliances; and

(b) space-heating appliances that include water-heating devices.

1.2.3 Excluded appliances

Appliances excluded from this Standard are—

(a) site-built masonry appliances;

(b) central heating appliances;

(c) cooking appliances;

(d) appliances intended solely for water heating;

(e) appliances intended solely to distribute convective heat via ducting to locations remote from the appliance; and

(f) appliances that, when fired at the high burn rate [see Clause 6.3(a)] prescribed in this Standard, have a maximum carbon dioxide output from the combustion chamber of less than 5% by volume with any optional doors fitted and closed.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS 2918	Domestic solid fuel burning appliances—Installation
AS/NZS 3869	Domestic solid fuel burning appliances—Design and construction
4013	Domestic solid fuel burning appliances—Method for determination of flue gas emission
4014	Domestic solid fuel burning appliances—Test fuels (series)

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A1 ISO/IEC
Guide 98 Uncertainty of measurement
Guide 98-3 Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)

1.4 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 2918, AS/NZS 3869, AS/NZS 4013 and those below apply.

1.4.1 Appliances above 25 kW

A heating appliance that has a maximum heat output rate greater than 25 kW, as measured for a period of not less than six minutes and under high burn rate conditions. This is with a fuel load calculated with a nominal volume of 16.5% of the fuel chamber usable volume, as described in Clause 5.3.1.

1.4.2 Appliance operating instructions

Written instructions, which are packed with the appliance, for the appliance operator detailing the manner in which the appliance is to be operated and fuelled.

1.4.3 Average burn cycle efficiency

The ratio of useable heat energy output to heat energy input for a valid burn cycle, expressed as a percentage.

1.4.4 Average efficiency

The average of efficiencies calculated for all valid burn cycles making up a test at a particular burn rate category.

1.4.5 Batch feed

The process of adding quantities (batches) of fuel at varying intervals to maintain a required burn rate.

NOTE: Batch feeding does not include pellet heaters.

1.4.6 Built-in appliance

An appliance designed to be in contact with or built into a heat sensitive structure within a building.

NOTE: An appliance with a through-wall, ceiling or other similar hot air outlet should be considered as a built-in appliance.

1.4.7 Burn cycle

The process of loading a batch of fuel and burning it until the fuel is reduced to ash.

1.4.8 Burn cycle time

The time between the loading of a test fuel load and the loss of the total load mass less ash.

1.4.9 Burn rate

The mass of a complete test fuel load (fuel plus moisture) divided by the burn cycle time.

1.4.10 Bypass damper

A device that enables combustion gases and excess air to be diverted so as to increase draught during lighting or refuelling.

1.4.11 Calorimeter room

An enclosed space that is designed and calibrated to allow accurate measurement of the combined convected and radiated heat transferred to the room from the appliance.

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1.4.12 Central heating appliance

A heating appliance that is intended for space heating by means of transferring heat to the living area by ducted hot air, hot water, or other fluid.

For the purposes of complying with New Zealand regulations, this also refers to a heating appliance that has a maximum heat output rate greater than 25 kW as measured for a period of not less than six minutes under high burn rate conditions set out in Section 6.

1.4.13 Cooking stove appliance

A solid fuel burning appliance that incorporates at least one cooking hot plate and an oven with a volume of not less than 28 L. Gaseous combustion products are capable of being routed around the oven.

1.4.14 Efficiency (overall efficiency or appliance efficiency)

The ratio of usable heat energy output to chemical energy input (gross calorific value of fuel load), expressed as a percentage.

1.4.15 Fireplace insert appliance

An appliance intended to be installed in a fireplace or a suitably flued masonry enclosure.

1.4.16 IANZ

International Accreditation New Zealand.

1.4.17 Inlet air damper

A valve or plate for regulating the air entering the firebox.

1.4.18 Maximum average heat output

The average power on high burn rate calculated in accordance with Clause 7.1.1 to the nearest kilowatt.

1.4.19 NATA

National Association of Testing Authorities, Australia.

1.4.20 Overall average efficiency

The average of all efficiency values calculated in accordance with Clause 7.1.4.

1.4.21 Peak power

The average of the highest (peak) power levels recorded during each valid high burn rate cycle.

1.4.22 Shall

Indicates that a statement is mandatory.

1.4.23 Should

Indicates a recommendation.

1.4.24 Test fuel load

The mass of test fuel load placed in the appliance at the start of each burn cycle during a test. This mass does not include the mass of ash or burning embers in the appliance at the time of refuelling.

1.5 PRINCIPLE

The appliance is installed in a calorimeter room and fired in a given manner. The heat output is measured over a number of burn cycles at three specified burn rates, and the efficiency calculated.

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SECTION 2 APPARATUS

2.1 AMBIENT TEMPERATURE MEASUREMENT SYSTEM

A system that measures ambient temperatures in the range 10°C to 40°C with an accuracy of ±2°C.

2.2 APPLIANCE TEMPERATURE MEASUREMENT SYSTEM

Apparatus for measuring appliance temperatures shall consist of—

(a) a number of type J (iron constantan) or type K (chromel-alumel) thermocouples having a wire diameter of no greater than 0.6 mm; and

(b) a recording device capable of responding to the outputs of the thermocouples, as required in Item (a) above.

2.3 WEIGHT DETERMINATION EQUIPMENT

The following weighing scales are required:

(a) A balance capable of measuring a test fuel load with an accuracy of ±10 g.

(b) A balance capable of measuring the mass of the appliance and fuel load, as installed, with an accuracy of ±0.5% of the test fuel load mass.

2.4 MASS FLOW MEASUREMENT SYSTEM

An instrument that measures the mass flow of the heat extraction medium with an accuracy of ±3% of the maximum measured flow.

NOTE: Assessment of accuracy will take into account density and instrument accuracy.

2.5 AMBIENT AIR PRESSURE MEASUREMENT SYSTEM

An instrument that is capable of measuring ambient barometric pressure within ±3 hPa.

2.6 ANEMOMETER

An instrument that measures the ambient air velocities in the vicinity of the appliance, in the range 0 to 2 m/s, with an accuracy of ±0.25 m/s.

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SECTION 3 TEST ENCLOSURE AND FLUE

3.1 GENERAL

The testing shall be carried out in a calorimeter room with an internal volume of not less than 15 m^3, provided that the test facility performance criteria set out in Clauses 3.2 to 3.9 are met.

3.2 ROOM INSULATION

The outer walls, ceiling and floor of the calorimeter room shall have a minimum thermal resistance of 2.5 m^2.K/W.

3.3 LENGTH OF FLUE

The flue pipe shall terminate at a height of 4.6 ±0.1 m above the lowermost part of the appliance.

Sections of flue outside the calorimeter room shall be surrounded by not less than 25 mm of high temperature insulation to within one flue diameter of the flue exit.

3.4 EXPOSED FLUE WITHIN CALORIMETER ROOM

3.4.1 Freestanding appliances

For freestanding appliances, the distance between the top of the exposed flue and the lowermost part of the appliance shall be 2000 ±20 mm, as shown in Figure 3.1. Flue sections within the calorimeter room above the 2 m height shall be wrapped with high-temperature insulation with minimum thickness of 25 mm.

If an appliance is designed to operate with a fully insulated flue or special flue nominated by the manufacturer, the flue specified in the appliance installation instructions shall be used.

NOTE: Flue guards venting directly into flue casings are not considered special flue types.

3.4.2 Fireplace-insert appliances

For fireplace-insert appliances, sections of flue pipe within the calorimeter room shall be surrounded by thermosiphon-vented flue casings, as shown in Figure 3.2. The air gap between casings shall be nominally 25 mm. The flue casings shall be wrapped with high temperature insulation with a minimum thickness of 25 mm. All outer surfaces of the appliance not directly exposed to a living area in normal fireplace installations shall be wrapped with high-temperature insulation with a minimum thickness of 25 mm. Insulation shall have an R rating of between 1 m^2.K/W and 3 m^2.K/W. If an appliance already has insulation built-in, it shall still be wrapped with high temperature insulation as described above.

3.4.3 Built-in appliances

The requirements of Clause 3.4.2 shall also apply to built-in appliances.

3.5 AIR TEMPERATURES

Air entering the calorimeter room shall be in the range 10°C to 25°C. The sum of the incoming and outgoing air temperatures shall not exceed 80°C at any time during a test.

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3.6 AIR PRESSURE

The air pressure within the calorimeter room shall not differ from ambient pressure by more than 1 Pa. The point of monitoring air pressure outside the calorimeter room shall communicate freely with the top of the flue. Flue draught pressure should not be influenced by wind-induced or fan-induced draughts by more than 1 Pa.

3.7 WALL TEMPERATURES

The surface temperature at the centre of each of the innermost walls or wall shields of the calorimeter room shall be within the range 15°C to 45°C throughout the test.

3.8 AIR FLOW

With the calorimeter room operating, air flows near the surface of the appliance under test shall be not greater than 1 m/s when measured at a distance of 100 mm from the appliance with the appliance not operating. In a ventilated calorimeter room, incoming air shall not be directed onto the appliance or flue.

3.9 CALIBRATION

3.9.1 General

All instruments referred to in this Clause (3.9) shall be calibrated before commissioning the test apparatus, and shall be recalibrated at the frequency prescribed by NATA/IANZ. All calibrations shall be traceable to the relevant Australian, New Zealand, Joint Australian/New Zealand or International Standards.

3.9.2 Calorimeter room

The calorimeter room shall be calibrated using electrical resistance heating to simulate the heat output of a solid fuel burning appliance. The electrical heating calibration shall cover the entire power range over which the calorimeter room will be used, i.e. interpolation of calibration points is permitted but not extrapolation.

The calibration shall be done for at least four power levels, spread evenly across the full range of powers. Each calibration shall allow for the thermal mass of the room. This may require a significant stabilization period at each power level. The time taken to reach 68% of steady-state conditions shall not exceed 30 min. The calibration factor shall be an average of calibration points for both increasing and decreasing power levels.

During calibration, power measurements shall be made at least every 2 min. Heat transfer medium flows, room pressure, room air temperature, and room wall temperature shall be recorded at sufficiently regular intervals to ensure that overall accuracy is not affected.

Calibration of the calorimeter room shall be carried out after any modification to the structure of the room or heat extraction system, and shall also be carried out at least annually.

NOTE: Calorimeter rooms using liquid heat transfer mediums are unlikely to meet this criterion.

3.9.3 Barometer

The barometer shall be calibrated at the frequency prescribed by NATA/IANZ.

3.9.4 Anemometer

The anemometer shall be calibrated at the frequency prescribed by NATA/IANZ.

3.9.5 Weighing instruments

All weighing instruments (platform scales for the test fuel load and the combined mass of the appliance and fuel load) shall be calibrated at the frequency prescribed by NATA/IANZ. A multipoint calibration with at least five points spanning the operational range of each instrument shall be performed.

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