

Australian Standard™

Gas fired water heaters for hot water supply and/or central heating



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Australian Standard™

Gas fired water heaters for hot water supply and/or central heating

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PREFACE

This Standard was prepared by the Standards Australia Working Group AG-001-00-11, Gas Water Heaters, under the responsibility of Standards Australia Committee AG-001, Gas Appliances. This edition is a substantial revision of the previous edition of AS 4552/AG 102:2000 to align with the expansion of the Scope. It supersedes AS 4552/AG 102 – 2000, *Gas Water Heaters*.

The objective of this Standard is to provide manufacturers, designers, regulatory authorities, testing laboratories and similar organizations with uniform minimum requirements for the safety, performance and use of gas fired water heaters and central heating boilers for hot water supply and/or central heating.

This Standard should not be regarded as a design specification or as an instruction manual.

In its preparation, consideration has been given to—

- (a) continuity of satisfactory operation;
- (b) the prevention of fire hazards, and explosions;
- (c) the prevention of injury to persons or property;
- (d) gas rules and regulations now in force; and
- (e) relevant International Standards.

AS 5601—Gas Installations, provides essential requirements and basic standards for gas installations.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

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STANDARDS AUSTRALIA

Australian Standard

Gas fired water heaters for hot water supply and/or central heating

SECTION 1 SCOPE AND DEFINITIONS

1.1 SCOPE

These requirements apply to gas water heaters and central heating boilers with natural draught or fan assisted combustion systems, intended for use with natural gas, town gas, liquefied petroleum gas (LPG) and tempered liquefied petroleum gas (TLP) with gas consumptions not exceeding 500 MJ/h, and includes types intended for the supply of hot water at a maximum temperature of 99°C for—

- (a) sanitary, potable and drinking purposes;
- (b) hydronic space heating; and
- (c) a combination of (a) and (b).

NOTE: Other statutory and regulatory requirements may be applicable to the product(s) that fall within the scope of this Standard. It is the manufacturer's, importer's or distributor's responsibility (as appropriate) to ensure that products comply with such requirements.

1.2 DEFINITIONS

1.2.1 Adjustable control thermostat

An adjustable device enabling the water temperature to be maintained automatically, within a given range.

1.2.2 Ambient temperature

The temperature of the air surrounding the appliance, as measured by a dry bulb thermometer or equivalent.

1.2.3 Appliance flueway

A port or passage conveying flue gases within the appliance.

1.2.4 Appliance regulator

A device fitted to an appliance to control the gas pressure or gas volume delivered to that appliance.

1.2.5 Appliance ventilation duct

A duct through a building designed to bring combustion air from, and take products of combustion to, the outside air, for Type 2 room sealed appliances.

1.2.6 Atmospheric burner

A burner system where all the air for combustion is introduced by the inspirating effect of a gas injector and/or by the natural draught in the combustion chamber without mechanical assistance.

1.2.7 Authority having jurisdiction

The authority having statutory (legal) control.

1.2.8 Automatic flue damper device

A device, in the outlet of the primary flue of an individual automatically operated gas appliance, which is designed to automatically open the flue outlet during appliance operation and to automatically close off or restrict the flue outlet when the appliance is in the standby condition.

1.2.9 Automatic heat exchange water heater

An appliance in which water is heated by passing it through a heat exchanger immersed in heated water.

1.2.10 Automatic ignition

The lighting of gas at a burner without a manual operation whenever gas flows from the burner.

1.2.11 Automatic shut off valve

An automatic valve used to shut off gas supply to an appliance.

1.2.12 Available gas (line gas)

Readily available gas with similar characteristics to the reference test gas.

1.2.13 Bleed line

A small diameter pipe or tube that conveys gas to a safe place from a diaphragm valve other than one used for pressure regulators.

1.2.14 Burner port

The opening in a burner through which gas or an air/gas mixture issues to be ignited and burned.

1.2.15 Bypass

An integral part of a gas control that enables gas to bypass the control.

1.2.16 Capacity

The quantity of water measured in litres (L) contained within the storage vessel of a storage water heater.

1.2.17 Central heating boiler

An appliance that is designed to heat and supply water at a temperature not exceeding 99°C for hydronic heating purposes.

1.2.18 Certified

Assessed by a Certifying body, and having a certificate number to demonstrate compliance with a Standard.

1.2.19 Certifying body

A body acceptable to the Technical Regulator that provides assurance of compliance of appliances and components with nominated standards or other accepted safety criteria.

1.2.20 Circulator

A water heater in which water passes to a storage tank after heating.

NOTE: In the case of hydronic heating systems the term 'circulator' may refer to a pump.

1.2.21 CO/CO₂ ratio

The ratio by volume of carbon monoxide to that of carbon dioxide in the combustion products.

1.2.22 Combination gas control

An assembly of two or more different control functions in a single body.

1.2.23 Combination appliance

An appliance that is designed to perform the functions of both a central heating boiler and a water heater by means of two separate water circuits.

1.2.24 Combustion circuit

Circuit including the combustion chamber, the heat exchanger and the circuit permitting evacuation of the combustion products up to and including the flue connection (flued appliance) or flue terminal (flueless appliance).

1.2.25 Combustible materials

Materials made of or surfaced with wood, compressed paper, plant fibres or other materials that will ignite and burn.

1.2.26 Combustion products discharge safety device

A device that causes at least safety shutdown of the main burner when there is an unacceptable spillage of combustion products at the draught diverter.

1.2.27 Compression fitting

Compression fittings and components are as defined in AS/NZS 3500.0.

1.2.27.1 Type 1 (non-manipulative) compression fitting

A fitting for a compression joint that does not require any working of the tube other than cutting square. The joint is made tight by means of a loose compression ring that grips the outside wall of the tube when the coupling nut is tightened.

1.2.27.2 Type 2 (manipulative) compression fitting

A fitting in which the joint is made by flaring, croxing, capping or beading the end of the tube which is then compressed by the coupling nut against the shaped end of the corresponding section in the fitting.

1.2.28 Control thermostat

A preset device enabling the water temperature to be maintained automatically, within a given range.

1.2.29 Cross lighting

Lighting of one burner from another either directly or by means of an intermediate flame.

1.2.30 Determined gas consumption

Gas consumption rate measured in megajoules per hour (MJ/h) corrected to standard conditions, using reference gas at specified test pressures.

1.2.31 Drain valve

A valve in the bottom of the water vessel, through which the water may be drained from an appliance.

1.2.32 Draught diverter

A device, without moving parts, fitted in the flue of an appliance for isolating the combustion system from the effects of pressure changes in the secondary flue.

1.2.33 Drinking water

As defined in AS/NZS 4020.

1.2.34 Excess air

Air in excess of that required for complete combustion which is mixed unchanged with the combustion products, in the combustion chamber.

1.2.35 Expansion relief valve

A pressure actuated valve that automatically discharges water at a specified set pressure to prevent the pressure in the system exceeding the maximum working pressure during normal operation.

1.2.36 Fan assisted combustion system

A system (that is an integral part of the appliance) in which all or part of the combustion air is supplied and/or in which the products of combustion are evacuated by mechanical means.

1.2.37 Flame abnormality

A flame condition that results in lifting, floating, lighting back, carbon deposition or objectionable odour.

1.2.38 Flame detector

A device that is sensitive to flame properties and initiates a signal when flame is detected.

1.2.39 Flame establishment period

The period which begins when the fuel valve is energized and ends when the flame supervision system is first required to supervise that flame.

1.2.40 Flame proving period

The supervised period following the flame establishment period and before any further operation other than shutdown is permitted.

1.2.41 Flame safeguard

A safety device that automatically cuts off the gas supply if the actuating flame is extinguished.

1.2.42 Flame safeguard system

A system consisting of a flame detector(s) plus associated circuitry, integral components, valves and interlocks the function of which is to shut off the fuel supply to the burner(s) in the event of ignition failure or flame failure.

1.2.43 Flash tube

A device for igniting a gas burner in which a flame is made to travel to the burner ports through a tube in which an inflammable mixture of gas and air has been induced.

1.2.44 Flue

The passage through which flue gases are conveyed from an appliance to a discharge point (i.e. flue terminal), excluding draught diverter, barometric device, fan or similar part.

1.2.45 Flue connection

A device incorporated in an appliance for the connection of a flue system.

NOTE: Where the draught diverter, barometric device, fan or similar component is an integral part of the appliance, the discharge point of the integral part shall be deemed to be the flue connection.

1.2.46 Flue cowl

A fitting placed at the flue terminal of an open flued appliance, designed to prevent the entry of rain or the disturbing effect of wind, while not interfering with the discharge of flue gases.

1.2.47 Flue gases

Combustion products plus all diluents and contaminants intermixed with the combustion products. These include, where applicable, excess air, dilution air, process air, and waste products from the process.

1.2.48 Flue system

The passage through which flue products are conveyed from an appliance to a discharge point (i.e. flue terminal), including draught diverter, barometric device, fan or similar part.

1.2.49 Flue terminal

In the case of a flueless appliance; the point at which the flue products discharge from the appliance.

In the case of a flued appliance; the point at which the flue products discharge from the flue into the atmosphere or into a flue cowl, if fitted.

1.2.50 Flueless appliance

An appliance designed not to discharge its flue gases through a flue.

1.2.51 Forced draught

All or part of the air for combustion is provided under positive pressure by mechanical means.

1.2.52 Gas

A combustible fuel gas that may be one of the following:

1.2.52.1 Natural gas (NG)

A hydrocarbon gas consisting mainly of methane.

1.2.52.2 Simulated natural gas (SNG)

A gas comprising a mixture of LPG and air, in the approximate proportions of 55% gas and 45% air for commercial propane.

1.2.52.3 Town gas (TG)

A gas manufactured from coal or petroleum feedstocks.

1.2.52.4 Tempered liquefied petroleum gas (TLP)

A gas comprising a mixture of LPG and air, in the approximate proportions of 27% gas and 73% air for commercial propane.

1.2.52.5 Liquefied petroleum gas (LPG)

A gas composed predominantly of any of the following hydrocarbons, or any combination of them in the vapour phase; propane, propene (propylene), butane, butene (butylene).

1.2.53 Gas consumption

The rate of energy consumed by an appliance under specific conditions and expressed in megajoules per hour (MJ/h).

1.2.54 Heat output

The amount of heat transferred to the water per unit time under specified conditions and expressed in kilowatts (kW).

1.2.55 Heating value, gross (at constant pressure)

The number of megajoules (MJ) liberated when one cubic metre of dry gas, at standard conditions of temperature (15°C) and absolute pressure (101.325 kPa), is completely burnt in air with all the water formed by the combustion process in the liquid state and with the products of combustion at standard conditions.

NOTE: Calculation of heating value is based upon ISO 6976.

1.2.56 Hydronic

Relating to a system of heating or cooling that involves the transfer of heat by circulation of a fluid (usually water) in a closed circuit, which may or may not be vented.

1.2.57 Induced draught

All or part of the air for combustion is introduced by providing suction in the combustion chamber by mechanical means.

1.2.58 Injector

A device which causes air to mix with a stream of gas. In the case of an aerated burner it incorporates an orifice discharging gas into the mixing throat or tube.

1.2.59 Instantaneous water heater

A water heater or central heating boiler in which gas, except for any pilot flame, burns only when water is discharged from the outlet of the appliance.

1.2.60 Intermittent pilot

A pilot which is automatically ignited each time the burner is started, and which is automatically extinguished with the main burner.

1.2.61 Interrupted pilot

A pilot which is automatically ignited each time the burner is started, and which is automatically extinguished at the end of the main flame establishment period.

1.2.62 Jointing compound

A manufactured liquid, paste-like or semi-solid material used to seal joints.

1.2.63 Jointing material

A manufactured solid material that may be in tape, cord or sheet form, used to seal joints.

1.2.64 Lift (flame)

Separation of a flame from a burner port, whilst continuing to burn with its base some distance from the port.

1.2.65 Light back

Transfer of the flame from burner port(s) into the body of the burner or back to the injector.

1.2.66 Limit thermostat

A device that shuts off the gas supply when the temperature rises above a limit value, and automatically re-establishes the gas supply when the temperature falls below a limit value.

1.2.67 Linting

Blocking of a burner port or air opening by dust or fluff.

1.2.68 Lockout

1.2.68.1 *Non-volatile lockout*

A safety shutdown condition of the control system which can only be reset by a manual operation.

1.2.68.2 *Volatile lockout*

A safety shutdown condition of the control system which can be reset by a manual operation or by the loss and subsequent restoration of the electricity supply.

1.2.69 LPG

See Gas.

1.2.70 Maintenance gas consumption

The gas consumption required to maintain at a steady value some particular condition in an appliance, e.g. to hold a specified temperature evenly.

1.2.71 Manual ignition

1.2.71.1 *Direct manual ignition*

The lighting of a burner by the use of a hand held ignition device.

1.2.71.2 *Remote manual ignition*

The lighting of a burner by a manual operation where the ignition activating device is remote from the ignition point.

1.2.72 Maximum working water pressure

The pressure setting of the water pressure relief valve or its equivalent.

1.2.73 Minimum working water pressure

The minimum water supply pressure required to operate the appliance at its stated performance.

1.2.74 Mixing tube

That part of an atmospheric burner in which the air and gas are mixed.

1.2.75 Natural gas

See Gas.

1.2.76 Nominal gas consumption

The appliance gas consumption, in megajoules per hour (MJ/h), as stated in manufacturer's specifications, instructions and general communications.

NOTE: This is the fundamental quantity on which all methods of test are based and is the starting point for all performance requirements.

1.2.77 Nominal test point pressure

The gas pressure specified by the manufacturer, at which the appliance is designed to operate, and measured at a test point.

1.2.78 Normal test gas pressure

The gas pressure for testing purposes, measured at the appliance inlet connection, as follows—0.75 kPa for TG and TLP, 1.13 kPa for NG and SNG, 2.75 kPa for LPG.

1.2.79 Open flued appliance

An indoor appliance designed to be connected to an open flue system, its combustion air being drawn from the room or space in which it is installed.

1.2.80 Outdoor appliance

An appliance designed for outdoor installation or use.

1.2.81 Overheat cut-off device

A device that causes safety shutdown and non-volatile lockout before the approach to an unsafe condition and/or before the appliance is damaged.

1.2.82 Overload gas consumption

For appliances—

- (a) with gas pressure regulators—120% of nominal gas consumption;
- (b) without gas pressure regulators—the gas consumption that results when gas at a pressure of 3.5 kPa is supplied to the appliance inlet.

1.2.83 Over-temperature cut-out device

A manual reset or non-resetting device that functions to shut off the gas supply to a burner or burners to prevent temperature exceeding a pre-determined level.

1.2.84 Permanent pilot

A pilot that is permanently alight while the appliance is in service and which is controlled independently of the main burner.

1.2.85 Pilot

A permanently located burner independent of the main burner, small in relation to it, and arranged to provide ignition for the main burner.

1.2.86 Power flued

A flue system in which products of combustion are removed from the appliance by a fan in the flue.

1.2.87 Potable water

See Drinking water.

1.2.88 Pre-ignition purge

The introduction of air into the combustion chamber and appliance flueway so as to either displace any gas/air mixture to a safe place or to dilute the gas/air mixture to an incombustible mixture.

1.2.89 Primary aeration control

An adjustable device for controlling primary air on an atmospheric burner.

1.2.90 Primary air

That portion of the total air required for combustion that is mixed with the gas prior to burning on the burner ports.

1.2.91 Primary air ports

The openings in an aerated burner for primary air.

1.2.92 Primary flue

That portion of the flue system conveying flue products from an appliance to the draught diverter, barometric device, fan or similar part when fitted.

1.2.93 Programmable electronic system (PES)

A system based on one or more central processing units (CPUs), connected to sensors and/or actuators, for the purpose of control, protection or monitoring.

NOTES:

- 1 The term PES extends to and includes all elements in the system such as—
 - (a) sensors and/or other input devices;
 - (b) data links and/or other communication paths; and
 - (c) actuators and/or other output devices.
- 2 The term PES includes system software such as executive, users and communication, etc. which is configured to operate a process.
- 3 The term PES is used to cover systems incorporating a wide range of programmable electronic devices and includes systems incorporating —
 - (a) microprocessors;
 - (b) programmable controllers (PCs);
 - (c) programmable logic controllers (PLCs);
 - (d) programmable state controllers;
 - (e) other computer based devices.
- 4 A PES can include a microprocessor-based temperature, pressure, air/fuel ratio, or level controller or monitor.

1.2.94 Programmed ignition

A multi-stage system of automatic ignition where each stage takes place automatically in a pre-determined sequence.

1.2.95 Proved

In relation to programmed ignition or other sequence of events, this term refers to the action of an automatic monitoring system which determines that a specific stage of the sequence has actually been completed before the next stage is initiated.

1.2.96 Purge volume

The purge volume includes the combustion chamber and all areas where combustion products and combustible vapours, dusts or gases may accumulate in the appliance or process up to the vertical connection of a flue or chimney that discharges directly to atmosphere.

1.2.97 Range rated appliance

An appliance with installer adjustable nominal heat input to suit the heat requirements of the installation.

1.2.98 Reference gas

The gas corresponding to an average of the gases most currently distributed, and for which the appliance has been specifically designed (see Test gases).

1.2.99 Relative density

The ratio of the mass of a volume of gas to the mass of the same volume of dry air under the same conditions of temperature and pressure.

NOTE: Calculation of relative density is based upon ISO 6976.

1.2.100 Relief device

A safety device designed to forestall the development of a dangerous condition by preventing pressure, temperature or vacuum build-up.

1.2.101 Room sealed appliance**1.2.101.1 Type 1**

An indoor appliance which is sealed from the room in which it is installed so that it directly discharges combustion products to, and takes air from, outside the building.

1.2.101.2 Type 2

An indoor appliance which is sealed from the room in which it is installed so that it directly discharges combustion products to, and takes air for combustion from, outside the building via an appliance ventilation duct.

1.2.102 Safety shutdown

The action of shutting off all gas and ignition energy by means of a safety control such that restart cannot be accomplished without a full start cycle.

1.2.103 Safety shut off system

An arrangement of valves and associated control systems which shuts off the supply of gas when required, by a device which senses the approach to an unsafe condition.

1.2.104 Safety shut off valve

An automatic valve used to shut off gas supply to an appliance when a signal is generated indicating the approach to an unsafe condition.

1.2.105 Safety temperature limiter

A device that causes safety shutdown and non-volatile lock out so as to prevent the water temperature exceeding a preset limit.

1.2.106 Sanitary appliance

An appliance which is intended to be used for sanitation and which is not a sanitary fixture. Included are machines for washing dishes and clothes.

1.2.107 Sanitary plumbing system

An assembly of pipes, fittings, fixtures and appliances that is used to collect and convey sewage to the sanitary drainage system.

1.2.108 Secondary air

Air required for completion of combustion, admitted to the combustion zone after combustion with primary air has commenced.

1.2.109 Secondary flue

That portion of the flue system conveying flue products from the draught diverter, barometric device, fan or similar part to the flue terminal.

1.2.110 Simulated natural gas (SNG)

See Gas.

1.2.111 Specific gravity

See Relative density.

1.2.112 Spillage

A condition in which the combustion products are not cleared by the flue, but escape from the appliance or the draught diverter relief openings.

1.2.113 Standard conditions

A temperature of 15°C and an absolute pressure of 101.325 kPa.

1.2.114 Start gas

The gas flowing at a pilot or, when no pilot is fitted, at a main burner during the flame establishment period for initial ignition.

1.2.115 Storage water heater

A water heater that incorporates a thermally insulated container in which the water is heated and stored for subsequent use.

1.2.116 Temperature limit device

A device that automatically interrupts the heat flow when the temperature at the control point reaches a pre-determined limit.

1.2.117 Temperature sensing element

A component that detects the temperature of the medium to be supervised or controlled.

1.2.118 Tempered liquefied petroleum gas (TLP)

See Gas.

1.2.119 Test gases

The test gases used in these requirements are defined in the test gas table (Table 1.1) that is based on pure components. Actual test gases are made up using constituent test gases of the purities listed below to the respective Wobbe Index $\pm 2\%$. Purities of the constituent gases are to be not less than—

- (a) 99% for hydrogen and nitrogen;
- (b) 95% for methane ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$);
- (c) 95% for propane ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$);
- (d) 95% for propylene ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$); and
- (e) 95% for butane ($H_2 + CO + O_2 < 1\%$, $N_2 + CO_2 < 2\%$).

Where base gases of the required composition or purity are not readily available, suitable blended gases of the same Wobbe Index and other combustion characteristics may be used. In case of dispute, the purity of the constituent gases shall not be less than the above values.

1.2.120 Thermostat

A device which automatically maintains a pre-determined temperature in an appliance or component.

1.2.121 Town gas

See Gas.

1.2.122 Turndown gas consumption

This shall be the higher of—

- (a) the lowest gas consumption to which the burner control can be set; or
- (b) 25% of the nominal gas consumption for infinite turndown gas controls; or
- (c) where a burner is under thermostatic control, the bypass rate is the turndown position.

1.2.123 Unvented

Having no provision for a vent permanently open between the water circuit and atmosphere.

1.2.124 Valve

A device for the purpose of controlling or shutting off flow.

1.2.125 Vented

Having provision for a vent permanently open between the water circuit and atmosphere.

1.2.126 Water heater

An appliance that is designed to heat and supply water at a temperature not exceeding 99°C for drinking and/or sanitary purposes.

1.2.127 Water operated gas valve

A gas valve actuated by a flow or change of pressure in a water system of an appliance.

1.2.128 Water pressure relief valve

A pressure actuated valve that automatically discharges fluid at a specified set pressure. It is fitted to heaters to prevent the pressure in the water carrying parts from exceeding the maximum working pressure during normal use and from exceeding a pre-determined margin over the maximum working pressure when temperature controls fail to limit pressure.

1.2.129 Wobbe index (Wobbe number)

The Wobbe index of a gas is:

$$\frac{\text{Heating value}}{\sqrt{\text{Relative density}}}$$

TABLE 1.1
TEST GAS TABLE

Test gas	Application	Composition percent						*Characteristics			
		Hydrogen	Methane	Propane	Propylene	Butane	Nitrogen	Air	Heating value MJ/m ³	Relative density	Wobbe index MJ/m ³
N	NG	-	97.5	1	-	-	1.5	-	37.8	0.571	50.0
Na		-	86	14	-	-	-	-	45.7	0.692	55.0
Nb		13	87	-	-	-	-	-	34.4	0.492	49.1
Nc		-	90	-	-	-	10	-	34.0	0.596	44.0
S		-	-	55	-	-	-	45	52.1	1.296	45.7
X	LPG	-	-	100	-	-	-	-	95.8	1.553	76.9
Y		-	-	-	-	100	-	-	125.7	2.078	87.2
Z		-	-	-	100	-	-	-	88.5	1.476	72.9
T		-	-	27	-	-	-	73	25.4	1.142	23.8
Ta	TLP	-	-	29	-	-	-	71	27.3	1.153	25.5
Tb		-	-	25	-	-	-	75	23.6	1.131	22.1
A	TG	50	-	18	-	-	32	-	23.0	0.619	29.2
B		65	-	7	-	-	28	-	14.5	0.423	22.2
C		28	-	18	-	-	54	-	20.3	0.817	22.5
D		50	-	15	-	-	35	-	20.2	0.602	26.0

* The reference conditions for the characteristics are 15°C, 101.325 kPa, Dry. The test gases shall be of a composition and of combustion characteristics as shown in the table. Where base gases of the required combustion purity are not available suitably blended gases of the same Wobbe index and other combustion characteristics may be used. In case of dispute gases strictly shown in the table shall be used.

NOTE: The listed characteristics for test gas 'Y' are based on the properties of iso-butane.

SECTION 2 DESIGN AND CONSTRUCTION

2.1 GENERAL

2.1.1 Requirements applicable to all types of water heaters and central heating boilers

2.1.1.1 Preliminary specification

Testing shall not commence until the manufacturer's written description of the appliance and instructions for installation and operation (sufficient for testing) have been submitted.

NOTE: Do not dismantle the appliance for individual component or specification study until testing has been completed.

2.1.1.2 Physical inspection

Before any physical performance testing takes place, the appliance shall satisfy the requirements as set out in this Section to ensure that it does not possess any obvious features which would prevent its certification. If the appliance is not considered satisfactory, adjustments must be made prior to the commencement of testing

2.1.1.3 Certification of safety components

All components relating to the safety of the gas burning operation shall be separately certified or shall be certified as part of the appliance against the requirements of the relevant component Standard(s).

NOTE: This includes, for example, automatic ignition systems, flame safeguards and pressure switches whether or not these carry gas.

2.1.1.4 Programmable electronic systems

Where a programmable electronic system (PES) is employed for safety related functions of burner management systems, the PES shall—

- be tested or assessed by a body recognized by the Certifying Body, for conformance to the relevant requirements of AS 4625 and EN 298 (or equivalent); or
- be certified by a body recognized by the Certifying Body to the requirements of AS 4625 and EN 298 (or equivalent).

2.1.1.5 Manual shut off gas valves

Manual shut off valves fitted to an appliance shall be certified as Type 1 or Type 2 in accordance with the classification specified in AS 4617.

2.1.1.6 Classification of safety shut off valves

The minimum classification of the safety shut off valve fitted shall be selected in accordance with Table 2.1.

TABLE 2.1
SAFETY SHUT OFF VALVE(S) SELECTION AND CLASSIFICATION

Burner type	Standard and classification
Atmospheric	AS 4620 or AS 4629 Class 3
Induced draught	AS 4629 Class 3
Forced draught with air pressure not exceeding 3 kPa	AS 4629 Class 2
Forced draught with air pressure exceeding 3 kPa	AS 4629 Class 1

NOTE: Refer to Clause 2.7.2 for fitting of safety shut off systems.

2.1.1.7 *Pressure vessels*

Pressure vessels incorporated in appliances shall comply with the requirements of the authority having jurisdiction.

2.1.1.8 *Compliance of electrical components*

Electrical components, and their installation in the appliance, shall comply with the requirements of the appropriate electrical authority. Documentary evidence for suitability of electrical components shall be provided to the testing authority.

2.1.1.9 *Power failure*

During a power failure the appliance shall not be activated automatically when the gas controls are in the 'OFF' position.

2.1.1.10 *Thermostats*

A thermostat shall be provided on all appliances other than instantaneous water heaters.

2.1.1.11 *Sharp edges*

Parts with which the installer, service person or user is likely to come in contact shall not have sharp points or edges.

2.1.1.12 *Handles and knobs*

Handles and knobs shall be so designed as to minimize accidental touching of hot surfaces.

2.1.1.13 *Continuity of satisfactory operation*

Construction of an appliance shall be such that continuity of satisfactory operation can be expected during normal usage.

2.1.1.14 *Insulation*

Insulation shall be—

- (a) fitted in such a way that it is not rendered ineffective or objectionable by settling, dislodgment or condensation during the normal operation of the appliance; and
- (b) protected against rodents.

2.1.1.15 *Covers on cold water feed tanks*

An integral cold water feed tank shall be supplied with an adequate and securely fastened dust and vermin-proof cover.

2.1.1.16 *Protection of vitreous enamel*

Screw heads in contact with cover coat vitreous enamel shall be provided with means of preventing enamel damage.

NOTE: This provision is optional in the case of ground coat or wiped areas.

2.1.1.17 *Means of support*

The appliance shall be provided with adequate means of support, which shall not allow the appliance to rock on a level surface or have sharp edges in contact with the floor.

2.1.1.18 *Compliance in alternative forms*

If an appliance is so designed that certain components may be fitted or omitted, e.g. legs, the appliance shall comply with all requirements in its alternative forms.

2.1.1.19 *Means of ignition for outdoor or room sealed appliances*

In the case of an outdoor or room sealed appliance the means of ignition shall be incorporated as part of the appliance.

2.1.1.20 *Locking means for adjusting devices*

Adjusting devices shall be provided with locking means that shall be sufficiently positive to prevent subsequent movement, either through accident or through the creep of sealing material. The tightening of a locking device shall not alter the setting.

2.1.1.21 *Alteration of programmed ignition*

Programmed ignition shall be sealed against alteration to settings.

2.1.1.22 *Means for gas pressure measurement*

Means shall be provided to allow the measurement of both the burner gas pressure and the gas pressure at the inlet to the appliance while it is in operation.

Pressure test points shall be designed to suit 6 mm bore flexible tubing and shall contain a limiting orifice not exceeding 1.0 mm or equivalent restriction.

2.1.1.23 *Design of appliance base*

The base of an appliance intended to stand on surfaces that may become wet shall be designed to resist corrosion of the base material.

2.1.1.24 *Provision for removal of condensate*

Where the appliance is specifically designed to operate under condensing conditions, adequate provision shall be made for the collection and removal of condensate. (Refer also to Clause 5.3.1)

2.1.2 **Requirements applicable only to water heaters****2.1.2.1** *Temperature setting markings*

Storage water heaters for sanitary purposes and with variable setting thermostats shall have a marking to indicate a nominal thermostat set point of 60°C.

2.1.3 **Requirements applicable only to central heating boilers****2.1.3.1** *Venting of waterways*

A central heating boiler shall be designed such that when it is installed and used according to the manufacturers instructions, it shall be possible to vent the air from the waterways, if it is not self-venting.

2.1.4 **Requirements applicable only to combination appliances****2.1.4.1** *Venting of central heating waterways*

A combination appliance shall be designed such that when it is installed and used according to the manufacturers instructions, it shall be possible to vent the air from the central heating waterways, if it is not self-venting.

2.2 **MATERIALS****2.2.1** **General**

The quality and thickness of the materials used in the construction of an appliance, and the method of assembling the various parts, shall be such that the constructional and performance characteristics do not alter significantly during a reasonable life and under normal conditions of installation and use.

In particular, when the appliance is installed according to accepted practice all components shall withstand the mechanical, chemical and thermal conditions to which they may be subjected in the course of normal operation.

NOTE: This requirement does not apply to consumption of any anode.

2.2.2 Materials containing asbestos

Materials containing asbestos are prohibited.

2.2.3 Materials in contact with gas

Materials in contact with gas shall be suitable for all gases.

2.2.4 Zinc based alloys

Zinc based alloys shall not be used in contact with water.

Where failure of a zinc based alloy may affect the safe operation of the appliance —

- (a) the alloy shall comply with AS 1881 – TYPE ZN AL 4;
- (b) the alloy shall not be exposed to a temperature exceeding 80°C during normal operation of the appliance; and
- (c) the alloy shall not swell, crumble or develop cracks when exposed to saturated water vapour at 97°C for 10 d.

2.2.5 Components required to be placed in a flame

Pilots, thermocouples and other components required to be placed in a flame shall be resistant to the effects of heat and corrosion. When refractory alloys are being used they shall not produce a catalytic cracking effect. Nickel alloys having less than 1% nickel such as AISI 416 steel shall be acceptable.

2.2.6 Materials used in electrical construction

Materials used in electrical construction shall be suitable for the application, in particular —

- (a) electrical insulation shall be of a moisture resistant material;
- (b) the temperature rating of the wiring shall be suitable for the conditions of use; and
- (c) insulation shall have adequate mechanical and dielectric strength.

2.2.7 Protection of aluminium tubing

Aluminium tubing in areas of restricted ventilation shall be provided with a protective barrier to prevent corrosion due to contact with condensation, insulation and other materials of the appliance.

2.2.8 Construction of primary air controls

Primary air controls where fitted should be constructed of a rust resistant material, or have a rust resistant finish except when the type of materials or construction employed will prevent sticking or corroding in position. Cast iron air shutters are considered acceptable.

2.2.9 Thermal insulation

Thermal insulation shall not contaminate the water in the appliance, produce obnoxious odours or fumes, or corrode materials with which it is in contact.

2.2.10 Compression fittings

Compression fittings on gas lines shall comply with the following conditions:

- (a) They shall be made to an acceptable standard and the mating surfaces shall be compatible.
- (b) Loose olives, where used, shall be symmetrical to prevent incorrect assembly.
- (c) Shear olives, where used, may be asymmetrical.

- (d) After making and breaking the fittings ten times, applying the torque value as listed in Table 2.2 to remake the fittings, the joints shall comply with the requirements of Clause 3.3.

TABLE 2.2
TORQUE VALUES

Nominal size mm	Torque Nm
6	15
8	20
10	35
15	50
20	75

- (e) The component parts shall be made of materials with a melting point not less than 430°C.

2.3 ELECTRICAL SYSTEMS

2.3.1 Connection to mains electrical supply

Appliances intended for connection to the mains electrical supply shall be designed for 240 V single phase or 415 V three phase, 50 Hz a.c.

2.3.2 Access to electrical system

Access shall be provided to adequately service the electrical wiring and components in the appliance.

2.3.3 Connection of electrical components

Electrical components or assemblies which may be required to be removed from an appliance, shall not be connected by permanent or soldered joints, except in the case of extra-low voltage circuits (as defined in AS/NZS 3000).

2.3.4 Plug and socket connections

Plug and socket connections of electrical components within the appliance shall be either—

- (a) non-interchangeable;
- (b) colour coded; or
- (c) appropriately identified.

2.3.5 Protection against accidental contact

Electrical parts other than extra-low voltage terminals shall be enclosed to provide protection against accidental contact. Checking shall be carried out in accordance with Clause 8.10 of AS/NZS 3100:2002.

2.3.6 Protection of low voltage electrical components and wiring

Low voltage electrical components and wiring, if required to be energized to permit servicing of gas components on the appliance, shall be adequately protected against accidental contact. Checking shall be carried out in accordance with Clause 8.10 of AS/NZS 3100:2002.

2.3.7 Protection from weather conditions

Appliances for outdoor installation shall have all controls and electrical wiring adequately protected from weather conditions to ensure safe and reliable operation.

2.3.8 Remote controls

Where the appliance is designed for the connection of remote control(s); it shall be possible to connect these controls without disturbing the internal electrical wiring, except for purpose-designed removable links.

2.4 INSTALLATION REQUIREMENTS

2.4.1 Fixing of gas inlet connection

The gas inlet connection shall be firmly fixed. The regulator shall be anchored to prevent rotation while making the connection. This requirement shall be deemed to be met if the regulator can be held in position by means of a spanner while making the connection in accordance with the manufacturer's installation instructions.

2.4.2 Gas inlet connection thread

The gas inlet connection shall have a thread in accordance with the appropriate part of AS 1722.

NOTE: See AS 3688 for guidance on the appropriate class of thread for various types of connection.

2.4.3 Access to connections

Gas and water connections shall be so located that sufficient free space is available for the connections to be made or disconnected, using normal tools.

2.5 MAINTENANCE REQUIREMENTS

2.5.1 Dismantling and replacement by the user

Any dismantling required by the user shall be easily carried out without tools or undue force. Any replacement shall not require undue force and incorrect replacement shall be either impossible or completely obvious.

2.5.2 Insertion and removal of gas injectors

Removable gas injectors shall be made so that they can be inserted and removed without damage.

2.5.3 Assembly and attachment of handles, dials and pointers

Valve handles, movable dials and pointers shall be so designed that they are not capable of being incorrectly assembled, shall be securely attached to their spindles and shall not contain loose parts which may become detached when the handles are removed.

2.5.4 Accessibility for adjustment

Components and integral parts that may require adjustment shall be accessible for such adjustment. In particular, the following shall be readily and easily adjusted without risk of injury while the appliance is installed and operating —

- (a) aeration controls. (It is acceptable for the adjustment to be finalized with the burner removed, provided the setting will not be disturbed during replacement);
- (b) pilots;
- (c) thermostat bypasses where provided;
- (d) regulator adjustments;

- (e) ignition devices;
- (f) safety devices;
- (g) slow lighting adjusters; and
- (h) water flow rate controls.

2.5.5 Accessibility for replacement

Components that require to be removed for service work shall be so made and attached to the appliance that they can be removed and replaced. In particular, except in the case of appliances readily disconnected and easily handled by one person, the following components shall be readily removed from and replaced in the appliance without undue risk of injury and without moving the appliance from the installed position—

- (a) regulator diaphragms and valves (body exempt);
- (b) gas valve plugs;
- (c) injectors;
- (d) thermostats;
- (e) filters (gas and water);
- (f) pilot head assemblies, pilot injectors;
- (g) burners;
- (h) ignition devices;
- (i) baffles when flue cleaning is necessary;
- (j) drip trays;
- (k) slow lighting adjusters;
- (l) automatic control equipment;
- (m) safety shut off systems;
- (n) fans, electric motors and drives;
- (o) water operated gas valve assemblies;
- (p) heat exchanger units;
- (q) printed circuit boards; and
- (r) anode(s).

2.5.6 Screwed connections

Components and assemblies of components with screwed connections shall be provided with flats for spanners unless accessible unions are provided on inlet and outlet connections.

2.5.7 Inaccessible nuts or bolts

Nuts or bolts in inaccessible positions securing parts requiring to be removed for service shall be captive.

2.5.8 Collection and removal of corrosion product

Access shall be provided for the collection and removal of corrosion product.

2.5.9 Provision for draining.

Appliances containing more than 1 L of water shall have provision for draining.

2.5.10 Drain valves

Drain valves shall be designed —

- (a) to take hose or flexible tubing to conduct drainage to waste; and
- (b) so that it is impossible to withdraw the valve stem completely in the normal operation of the valve.

2.6 PRESSURE REGULATORS

2.6.1 Provision of a pressure regulating device

Each appliance shall have a device to regulate the pressure of gas supplied to the burner. Where practicable this device should be fitted within the perimeter of the appliance.

NOTE: The requirement for regulators on LPG appliances becomes part of this standard from 12 months from the date of publication of this Standard.

Regulator outlet pressures nominated by the appliance manufacturer shall not exceed:

- (a) Town gas, TLP: 0.63 kPa.
- (b) Natural gas: 1.00 kPa.

2.6.2 Positioning of pressure regulators

Regulators shall be so placed that—

- (a) breather holes cannot easily be blocked; and
- (b) the risk of ignition of any gas leaking from the breather holes is minimized.

2.7 GAS CONTROLS, SAFETY SHUT OFF SYSTEMS AND RELIEF DEVICES

2.7.1 General

The operation of safety devices shall not be overridden by any other devices.

2.7.2 Safety shut off system

A safety shut off system shall be fitted, including a safety shut off valve(s) that will shut off all gas to the appliance on the approach to an unsafe condition.

2.7.3 Accessibility by the user

Where controls are required to be operated by the user, they shall be accessible and easily operated.

2.7.4 Accidental change of settings of valves, dials and pointers

Gas valves, movable dials and pointers shall be designed or located to avoid accidental change of setting when in use.

2.7.5 Interlock for combination controls

Where a combination control is fitted which incorporates a manual shut off valve with off/pilot/on positions, there shall be a positive stop, latch or interlock to prevent inadvertent movement from the pilot to off position.

2.7.6 Indication of function

The off position of all gas valves shall be clearly indicated. Gas valves serving more than one function shall have the position of each function including any special lighting position clearly indicated.

2.7.7 Provision of flame safeguard

A flame safeguard system shall be fitted to every appliance to shut off all gas to the appliance in the event of flame failure at the point of supervision.

2.7.8 Failure of pilot

Failure of any pilot shall cause the safety shut off valves(s) to close.

2.7.9 Main burner automatic shut off valves

All gas to the main burner shall pass through at least two automatic shut off valves in series that may or may not be in a single control body. One valve shall be actuated by the temperature control device and or by water flow, the other by the device specified in Clause 2.7.12 unless both devices control both valves.

2.7.10 Relief valves for unvented appliances containing more than 1L of water

Each unvented appliance containing more than 1 L of water shall be supplied with one or more certified combination temperature and pressure relief valves, complying with AS 1357.1 or equivalent, with a pressure setting not exceeding the maximum working pressure of the appliance and having a total rating in kW not less than $0.21 \times \text{Gas Consumption (MJ/h)}$.

For storage water heaters the valves shall be located within 150 mm of the top of the water container or top 20% of the water capacity, whichever is the higher. In the case of instantaneous water heaters, fitting the valves in the plumbing immediately adjacent to the outlet will be deemed to comply with the requirement.

2.7.11 Relief devices for unvented appliances containing less than 1L of water

All unvented appliances not exceeding 1 L in capacity shall be supplied with a relief device meeting the requirements of Clause 6.8.

2.7.12 Over-temperature cut-out devices

All unvented appliances containing more than 1 L of water and all water heaters with nominal gas consumption greater than 200 MJ/h shall be fitted with an over-temperature cut-out device actuated by hot water temperature as an integral part of the appliance. The device is to operate independently of other controls and is to be a manual reset type.

2.7.13 Expansion relief valve for unvented heat exchangers

A suitable expansion relief valve shall be supplied with each unvented heat exchanger.

2.8 COMBUSTION AIR SUPPLY AND CONTROLS

2.8.1 Combustion air supply equipment

The combustion air supply equipment shall be supplied with the appliance and shall be correctly sized and arranged to ensure an air flow adequate for all operating conditions specified by the manufacturer.

2.8.2 Combustion air flow proving interlock

The combustion air flow proving devices shall be interlocked to cause lockout or prevent an ignition attempt unless the devices are in the 'no flow' condition prior to the start-up of their respective supply fans.

2.8.3 Prevention of combustion air backflow

Where air at pressure is pre-mixed with the fuel gas, effective means shall ensure air does not pass back into the gas line.

2.9 IGNITION, PILOTS AND MAIN BURNERS

2.9.1 Burners with remote manual ignition

The remote manual ignition of a burner, including pilots, shall be visible or visibly indicated to the user while operating the ignition devices and the appropriate gas controls.

2.9.2 Burners with direct manual ignition

The direct manual ignition of a burner, including pilots, shall be accessible and visible while operating the appropriate gas controls.

2.9.3 Prevention of injury at ignition

The method of ignition shall be such that it is not necessary to place the hand in a position where injury may occur when ignition takes place.

2.9.4 Manually operated burners in an enclosed compartment

Where remote or direct manually operated burners are enclosed in a compartment in which an explosive accumulation of gas can occur, it shall be necessary to open the compartment to light the burner unless an adequate interlock purge is provided.

2.9.5 Burners interconnected by flues or passages

When two or more burners are enclosed in the same compartment or compartments that are interconnected by flues or other passages the gas system shall be so designed that unburnt gas cannot be discharged from one burner while the other is alight except in the case of initial lighting of a burner fitted with a safety shut off system.

2.9.6 Means for turning off pilot gas supply

Means shall be provided for turning off the gas supply to a pilot.

2.9.7 Viewing of flames

It shall be possible to view burner flames either directly or by use of a mirror. It is acceptable if this can be achieved by removal of a part of the appliance.

2.9.8 Proving of burner operation

It shall be possible to prove that a burner or pilot is alight when the appliance is in operation in the installed position.

2.9.9 Positive location of flash tubes

Flash tubes shall be positively located in relation to the source of ignition and the flame ports to prevent misalignment or rendering of the lighting system inoperative, by normal handling, dismantling reassembling, or cleaning of the appliance.

2.9.10 Support of pilots, igniters and flame sensing devices

Pilot, igniters and flame sensing devices shall be supported in such a manner that their position relative to each other and the main burner(s) shall remain fixed.

2.9.11 Location of burner mixing tubes

Burner mixing tubes shall be positively located in relation to gas injectors. Where a mixing tube rests on an injector, provision shall be made to prevent the mixing tube from interfering with the correct functioning of the valve or injector.

2.9.12 Burner supports

Burner supports shall be such that the burners cannot be easily displaced in normal usage.

2.9.13 Fixing of gas manifolds

Gas manifolds shall be firmly fixed to prevent displacement during handling and installation.

2.9.14 Protection of ports and injectors

Any ports and injectors of main burners and pilots that may be exposed to falling particles in their normal operation shall be protected against blockage.

2.9.15 Restriction on gauze over primary air ports

Gauze shall not be fitted over primary air ports of burners other than pilots.

2.9.16 Pilot gas filters

Gas filters shall be provided for continuously burning pilots of 0.5 MJ/h or less capacity (optional for LPG).

2.9.17 Aeration adjustment for universal LPG appliances

For universal LPG appliances, primary burner aeration shall be non-adjustable.

2.9.18 Ignition of automatically controlled burners

Appliances incorporating automatically controlled burners shall include means for automatic ignition of these burners.

2.10 FLUEING REQUIREMENTS

2.10.1 Flueing of indoor appliances

An indoor appliance shall be flued.

2.10.2 Draught diverter or barometric regulator for open flued appliances

An open flued appliance shall be supplied with a draught diverter or barometric regulator unless satisfactory combustion is maintained against a back pressure of 140 Pa.

2.10.3 Design of air entry and combustion product discharge

Appliances shall be so designed that flue terminals, draught diverter relief openings and openings for the entry of air for combustion are part of the appliance structure and are unlikely to be obstructed by cabinets, walls or partitions on or in which the appliance is installed. In the case of appliances specifically designed to be built-in, any clearance necessary to the safe and effective operation of the appliance shall be ensured by means of permanently attached spacers.

2.10.4 Design of flue connection

The flue connection shall provide means to prevent partial or complete blockage caused by the fitting of the flue system.

2.10.5 Engagement of secondary flue

The connection for a secondary flue shall provide at least 13 mm engagement for vertical outlets and at least 25 mm for horizontal outlets.

2.10.6 Flue terminal and draught diverter construction

Flue terminals and draught diverters shall be constructed so that they cannot be installed in other than the correct position.

2.10.7 Flue terminal openings

In order to ensure against the entry of birds, no opening of the flue terminal shall permit the entry of a ball of 16 mm diameter with an applied force of 5 N.

2.10.8 Combustion products temperature limiter

If the appliance is intended to be connected to a flue likely to be adversely affected by abnormal temperature of the combustion product (for example a plastics flue or a plastics-lined flue), the appliance shall have a device that prevents the combustion products temperature from exceeding the maximum permissible temperature declared by the manufacturer.

This device shall not be adjustable and shall not be accessible without a tool. The action of this device shall result in a non-volatile lockout of the appliance.

2.10.9 Automatic flue damper devices

2.10.9.1 *Installation of automatic flue damper devices*

If an automatic flue damper device is installed in the primary flue, the flue damper and all its components shall be factory installed.

2.10.9.2 *Provision for a continuous pilot*

For an appliance equipped with a continuous pilot that has an input rate over 1.5 MJ/h the minimum internal free venting area of the flue gas passageway of the flue damper device, with the damper in the closed position, shall not be less than 3.2 cm² or 1.0 cm² per 1.0 MJ/h of the total continuous pilot input, whichever is the larger.

2.10.9.3 *Automatic valves*

An appliance equipped with a flue damper device shall have two automatic valves, in series, each of which opens and closes the main burner gas supply on each heating cycle. These valves may or may not be in a single control body. For the purposes of this provision, a thermostatically operated valve is considered an automatic valve.

2.10.9.4 *Electrical requirements*

All electrical components of an electrically operated flue damper device shall be factory wired into the electrical circuit of the appliance, or the flue damper device shall be supplied with a wiring harness.

2.10.9.5 *Ignition safety interlock*

An appliance shall be designed so that—

- (a) the damper of any flue damper device assumes its open position in the event of motive power failure or de-energization of the flue damper;
- (b) any flue damper device is electrically interlocked with an automatic gas ignition system so as to prevent operation of the automatic gas ignition system when the damper is in other than the fully open position; or
- (c) the loss of motive power will prevent operation of the automatic gas ignition system when any damper is in other than the fully open position.

2.10.9.6 *Visual indication of damper position*

The design of the appliance shall be such that the flue damper position can be visually determined when the appliance is installed in accordance with the manufacturer's installation instructions.

2.10.9.7 *Automatic valve safety interlock*

Flue damper devices shall incorporate integral means actuated directly by the damper, or by the assembly of parts securely attached to the damper, so as to maintain a fixed relationship to the damper, which will provide an interlock with both the automatic valves specified in 2.10.9.3 to prevent main burner firing unless the damper is in the open position.

2.10.9.8 *Safe operation under interlock failure conditions*

An appliance shall be equipped with a means, in addition to the interlock specified in Clause 2.10.9.7 which will either prevent main burner firing, provide for main burner shutdown if the damper is in other than the open position, or bring the damper to a permanent full open position if the interlock specified in Clause 2.10.9.7 fails unsafe.

A flue damper device having two systems, either of which will prevent main burner gas flow with the damper in other than the open position, one of which complies with Clause 2.10.9.7 and the other being one of the means specified in this Section, shall be deemed as complying with the intent of this Section. Each system shall operate completely independently of the other and each shall have a separate switch for operating either a separate automatic valve or two automatic valves in series.

2.11 MARKINGS

2.11.1 Markings on packaging

The packaging, or the appliance where there is no packaging, shall be marked in a prominent position with —

- (a) the text — ‘TO BE INSTALLED ONLY BY AN AUTHORIZED PERSON’;
- (b) the maximum packaged weight in kilograms;
- (c) the text — ‘NOT TO BE USED AS A POOL HEATER’, in the case of an appliance unsuitable for use as a pool heater; and
- (d) the text — ‘THE INSTRUCTIONS PACKAGED WITH THIS APPLIANCE CONTAIN IMPORTANT INFORMATION ABOUT INSTALLATION AND USE’.

2.11.2 Gas type label

A label shall be firmly attached in a prominent position on each appliance stating the type of gas for which it has been manufactured and adjusted. The colour of the label or the text shall be that appropriate to the gas specified, as shown in the schedule in Clause 2.11.3.

For appliances intended for use with a flexible connection, additional wording shall refer to the network operator or gas supplier for confirmation of the gas type, if in doubt.

2.11.3 Gas type colour code

Where a colour code only is used to indicate the type of gas for which an appliance or component is to be used, it shall comply with the following:

- (a) Natural gas: Black.
- (b) Town gas: Dark Blue.
- (c) Universal LPG: Signal Red.
- (d) Propane only: Orange.
- (e) Butane only: Grass Green.
- (f) Tempered LPG: Pink.
- (g) All gases: Primrose.

2.11.4 Identification of injectors

Removable injectors shall carry an identifying cipher. The cipher shall be in the form of numerals indicating the orifice size in millimetres or the BS number. In the case of pilot injectors, a colour coding in accordance with Clause 2.11.3 is acceptable. Alternatively the injector size may be marked on the appliance.

2.11.5 Marking of fans

The direction of rotation of fans shall be clearly and permanently marked where incorrect fitting of a fan is possible.

2.11.6 Markings on appliances

The appliance shall be provided with clear and permanent markings readily accessible and easy to read in the installed position including at least the following:

- (a) Certificate holder's trade name or identifying symbol.
- (b) Model designation.
- (c) Month and year of manufacture or serial number where this is documented to show month and year of manufacture.
- (d) Gas or gases for which the appliance is intended to be used.
- (e) Total nominal gas consumptions in MJ/h and test point pressure in kPa for each gas nominated in (d) above, or in the case of range-rated appliances the maximum and minimum values.
- (f) For main burners with an adjustable bypass and which are ignited by a pilot, the main burner test point pressure in kPa at the bypass rate for each gas nominated in (d) above.
- (g) Electrical markings as required by the appropriate electricity authority.
- (h) A wiring diagram with the connection terminals, including those for external controls.
- (i) The certification number.
- (j) The text: 'TO BE INSTALLED ON A FIRE-PROOF BASE', where an appliance is required to be installed on a non-combustible floor.
- (k) A warning label containing at least the information as shown in Figure A1, as appropriate.
- (l) For appliances suitable for indoor installation only, the text: 'CERTIFIED FOR INDOOR INSTALLATION ONLY'.
- (m) For appliances suitable for outdoor installation only, the text: 'CERTIFIED FOR OUTDOOR INSTALLATION ONLY'.
- (n) The text: 'CERTIFIED FOR INSTALLATION WITH AN APPLIANCE VENTILATION DUCT ONLY' for a Type 2 room sealed appliance.
- (o) Maximum working water pressure in kPa or MPa.
- (p) Minimum working water pressure, except for storage water heaters.
- (q) Storage capacity in litres, for storage water heaters.
- (r) Water heating capacity in litres per minute (L/min) for a nominated temperature rise, for instantaneous water heaters only.
- (s) Heat output in kW or for range-rated appliances the maximum and minimum output values in kW.
- (t) Instructions as required in Clause 2.12.3 (e).
- (u) Any additional information called for in other sections of this Standard.

2.11.7 Marking of doors and covers

Those doors, covers and other components that must be left open, closed or removed during operation shall be indicated with a permanent marking.

2.11.8 Flue terminal marking

A Type 1 room sealed appliance venting through a wall shall be provided with a durable marking stating:

‘THIS TERMINAL MUST ALWAYS VENT DIRECTLY TO OUTDOORS’.

This marking shall be fixed to or integral with the flue terminal or its guard.

2.11.9 Marking of direction of movement of thermostats

Variable setting thermostats and temperature controls shall clearly indicate direction of movement required to raise or lower temperature.

2.11.10 Marking of ignition points, flash lighting tubes

Flash lighting tubes that are used for the manual ignition of burners shall have the point of ignition suitably marked, unless this is obvious.

2.11.11 Identification of connections

Gas and water inlet and outlet connections shall be clearly identified.

2.11.12 Relief valve warning notice

Storage water heaters shall carry a warning notice, immediately adjacent to the temperature and pressure relief valve location, advising the installer to fit the valve unless it has been fitted by the manufacturer.

2.12 INSTRUCTIONS

2.12.1 Documents remaining with user

Any document referencing servicing instructions, supplied with the appliance and remaining with the consumer, shall contain a warning that servicing shall be carried out only by authorized personnel.

2.12.2 Installation instructions

Each appliance shall be supplied with written and diagrammatic instructions that include at least:

- (a) Model or type of appliance.
- (b) Gas or gases for which the appliance is intended and data such as gas consumptions, pressures, etc, or reference to where this information is marked on the appliance.
- (c) The requirements of AS 5601 and local authority – for example gas, water or electricity.
- (d) Reference to AS 5601 for gas pipe sizing and flueing details.
- (e) Overall dimensions of the appliance and location by measurement of connecting points of gas, water, electricity, flues.
- (f) Details of appliance connections for gas, water, and power.
- (g) The alternative types of installations which may be made.
- (h) Details of methods of installation that affect other trades, e.g. built-in flues - details for bricklayer and plasterer. Where electrical connections are required, details for electrician.
- (i) Removal of any transit protection.
- (j) Details of the methods of connection and alternatives.

- (k) Required surroundings of the appliance, clearance from cupboards and fixings, walls, curtains, floors, or other combustible materials.
- (l) Special conditions of installation, that may be required as the result of the certification test.
- (m) Special conditions which shall be avoided, e.g. marine environment, and any conditions necessary to ensure optimum performance.
- (n) Details of any assembly work required to be done by the installer.
- (o) Explicit instructions to the installer to test the operation of the appliance after installation.
- (p) Details of the necessary testing and instructions for minor adjustments.
- (q) Instructions on the procedure to be adopted if the appliance cannot be adjusted to perform correctly.
- (r) Fitting of temperature and pressure relief valve(s) where applicable.
- (s) A warning if the appliance is unsuitable for use as a pool heater.
- (t) For appliances with fan assisted combustion systems, conditions when a barometric device is required in the flue system and the method of its installation.
- (u) For open flued appliances, details of the necessary ventilation requirements including the size of any openings in accordance with AS 5601.
- (v) For an open flued appliance fitted with a combustion products discharge safety device—
 - (i) a technical description of the combustion products discharge safety device;
 - (ii) specific instruction that the combustion products discharge safety device shall not be disabled or bypassed;
 - (iii) if required, instructions on the mounting of the combustion products discharge safety device; and
 - (iv) the waiting time for an appliance with automatic reset (see Clause 5.9.2 (c));
- (w) A wiring diagram with the connection terminals, including those for external controls.
- (x) An indication of the external controls that can be used with the appliance.

2.12.3 Operating instructions

Each appliance shall be supplied with operating instructions, covering each separate function of the appliance and such dismantling, cleaning, and assembly as is necessary for the user, and that include reference to the following:

- (a) A clear explanation of programming and the effect of any power supply interruption for programmed appliances.
- (b) Information to assist the user to recognize abnormal operation which requires service.
- (c) A recommended maintenance schedule for the life expectancy of the appliance.
- (d) Where service and any necessary replacement parts may be obtained.
- (e) Clear and complete instructions for lighting and/or shutdown where incorrect procedures can result in a hazardous condition.
- (f) Where necessary, a safe purge before the appliance is re-lit.
- (g) Where necessary, the precautions to be taken in freezing conditions.

- (h) For an open-flued appliance fitted with a combustion products discharge safety device—
 - (i) information that in the event of interference with the discharge of combustion products, the device will cut off the gas supply;
 - (ii) a description of the means of restart; and
 - (iii) a recommendation that a qualified person be contacted if interruptions recur.
- (i) Where symbols are used to indicate the functions of operating controls, the meanings of these symbols.

2.12.4 Servicing instructions

Servicing instructions shall be available and they shall include reference to—

- (a) removal of covers and other parts for access to all components;
- (b) removal of components for service—
 - (i) burner equipment;
 - (ii) pilot and flame safeguard;
 - (iii) ignition system;
 - (iv) thermostat;
 - (v) combination control;
 - (vi) water controls;
- (c) parts replacement—
 - (i) fan;
 - (ii) over-temperature cut-out device;
 - (iii) heat exchanger or cylinder;
- (d) adjustments—
 - (i) pilot;
 - (ii) burner test point pressure;
 - (iii) aeration;
 - (iv) thermostat calibration, where applicable;
 - (v) ignition (spark gap);
- (e) fault finding chart;
- (f) wiring diagram as specified in Clause 2.11.6 (h);
- (g) in the case of an appliance fitted with a combustion products discharge safety device—
 - (i) a technical description of the device and its operation;
 - (ii) an instruction that the combustion products discharge safety device shall not be disabled or bypassed;
 - (iii) advice that in the case of repeated shutdown of the appliance, it will be necessary to take appropriate action to find the cause, and if necessary, remedy the discharge fault; and
 - (iv) the actual waiting time for an appliance with automatic reset.

SECTION 3 PRELIMINARY TESTS - LINE G A S E S

3.1 GENERAL

The nominal gas consumption in MJ/h as specified by the manufacturer, is the fundamental quantity on which all methods of test are based and is the starting point for all performance requirements.

Before commencing testing in this Section refer to Clause 2.1.1.

3.1.1 Test gases

Tests in all parts of this Standard (except Section 4 which requires the use of special gases in addition to those listed here) shall be carried out using the following test gases—

- (a) Appliances intended for use with natural gas shall be tested using available natural gas but in the case of dispute or borderline results test gas 'N' shall be used.
- (b) Appliances intended for use with town gas shall be tested using available town gas but in the case of dispute or borderline results test gas 'D' shall be used.
- (c) Appliances intended for use with propane only shall be tested with test gas 'X'.
- (d) Appliances intended for use with butane only shall be tested with test gas 'Y'.
- (e) Appliances intended for use with universal LPG shall be tested with test gas 'X' for all performance tests except for Clauses 5.7 and 5.8 where test gas 'Y' shall be used.

NOTE: Nominal gas consumption shall be rated on test gas 'X' and this is the figure to be stated on the appliance.

- (f) Appliances intended for use with tempered LPG shall be tested with test gas 'T'.

NOTE: See Table 1.1 for gas characteristics.

3.1.2 Appliances designed for various flue configurations

Appliances designed for various flue configurations shall be tested for compliance with the requirements of this Standard in all of these configurations.

3.2 PREPARATION FOR TESTING

3.2.1 Electrical safety requirements

The appliance shall comply with the following electrical safety requirements:

- (a) When the appliance is disconnected from the power supply the measured resistance between the earth pin of the plug and any exposed metal on the appliance shall not exceed 1 ohm for rotating parts and 0.1 ohm for all other parts.
- (b) When the appliance is disconnected from the power supply the measured insulation resistance between current carrying conductors and any exposed metal shall be not less than—
 - (i) 1 MΩ for earthed appliances; and
 - (ii) 10 MΩ for double insulated appliances.

NOTE: All appliance switches shall be in the 'ON' position.

3.2.2 Setting up appliance for testing

3.2.2.1 General

The appliance shall be set up in accordance with the manufacturer's instructions unless otherwise specified in this Standard and checked to ensure that gas consumption, aeration, temperature settings and other adjustments have been made in accordance with the manufacturer's recommendations. Adjustments should be made with the test gas which is applicable (see Clause 3.1.1) with the inlet pressure set at normal test gas pressure.

3.2.2.2 Appliances intended for provision of hydronic heating

The appliance shall be set up in accordance with the manufacturer's instructions unless otherwise specified. In addition the appliance shall be set up in accordance with the following:

- (a) Appliances intended for provision of hydronic heating shall be connected to an appropriate test rig. The water circuit installation shall be purged of air in accordance with the manufacturers instructions.
- (b) If fitted with a thermostat which is adjustable up to 95°C, or with a non-adjustable thermostat having a set point in the range 70°C to 95°C, the tests will be carried out with a flow temperature of $80 \pm 2^\circ\text{C}$. However, where the maximum flow temperature, by design, cannot exceed some lower temperature, the tests should be carried out using the maximum flow temperature stated in the manufacturer's instructions.
- (c) The test rig shall have means to achieve a temperature difference between the flow and return as specified by the manufacturer or a temperature difference $20 \pm 1^\circ\text{C}$ where the manufacturer does not specify a temperature difference.
- (d) Except where otherwise stated, all tests are carried out with the boiler at thermal equilibrium, i.e. when the water flow and return temperatures have stabilized within 2°C.

3.2.3 Appliance gas regulators not to be removed during testing

Appliance gas regulators are to be considered an integral part of the appliance and shall not be removed during tests, unless specifically instructed otherwise.

3.2.4 Protection from accidental draughts

The appliance under test shall be protected from accidental draughts.

3.2.5 Prevention of gas rate variation

Provision shall be made to prevent thermostats, or any other variable restriction in the gas line, from varying the gas rate during tests except as necessitated by the requirements of this Standard.

3.2.6 Pressure and gas volume test equipment

The following equipment shall be used for the control of testing pressures and the measurement of gas volume.

- (a) A wet test gas meter, which shall be calibrated before use. A graph should be provided showing the error or correction factor of the meter over as wide a range as possible.

NOTES:

- 1 A saturator shall be used with a wet test gas meter to ensure saturation of the gas.
 - 2 It is permitted to use a calibrated dry gas meter or a calibrated flow meter for test purposes, but in case of dispute, the wet meter shall be the reference standard.
- (b) An adjustable regulator of adequate capacity fitted to the meter inlet.

- (c) Pressure gauges connected to meter inlet, appliance inlet and pressure test point, to read to the nearest 10 Pa.
- (d) A thermometer, graduated to at least 0.5°C installed to measure the gas temperature. The meter water temperature gives a sufficiently accurate figure.
- (e) A barometer, to measure atmospheric pressure in the laboratory correct to 30 Pa.
- (f) A means of determining within 1% the heating value of the gas being used.
- (g) A means of determining within 2% the relative density of the gas being used.

3.3 GAS LEAKAGE

3.3.1 Gas circuit soundness

The fully assembled appliance shall be gas tight when subjected to an inlet gas pressure of 14 kPa.

3.3.2 Soundness at completion of testing

The appliance shall be gas tight (as in Clause 3.3.1) at the conclusion of all certification tests.

3.3.3 Control of bleed line gas

Gas actuated controls shall be constructed so that there is no continuous bleed during the 'off' period. The bleed line shall either re-enter the main gas line downstream from the control valve or be terminated with a suitable heat resistant tip and positioned so that bleed gas is ignited.

3.4 GAS CONSUMPTION

3.4.1 Tolerance on determined gas consumption

The determined gas consumption in MJ/h of each burner shall be within 5% of nominal gas consumption.

3.4.2 Determined gas consumption of permanent pilots

The determined gas consumption of each permanent pilot shall not be more than 0.25 MJ/h except where—

- (a) heat is employed for operating a safety device, in which case it shall not exceed 0.5 MJ/h (except as specified in (b) and (c) below);
- (b) heat is usefully employed as part of the maintenance gas consumption or output of the appliance; or
- (c) heat is applied in conjunction with a mercury vapour system or thermopile as a thermal generator, in which case it shall not exceed 1.0 MJ/h.

3.5 GAS PRESSURE REGULATORS

3.5.1 Pressure regulator performance

The regulator outlet pressure shall not vary by more than $\pm 20\%$ from the nominal outlet pressure when the appliance inlet pressure is varied between maximum and minimum as shown in Table B2.

3.6 IGNITION AND SAFETY SHUT OFF SYSTEMS

3.6.1 General

Ignition and safety shut off systems shall comply with the following:

- (a) Aerated pilots when lit back, shall either ignite the main burner promptly and without undue noise or cause a safety shut off valve to close.
- (b) Aerated pilots when their primary air opening is closed, shall either ignite the main burner promptly and without undue noise or cause the safety shut off valve to close.
- (c) When the pilot flame is turned down to the point where it will just actuate the flame safeguard system, the main burner, operating at any rate at which its control will permit, shall light safely and reliably from that pilot flame.
- (d) For any means of ignition other than a permanent pilot, when the voltage supplied to the appliance is lowered to any point where the main gas valves will still actuate, the main burner, operating at any rate at which its control will permit, shall light safely and reliably from that means of ignition, or the ignition system shall shut down safely.
- (e) Multi-port pilots shall conform with (a), (b) and (c) with all ports blocked other than the one activating the flame safeguard sensor.
- (f) On carrying out the normal lighting procedure on a manually ignited atmospheric burner protected by a thermoelectric flame safeguard system, the flame safeguard shall hold open within 1 min of igniting the operating flame.
- (g) Flames shall travel freely to all ports on a burner when gas is ignited on any one port.
- (h) If the means of ignition can interfere with the flame sensing system, then the means of ignition shall cease at the end of the start flame establishment period.
- (i) Where a pre-ignition purge period is included, the means of ignition shall commence immediately after the purge period is completed.
- (j) Gas shall not flow beyond the ignition safety time unless the start flame has been proved. The start flame shall be proved before the gas rate increases beyond the start flame rate.
- (k) Safety shut off systems other than 'thermoelectric' types shall incorporate a self-check of integral circuitry to prove that the system is not in the flame proved condition prior to start-up.
- (l) Flame failure of the supervised burners shall result in lockout in accordance with Clause 2.7.7 (see Clause 3.6.2.2 for reignition attempt conditions for automatic atmospheric burners and Clause 3.6.2.3 for forced or induced draught burners).
- (m) The combined time for the safety shut off system and its associated valves to shut off the gas supply in the event of flame failure at the point of supervision shall not exceed—
 - (i) 90 s where atmospheric type main burners are used and the total gas consumption is up to and including 50 MJ/h;
 - (ii) 60 s where atmospheric type main burners are used and the total gas consumption exceeds 50 MJ/h up to and including 150 MJ/h;
 - (iii) 45 s where atmospheric type main burners are used and the total gas consumption exceeds 150 MJ/h up to and including 500 MJ/h; and
 - (iv) 3 s for all other types of main burner.

3.6.2 Burner systems without permanent pilots

3.6.2.1 General

All burner systems without permanent pilots, shall comply with the following:

- (a) The start flame establishment period and, where applicable, the main flame establishment period shall be less than the maximum value as nominated by the manufacturer.
- (b) The appliance shall meet one of the following criteria—
 - (i) the start gas rate does not exceed 4 MJ/h and the maximum start flame establishment period does not exceed 90 s; or
 - (ii) for natural draught burner systems, the energy released during the ignition safety time does not exceed 0.1 MJ; or
 - (iii) for forced or induced draught burner systems, throughout the flame establishment period the gas concentration in relation to the proved air flow rate for that period does not exceed 50% of the lower explosive limit (LEL) for natural and town gases, or 25% of the LEL for other fuels provided that—
 - (A) the gases during the start flame establishment period are thoroughly mixed with the air flow except in the immediate vicinity of the burner; and
 - (B) the preheated air temperature does not exceed 400°C; or
 - (iv) the appliance satisfactorily meets delayed ignition tests up to twice the maximum start flame establishment period.

NOTE: Explosive noise and flame roll-out may be acceptable provided—

- (a) there is no damage to the appliance;
 - (b) the burner does not light back; and
 - (c) there is no danger to persons or adjacent property.
- (c) Where an interrupted pilot is used the main flame shall be proved on its own beyond the end of the main flame establishment period.
- (d) Where an interrupted or intermittent pilot is used, the main flame establishment period shall not exceed 5 s.

3.6.2.2 Atmospheric burner systems without permanent pilots

3.6.2.2.1 Ignition cycles prior to lockout (no flame established)

The total number of ignition cycles prior to lockout, shall be limited to 5.

Each ignition cycle after the first shall comply as follows—

- (a) shutdown is followed by a full start cycle including mechanical pre-ignition purge sufficient to ensure that the volume of the purging medium is at least 5 times the purge volume; or
- (b) shutdown is followed by a delay of not less than 5 min before the next ignition attempt.

3.6.2.2.2 *Reignition cycles after flame failure*

After flame failure, the total number of reignition cycles prior to lockout shall be limited to 5.

Flame safeguard systems shall respond to flame failure or loss of flame detector signal by initiating a reignition cycle within 2 s.

The first reignition cycle following loss of flame shall comply as follows—

- (a) the ignition source is applied immediately; or
- (b) safety shutdown is followed by a full start cycle including mechanical pre-ignition purge sufficient to ensure that the volume of the purging medium is at least 5 times the purge volume; or
- (c) safety shutdown is followed by a delay of not less than 5 min before a reignition attempt.

Subsequent reignition cycles shall be in accordance with (b) or (c) above.

3.6.2.3 *Forced and induced draught burner systems without permanent pilots*

3.6.2.3.1 *Pre-ignition purge*

A pre-ignition purge period shall be provided prior to any ignition attempt except where purging is continuous during the ‘burner off’ part of the cycle.

3.6.2.3.2 *Ignition cycles prior to lockout*

The total number of ignition cycles prior to lockout, shall be limited to 5.

Each ignition cycle after the first shall comply as follows—

- (a) the main burner shut off valve remains closed during pre-ignition purge;
- (b) each ignition cycle commences with the pre-ignition purge and the requirements of Clause 3.6.2.1 (b) are met; and
- (c) the duration of the pre-ignition purge period is sufficient to ensure that the volume of the purging medium is at least 5 times the purge volume.

3.6.2.3.3 *Reignition cycles after flame failure*

After flame failure, the total number of reignition cycles prior to lockout shall be limited to 5.

Each reignition cycle following loss of flame shall comply as follows—

- (a) the main burner shut off valve is closed within 3 s of loss of flame and remains closed during pre-ignition purge;
- (b) each reignition commences with the pre-ignition purge and the requirements of 3.6.2.1 (b) are met; and
- (c) the duration of the pre-ignition purge period is sufficient to ensure that the volume of the purging medium is at least 5 times the purge volume.

SECTION 4 LIMIT GAS TESTS

4.1 GENERAL

Appliances shall comply with the requirements of Section 4 when supplied with the appropriate limit gases from the following list and under the limiting conditions specified in each Clause:

- (a) Natural gas appliances: Limit gases Na, Nb and Nc, with an additional test for compatibility with gas S.
- (b) Propane appliances: Limit gases X and Z.
- (c) Butane appliances: Limit gas Y.
- (d) Universal LPG appliances: Limit gases X, Y and Z.
- (e) TLP appliances: Limit gases Ta, Tb and T.
- (f) Town gas appliances: Limit gases A, B and C.

For natural gas appliances all tests on limit gases shall be performed with the aeration adjustment (if provided) set on Nc gas. If results are satisfactory on Na, Nb, and Nc but not on S gas, the aeration may be reset on S gas for a repeat test on this gas only. If results are satisfactory a note shall be made in the test report that aeration has been reset.

For town gas appliances, aeration may be reset for each limit gas.

For TLP gas the aeration shall be set on T gas.

Before commencing testing in this Section refer to Clause 2.1.1.

4.2 CO/CO₂ RATIO LIMITS FOR ANY INDEPENDENT BURNER—OVERLOAD

The CO/CO₂ ratio of the combustion products of any independent burner of an appliance operating at the test conditions specified in Table B3 shall not exceed 0.02 after 10 min.

4.3 CO/CO₂ RATIO LIMITS FOR PERMANENT PILOTS—OVERLOAD

The CO/CO₂ ratio of the combustion products of a permanent pilot of an appliance operating at the test conditions specified in Table B4 shall not exceed 0.02 after 10 min.

4.4 FLAME CHARACTERISTICS AT MAXIMUM AND MINIMUM LIMITING CONDITIONS

The burner on any appliance shall exhibit no flame abnormality (see Definitions 1.2.37) or safety shutdown shall occur at maximum and minimum limiting conditions whether the appliance is hot or cold.

The limiting conditions shall be as shown in Table B5.

4.5 BURNER IGNITION AT MAXIMUM AND MINIMUM LIMITING CONDITIONS

On carrying out the normal lighting procedure, all burners, other than pilots, shall ignite completely and quietly within 5 s for all gases, at maximum and minimum limiting conditions when the appliance is hot and cold. The time shall be measured from the first flow of gas.

In the case of mains ignition systems a voltage equivalent to both 85% and 110% of the mains supply voltage shall be applied to the appliance.

In the case of battery-operated ignition systems a voltage equivalent to 80% of the nominal voltage for each battery shall be applied.

Five successive ignition tests shall be applied. Satisfactory ignition shall occur in all five tests.

The limiting conditions shall be as shown in Table B6.

4.6 DELAYED IGNITION AT MAXIMUM AND MINIMUM LIMITING CONDITIONS

When the ignition of a manually ignited burner has been delayed for 10 s, or for 5 s in the case of a burner fitted with a safety shut off system, the burner shall at both maximum and minimum limiting conditions:

- (a) Ignite completely.
- (b) Remain alight.
- (c) Not light back.
- (d) Not burn outside the appliance.
- (e) Not extinguish any other burner at any setting.
- (f) Not damage the appliance.

The limiting conditions shall be as shown in Table B7.

4.7 REIGNITION AT TURNDOWN UNDER DRAUGHT CONDITIONS

When a burner has been set to turndown setting and the appliance subjected to an 8 km/h draught, complete reignition of the gas shall occur when the draught is removed or the appliance shall lock out.

The limiting conditions shall be as shown in Table B8.

4.8 NOISE OF EXTINCTION

Noise of extinction shall not be excessive when the burner is extinguished in the normal manner from both full and turndown settings, on all relevant limit gases.

4.9 BURNER STABILITY WHEN CHANGING SETTING

Burners that have a turndown or bypass setting shall not light back or be extinguished when operated in the normal manner from full to turndown setting or from turndown to full setting, on all relevant limit gases.

4.10 PILOT IGNITION AND STABILITY AT MAXIMUM AND MINIMUM LIMITING CONDITIONS

When a permanent pilot is set to the manufacturer's specifications, it shall light satisfactorily when the manufacturer's instructions are followed and the flames shall not be extinguished in the following circumstances:

- (a) Appliance is subjected to an 8 km/h draught.
- (b) Gas to the main burner is turned off and on in the normal manner.

The minimum limiting conditions shall be as in Table B9 (a) and the maximum limiting conditions shall be as in Table B9 (b).

4.11 EFFECT OF OPENING AND CLOSING DOORS AT TURNDOWN CONDITION

With the appliance installed in accordance with the manufacturer's instructions, the normal opening or closing of appliance doors and other doors associated with the installation shall not extinguish any burner when tested at turndown setting.

The limit gases as shown in Table B10 shall be used.

4.12 UNBURNT GAS RELEASE FROM BURNER SYSTEM

Unburnt gases shall not be released from any part of the burner system except for the burner ports.

The limiting conditions shall be as shown in Table B11.

4.13 BURNER INTERFERENCE AT IGNITION OR DURING COMBUSTION

Where there is a possibility that the operation of any burner may interfere with the ignition or combustion of any other burner, including a pilot, then the tests required in this Section shall be repeated with such interference conditions operating.

SECTION 5 PERFORMANCE TESTS - ALL APPLIANCES

5.1 GENERAL

All tests in Section 5 are to be conducted with an inlet water temperature of 15°C unless otherwise specified.

Before commencing testing in this Section refer to Clause 2.1.1.

5.2 DRAIN PERFORMANCE

The provision for draining, specified in Clause 2.5.9, shall be capable of draining the appliance—

- (a) in accordance with the manufacturer's specification; or
- (b) in the absence of any specifications, 85% of the nominal capacity at an average rate of not less than 9 L/m.

5.3 CONDENSATION

5.3.1 Control of flue gas condensate

Appliances shall be designed so that under normal operating conditions, no condensate shall escape from the appliance other than through the condensate drain. (Refer also to Clause 2.1.1.24).

5.3.2 Condensate—interference with combustion

Condensation, where present, shall not interfere with combustion.

5.3.3 Blocked condensate drain

A blocked condensate drain shall not create an unsafe condition.

5.4 COMBUSTION AIR SUPPLY

5.4.1 Proving of means of mechanical air supply

Where combustion air is supplied mechanically, provision shall be made to prove that the means for supplying the air is operating.

5.4.2 Burner shutdown following air supply failure

In the case of failure of the means for supplying the combustion air, the gas to the burner(s) requiring the air shall be shut off.

5.4.3 Obstruction of air inlets on flued appliances with fan assisted combustion systems

For flued appliances, with fan assisted combustion systems, other than room sealed appliances, the CO/CO₂ ratio of the combustion products shall not exceed 0.02 when the combustion air flow inlets are progressively blocked until safety shut down occurs.

5.5 RESPONSE TO ELECTRICAL POWER VARIATION OR FAILURE

Appliances for connection to the mains electricity supply shall:

- (a) Function normally at rated voltage +10% and –15%.
- (b) Operate without hazard or cease operation without hazard with—
 - (i) electricity supply disconnected; and
 - (ii) electricity supply voltage fluctuations outside the limits specified in Clause 5.5 (a) above.

5.6 TEMPERATURE HAZARDS

5.6.1 Test conditions

An appliance shall comply with the requirements listed below when it has been operated under the following conditions:

- (a) The appliance shall be installed in accordance with any special conditions as indicated by a permanent marking on the appliance. If any such special conditions are specified, the test of surrounding surfaces shall be repeated with the appliance installed without these special conditions and with only the clearances specified in AS 5601 (or zero clearances where none are specified in AS 5601) or as guaranteed by the fitting of clearance channels or spacers on the appliance.
- (b) The appliance shall be operated continuously for not less than 2 h with the thermostat, if fitted, set at maximum and sufficient water passing through to keep the thermostat open.
- (c) For storage water heaters intended for indoor installation, the floor temperature measurements shall be repeated with the dome of the combustion chamber lined with insulation and the burner aeration adjusted to give a luminous, sooting flame.
- (d) For instantaneous water heaters, the wall temperature measurements shall be repeated with a 30 mm diameter hole cut in the rear skirt of the heat exchanger, centrally between the top and second top coils and centrally between the sides.
- (e) For central heating boilers and combination appliances the appliance shall be connected to a simulated central heating system in accordance with the manufacturer's instructions.
- (f) Appliances intended for connection to the mains electricity supply shall comply when—
 - (i) the electricity supply is connected; and
 - (ii) the electricity is disconnected.

5.6.2 Surrounding surfaces—Temperature limits

5.6.2.1 Floor, wall and overhead surfaces

The temperatures of floor, wall and overhead surfaces shall not exceed—

- (a) 65°C above ambient when installed in accordance with the manufacturer's instructions; and
- (b) 75°C above ambient when installed in the absence of any special conditions.

5.6.3 Personal safety—Temperature limits

5.6.3.1 Surfaces intended to be handled

The temperatures of surfaces intended to be handled, except those parts that are located in an area where they are obviously hot, shall not exceed—

- (a) 35°C for metals;
- (b) 45°C for porcelain or vitreous enamel; and
- (c) 60°C for plastics;

all temperatures being above ambient.

NOTES:

- 1 Parts in this category include control knobs, tap handles, push buttons, switches and door handles.
- 2 The temperatures for plastics refer to components that are substantially, if not entirely, manufactured from plastics material.

5.6.3.2 Surfaces likely to be accidentally touched

The temperatures of surfaces likely to be accidentally touched (excluding working surfaces) shall not exceed—

- (a) 80°C for metals;
- (b) 95°C for vitreous enamelled steel, glass and similar surfaces; and
- (c) 100°C for plastics;

all temperatures being above ambient.

NOTES:

- 1 Parts in this category include control panel fascia, side panels, panels adjacent to door handles and edges of doors when opened.
- 2 Working surfaces include flue outlets.

5.6.4 Appliance safety—Temperature limits

5.6.4.1 Bodies of gas valves, thermostats, etc

Temperatures of bodies of gas valves, thermostats, etc. shall not exceed the temperature for which they have been certified.

5.6.4.2 Components containing non-metallic diaphragms

Temperatures of components containing non-metallic diaphragms shall not exceed 45°C above ambient, unless specifically certified for higher temperatures and so marked permanently.

5.6.4.3 Body of a clock or timer

The temperature of the body of a clock or timer shall not exceed the maximum specified by the manufacturer.

5.6.4.4 Main gas and pilot lines susceptible to sulphide attack

Temperatures of main gas and pilot lines susceptible to sulphide attack, e.g. copper, shall not exceed 50°C above ambient.

5.6.4.5 Electric motor windings

Temperatures of electric motor windings shall not exceed the maximum rated temperature for the conditions of use.

5.6.4.6 *Flexible hoses*

Temperatures of flexible hoses shall not exceed the maximum temperature for that class of hose.

5.6.4.7 *Joints sealed with jointing materials*

Temperatures of joints sealed with jointing materials shall not exceed the maximum temperature recommended by the manufacturers of the materials, under the conditions of use.

5.6.4.8 *Electrical wiring*

The temperature of electrical wiring shall not exceed the maximum specified for the wiring.

5.6.4.9 *Glass components*

The temperature of glass components shall not exceed the maximum temperature specified by the manufacturer of the glass.

5.6.4.10 *Expansion vessel*

The temperature of any sealed system expansion vessel shall not exceed the maximum temperature specified by the manufacturer.

5.7 HEAT RESISTANCE

5.7.1 Resistance to temperatures—overload conditions

During and after the appliance has been operated continuously at overload gas consumption (see Definitions 1.2.82) for 10 h with the thermostat, if fitted, set at maximum and sufficient water passing through to keep the thermostat open, the appliance shall comply with the following requirements.

- (a) Doors and other movable fittings shall function correctly.
- (b) Surface finishes of the appliance or its surroundings shall not deteriorate permanently.
- (c) Controls, thermostats, etc. shall not leak, seize or fail.
- (d) Refractories shall not deteriorate seriously. Incipient cracks appearing in bricks shall not be regarded as failures, unless the appearance or the operation of the appliance is affected.
- (e) Burners shall not distort or deteriorate sufficiently to affect normal operation.
- (f) Motors and fans shall not deteriorate.
- (g) Wiring insulation shall not scorch or melt.
- (h) The set points of sensors, control thermostats, limit thermostats, safety temperature limiters and overheat cut-off devices shall not be affected.
- (i) All components of any flue damper device, installed as part of a water heater, shall function correctly and not be damaged.

5.7.2 Resistance to temperatures—Burners lit back

Burners in which a light back condition can be established shall be constructed of such materials that they will not melt or distort with the burner operated for 1 h at the maximum gas rate at which the light back condition can be maintained, but at no more than the nominal gas rate.

5.8 ENDURANCE OF COMPONENTS

For components not separately certified the following endurance requirements apply.

5.8.1 Automatic gas valves

Automatic gas valves are subjected to the following endurance test under the conditions specified in AS 4624 or equivalent—

- (a) 250 000 cycles for valves that are operated at each controlled shutdown; and
- (b) 2 000 cycles for valves that remain permanently open and are closed only by a safety device, including thermo-electric flame safeguards.

At the end of the endurance test the operation of the shut off valve shall remain satisfactory.

5.8.2 Automatic burner control systems

Automatic burner control systems are subjected to the following endurance test under the conditions specified in AS 4625 or equivalent —

- (a) 25 000 cycles for the parts operated at each start sequence; and
- (b) 2 000 cycles for the parts operated only in the case of locking out.

At the end of the endurance test the operation of the automatic burner control system shall remain satisfactory.

5.8.3 Control thermostat

Mechanical control thermostats are subjected to an endurance test of 30 000 cycles under the conditions specified in AS 4619 or equivalent.

At the end of the endurance test the operation of the control thermostat shall remain satisfactory.

5.8.4 Automatic flue damper device

A flue damper device shall withstand 100 000 cycles of opening and closing the damper under normal operating conditions without any mechanical failure, impairment of operation or damage.

5.9 FLUE OPERATION

5.9.1 Leakage or spillage of combustion products

There shall be no leakage or spillage of combustion products from the combustion circuit or draught diverter of an open flued appliance, 5 min after ignition when the appliance is operated at nominal gas consumption. The appliance shall be fitted with a 0.6 m length of flue or the minimum length specified in the manufacturer's instructions, where this is less than 0.6 m.

5.9.2 Combustion products discharge safety device

Where a flued appliance is fitted with a device to prevent the release of combustion products in a dangerous quantity into the room under abnormal draft conditions, the appliance shall—

- (a) shut down within the times given in Table B13;
- (b) not cause nuisance shutdowns; and
- (c) only restart automatically after a minimum waiting time of 10 min. The manufacturer shall state in the instructions the actual waiting time.

5.9.3 Performance of combustion products temperature limiter

If the appliance incorporates a device to limit the temperature of the combustion products, the temperature of the combustion products shall not exceed 90% of the maximum continuous service temperature (in °C) for the materials of the combustion circuit and the flue materials specified by the appliance manufacturer.