

Australian Standard<sup>®</sup>

## Gas space heating appliances



This Australian Standard® was prepared by Committee AG-001, Gas Appliances. It was approved on behalf of the Council of Standards Australia on 13 June 2008. This Standard was published on 30 June 2008.

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The following are represented on Committee AG-001:

- Appliance and Component Testing
  - Australian Gas Association
  - Australian Greenhouse Office, Department of the Environment and Water Resources
  - Consumers' Federation of Australia
  - Energy Networks Association
  - Gas Appliance Manufacturers Association of Australia
  - Gas Association of New Zealand
  - Gas Technical Regulators Committee
  - Gas Utilisation Institute
  - LPG Australia
  - Master Plumbers, Gasfitters and Drainlayers New Zealand
  - Ministry of Economic Development (New Zealand)
  - New Zealand Employers and Manufacturers Association
- 

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Australian Standard<sup>®</sup>

## Gas space heating appliances

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## PREFACE

This Standard was prepared by the Standards Australia Committee AG-001, Gas Appliances to supersede AS 4553/AG 103—2000, *Gas space heating appliances*.

*This Standard incorporates Amendment No. 1 (February 2011). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.*

The 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 space heating appliances.

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 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.

The principal differences between this edition and AS 4553/AG 103—2000, are marked by a line in the margin. These may be a new or revised definition, Clause, Figure or M.O.T. (Method of Test).

The following have been deleted:

Definitions AGA, ALPGA, approved, authority, bypass screw, connector ends, flame blow off, flame lift, interrupter screw, occupied zone, Piezo electric ignition, room sealed appliance type 2, semi-automatic ignition, statutory authority, task efficiency, terminal and under pressure cut-off device.

Clauses: 2.3.7, 2.5.1, 2.5.6 (p), 2.7.4, 3.1.2 (last paragraph), 5.4 (2nd sentence) 5.11.4.

Figures: 1, 2, 5, 7 (replaced by dew plate), 11.

M.O.T: 5.1.2—99 Flue operation—Spillage test, Preparation of apparatus—Method 1, Steps 5 & 6.

5.1.4—95 Determination of CO/CO<sub>2</sub> ratio of combustion products under conditions of flue blockage, downdraught or updraught.

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**STANDARDS AUSTRALIA**

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**Australian Standard**

**Gas space heating appliances**

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SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE**

These requirements apply to gas space heating appliances (convectors, radiant convectors, wall furnaces) 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 150 MJ/h.

Decorative gas log fires are not covered by this Standard but are covered by the requirements of AS 4558.

A1

This Standard covers direct fired air heaters with gas consumption up to and including 50 MJ/h.

NOTE: For direct fired air heaters with gas consumption greater than 50 MJ/h, refer to AS 5262.

**1.2 REFERENCE DOCUMENTS**

The following documents are referred to in this Standard as follows:

|        |                                                                                                               |
|--------|---------------------------------------------------------------------------------------------------------------|
| AS     |                                                                                                               |
| 1074   | Steel tubes and tubulars for ordinary service                                                                 |
| 1167   | Welding and brazing—Filler metals                                                                             |
| 1167.1 | Part 1: Filler metal for brazing and braze welding                                                            |
| 1432   | Copper tubes for plumbing, gasfitting and drainage applications                                               |
| 1450   | Steel tubes for mechanical purposes                                                                           |
| 1722   | Pipe threads of Whitworth form                                                                                |
| 1722.1 | Part 1: Sealing pipe threads                                                                                  |
| 1751   | Copper brazed steel tubes                                                                                     |
| 1769   | Welded stainless steel tubes for plumbing applications                                                        |
| 1832   | Malleable cast iron                                                                                           |
| 1881   | Zinc alloys—Casting ingots and castings—Quality requirements                                                  |
| 2129   | Flanges for pipes, valves and fittings                                                                        |
| 3000   | Electrical installations (known as the Australian/New Zealand Wiring Rules)                                   |
| 3100   | Approval and test specification—General requirements for electrical equipment                                 |
| 3688   | Water supply—Metallic fittings and end connectors                                                             |
| 4567   | Twin wall metal flues - Gas appliances                                                                        |
| 4617   | Manual shut off gas valves                                                                                    |
| 4620   | Thermoelectric flame safeguards                                                                               |
| 4625   | Electronic flame safeguards and flame detectors                                                               |
| 4629   | Automatic shut off valves and vent valves                                                                     |
| 4646   | Gas appliance standards—Definitions and calculations                                                          |
| 5601   | Gas installation                                                                                              |
| D26    | Tube fittings with Dryseal American standard taper pipe and unified threads for automotive and industrial use |
| AS/NZS |                                                                                                               |
| 3500   | Plumbing and drainage                                                                                         |

ISO  
6976

Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition

SPEIGHT, J., *Lange's Handbook of Chemistry*, 16<sup>th</sup> ed. USA: McGraw-Hill Professional, 2004

### 1.3 DEFINITIONS

For the purpose of this Standard the definitions below apply.

#### 1.3.1 Appliance flueway

A port or passage conveying flue gases within the appliance.

#### 1.3.2 Appliance flueway terminal

A protective device fitted to the exit of an appliance flueway of a flueless appliance.

#### 1.3.3 Appliance regulator

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

#### 1.3.4 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.

#### 1.3.5 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.

#### 1.3.6 Authority having jurisdiction

The authority having statutory (legal) control.

#### 1.3.7 Automatic ignition

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

#### 1.3.8 Automatic operation

The use of a sequence of operations, which once initiated, does not require any intermediate manual operation.

#### 1.3.9 Automatic shut off valve

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

#### 1.3.10 Available gas (line gas)

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

#### 1.3.11 Balanced flue appliance

A room sealed appliance which has combustion air ducted from, and combustion products ducted to, a common terminal assembly located externally.

#### 1.3.12 Burner port

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

### **1.3.13 Bypass**

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

### **1.3.14 Calibration**

The determination of the relationship between the measured or indicated value of a parameter and its true value.

### **1.3.15 Certified/Certification**

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

### **1.3.16 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.

### **1.3.17 CO/CO<sub>2</sub> ratio**

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

### **1.3.18 Combination gas control**

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

### **1.3.19 Combustible materials**

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

### **1.3.20 Combustion products**

Constituents resulting from the combustion of a fuel with oxygen, including the inerts associated with the fuel and the oxygen but excluding any other diluent or contaminant.

### **1.3.21 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.

### **1.3.22 Compression fitting**

#### **1.3.22.1 General**

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

#### **1.3.22.2 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.

#### **1.3.22.3 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.

### **1.3.23 Convection heater**

An appliance with an effective output of heated air and no visible source of radiation.

### **1.3.24 Cross lighting**

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

### 1.3.25 Determined gas consumption

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

### 1.3.26 Direct ignition device

A device which provides ignition of a burner without the use of another flame.

### 1.3.27 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.

### 1.3.28 Electronic flame safeguard

A flame safeguard utilising electronic components to perform its function.

### 1.3.29 Emission class

A classification of appliances based on the emission rate of NO<sub>2</sub>.

#### 1.3.29.1 Emission class 0 appliance

An appliance with an NO<sub>2</sub> emission rate into the room of 0 ng/J.

#### 1.3.29.2 Emission class 1 appliance

An indoor flueless appliance with an NO<sub>2</sub> emission rate less than or equal to 2.5 ng/J.

#### 1.3.29.3 Emission class 2 appliance

An indoor flueless appliance with an NO<sub>2</sub> emission rate greater than 2.5 ng/J, but less than or equal to 5 ng/J.

### 1.3.30 Excess air

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

### 1.3.31 External surfaces

All surfaces of an appliance other than working surfaces. External surfaces include –

- (a) handles for carrying or intended to be held for long periods while the appliance is operating;
- (b) controls or handles which are touched for short periods when the appliance is operating but which are not required to be gripped; and
- (c) all other external surfaces not closer than 25 mm to a working surface.

### 1.3.32 Fan assisted combustion system

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

### 1.3.33 Flame abnormality

A flame condition which results in appreciable yellow tipping and carbon deposition (except in the case of appliances specifically designed for a luminous effect), lifting, floating, lighting back or objectionable odour.

#### NOTES:

- 1 If the length of the yellow tipping is less than 20% of the total length of the flame on visual inspection it is not considered to be appreciable yellow tipping
- 2 In appliances designed specifically for a luminous effect, yellow tipping or limited carbon deposition within the appliance, are not considered abnormal.

#### **1.3.34 Flame detector**

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

#### **1.3.35 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 the flame.

#### **1.3.36 Flame failure response time**

The time taken for the flame safeguard to detect loss of flame and de-energize the shut off valve.

#### **1.3.37 Flame proving period**

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

#### **1.3.38 Flame safeguard**

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

#### **1.3.39 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. Programming flame safeguards automatically sequence at least two burner functions such as ignition spark, gas valve, etc.

#### **1.3.40 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.

#### **1.3.41 Flue**

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

#### **1.3.42 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.

#### **1.3.43 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.

#### **1.3.44 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.

#### **1.3.45 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.

**1.3.46 Flue terminal**

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

**1.3.47 Forced draught**

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

**1.3.48 Gas****1.3.48.1 General**

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

**1.3.48.2 Natural gas (NG)**

A hydrocarbon gas consisting mainly of methane.

**1.3.48.3 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.

**1.3.48.4 Town gas (TG)**

A gas manufactured from coal or petroleum feedstocks.

**1.3.48.5 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.

**1.3.48.6 Liquefied petroleum gas (LPG)**

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

**1.3.49 Gas consumption**

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

**1.3.50 Heat sources**

Surfaces which, for the satisfactory performance of the appliance, are required to be at high temperature.

Examples of heat sources are—

- (a) radiant elements;
- (b) burner components and flame;
- (c) radiant heat reflector(s);
- (d) heat exchangers; and
- (e) burning fuel.

**1.3.51 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 as given in AS 4646.

### **1.3.52 Hose assembly**

Flexible hose including end fittings connecting the gas supply to the appliance inlet.

### **1.3.53 Indoor flueless appliance**

An indoor appliance designed to discharge its combustion products into the same room or space in which it is installed.

### **1.3.54 Induced draught**

Describes combustion systems or appliances in which all or part of the air for combustion is introduced by providing suction in the combustion chamber by mechanical means.

### **1.3.55 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.

### **1.3.56 Intermittent pilot**

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

### **1.3.57 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.

### **1.3.58 Jointing compound**

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

### **1.3.59 Jointing material**

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

### **1.3.60 Lift (flame)**

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

### **1.3.61 Light back**

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

### **1.3.62 Linting**

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

### **1.3.63 Lockout**

A safety shutdown condition of the control system which requires a manual reset in order to restart.

### **1.3.64 LPG**

See Clause 1.3.47.6.

### **1.3.65 Manual ignition**

#### **1.3.65.1 Direct manual ignition**

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

### **1.3.65.2 Remote manual ignition**

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

### **1.3.66 Maximum useful heat output (MUHO)**

The useful heat output of the appliance derived from the task efficiency of the appliance in relation to the nominal gas consumption.

### **1.3.67 Mixing tube**

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

### **1.3.68 Natural draught burner**

See Clause 1.3.5.

### **1.3.69 Natural gas**

See Clause 1.3.47.2.

### **1.3.70 Nominal gas consumption**

The appliance gas consumption, in megajoules per hour (MJ/h), as stated in manufacturer's specifications, data plates, 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.

### **1.3.71 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.

### **1.3.72 Normal test gas pressure**

0.75 kPa for TG and TLP gas, 1.13 kPa for NG and SNG, 2.75 kPa for LPG.

### **1.3.73 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.

### **1.3.74 Overheat cut-off device**

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

### **1.3.75 Overload gas consumption**

120% of nominal gas consumption for all gases other than LPG. For LPG, it is the gas consumption that results when gas at a pressure of 3.5 kPa is supplied to the appliance inlet.

### **1.3.76 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.

### **1.3.77 Oxygen depletion system (ODS)**

A system which causes the gas supply to be shut off when the oxygen content of the ambient air is depleted to a specified concentration.

### **1.3.78 Permanent pilot**

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

### 1.3.79 Pilot

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

### 1.3.80 Portable appliance

An appliance designed to be moved by the user from place to place, as required.

### 1.3.81 Power flued

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

### 1.3.82 Primary aeration control

An adjustable device for controlling primary air to a burner.

### 1.3.83 Primary air

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

### 1.3.84 Primary air ports

The openings in an aerated burner for primary air.

### 1.3.85 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.

### 1.3.86 Primary guard

A guard supplied integral with an appliance and intended to prevent direct contact with, or close approach to, heat sources(s).

NOTE: A primary guard is principally intended to reduce risk of accidental ignition of flammable materials; however, if personal contact occurs, it does not necessarily prevent accidental burning.

### 1.3.87 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.

**1.3.88 Programmed ignition**

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

**1.3.89 Programming flame safeguard**

A flame safeguard which automatically sequences at least two burner functions such as ignition spark, gas valve, etc.

**1.3.90 Protected pilot**

A pilot which is fitted with a flame safeguard.

**1.3.91 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.

**1.3.92 Quick-connect device**

A two-part mating plug and socket assembly for connecting an appliance to a gas supply without the use of tools.

**1.3.93 Radiant convection heater**

An appliance with an effective output of both radiation and heated air.

**1.3.94 Radiant heater**

An appliance with an effective output mainly in the form of radiation.

**1.3.95 Recessed wall heater**

A flued convection heater designed for installation partly or wholly inside the room wall.

**1.3.96 Reference gas**

The gas corresponding to an average of the gases most currently distributed, and for which the appliance has been specifically designed (see Clause 1.3.114).

**1.3.97 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 as given in AS 4646.

**1.3.98 Room sealed appliance**

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.

**1.3.99 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.

**1.3.100 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.

**1.3.101 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.

**1.3.102 Secondary air**

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

**1.3.103 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.

**1.3.104 Secondary guard**

A guard supplied integral with or separate from an appliance and intended to prevent deliberate or accidental contact with any surfaces which are at such a temperature as would cause thermal damage to body tissue.

A secondary guard is for use in situations where young children or the infirm may be at risk.

**1.3.105 Self-latching gas valve**

A gas valve with a built-in safety catch, which locks automatically when the valve is turned off. A separate and distinct movement is required to unlock before the valve can be turned on.

**1.3.106 Simulated natural gas (SNG)**

See Clause 1.3.47.3

**1.3.107 Specific gravity**

See Clause 1.3.96.

**1.3.108 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.

**1.3.109 Star allocation index (SAI)**

This index is a measure of the energy efficiency of the appliance when subjected to a nominal daily operating profile consisting of 5 h of heating and 19 h of standby operation.

**1.3.110 Start gas**

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

**1.3.111 Surface combustion burner**

A burner where combustion takes place on the surface of a perforated or porous material or gauze.

**1.3.112 Technical Regulator**

The Government appointed person, body or authority that has jurisdiction over gas safety legislation (or other entity authorized by that person, body or authority).

**1.3.113 Temperature limit device**

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

**1.3.114 Tempered liquefied petroleum gas (TLP)**

See Clause 1.3.47.5.

**1.3.115 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 ( $H_2 + CO + O_2 < 1\%$ ,  $N_2 + CO_2 < 2\%$ );
- (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.

**1.3.116 Thermostat**

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

**1.3.117 Thermostat bypass**

An integral part of a thermostat control which enables a preset volume of gas to bypass the thermostat valve.

**1.3.118 Town gas**

See Clause 1.3.47.4.

**1.3.119 Turndown gas consumption**

- (a) If the turndown is limited, the lowest turndown to which the burner control can be set; or
- (b) 25% of the nominal gas consumption for infinite turndown gas controls except:
  - (i) Where a burner is under thermostatic control, the bypass rate is the turndown position.
  - (ii) Where no bypass is provided, the marked turndown setting will apply.

**1.3.120 Valve**

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

**1.3.121 Wobbe index (Wobbe number)**

The Wobbe index of a gas is:

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

**1.3.122 Working surfaces**

Surfaces through which heat passes to the space being heated, e.g. hot air discharge grilles, transparent materials.

**TABLE 1.1**  
**TEST GAS**

| Test gas | Application | Composition (%) |         |         |           |        |          |     | Characteristics*                |                  |                               |
|----------|-------------|-----------------|---------|---------|-----------|--------|----------|-----|---------------------------------|------------------|-------------------------------|
|          |             | Hydrogen        | Methane | Propane | Propylene | Butane | Nitrogen | Air | Heating value MJ/m <sup>3</sup> | Relative density | Wobbe index MJ/m <sup>3</sup> |
| 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        | TLP         | —               | —       | 27      | —         | —      | —        | 73  | 25.4                            | 1.142            | 23.8                          |
| Ta       |             | —               | —       | 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 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.

#### 2.1.2 Physical inspection

Before any physical performance testing as set out in Sections 3, 4 and 5 takes place the appliance shall satisfy the design and construction and other 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, no time will be spent in testing until the manufacturer has made the necessary adjustments.

#### 2.1.3 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.

#### 2.1.4 Programmable electronic systems

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

- (a) conform to the relevant requirements of AS 4625 and EN 298 (or equivalent); or
- (b) be certified by a body recognized by the Certifying Body to the requirements of EN 298 (or equivalent).

#### 2.1.5 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.

#### 2.1.6 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 2.7.5 for fitting of flame safeguard systems.

### **2.1.7 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.

### **2.1.8 Power failure**

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

### **2.1.9 Fuel storage container**

The appliance shall not incorporate, or have provision for a fuel storage container.

### **2.1.10 Prohibited burner systems**

Burner systems employing granular media shall not be used.

### **2.1.11 Positioning of logs or coals**

Positioning of logs or coals on the base or frame shall be positive and shall prevent any accidental rearrangement or displacement from the designed position.

### **2.1.12 Provision for moving appliances**

Portable appliances shall be provided with a facility/ies for moving the appliance with safety.

NOTE: Examples of facilities are carry handles, castors, etc.

### **2.1.13 Sharp edges**

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

### **2.1.14 Handles and knobs**

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

### **2.1.15 Continuity of satisfactory operation**

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

### **2.1.16 Insulation**

Insulation shall be 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.

Insulation shall be protected against rodents.

### **2.1.17 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.

### **2.1.18 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.

### **2.1.19 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.

### 2.1.20 Means of ignition for room sealed appliances

In the case of room sealed appliances the means of ignition shall be incorporated as part of the appliance.

### 2.1.21 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.

### 2.1.22 Fitting of primary guard

A primary guard shall be fitted in the following circumstances:

- (a) To all external surfaces which fail the fabric drape test (see Clause 3.3.4).
- (b) To all external surfaces which during operation reach a temperature in excess of 95°C above ambient, except working surfaces and surfaces within 25 mm of a working surface.
- (c) To all heat sources and external surfaces within 25 mm of working surfaces which during operation reach a temperature in excess of 200°C above ambient.
- (d) To all working surfaces with an open area less than 85% of the total area of the working surface, which during operation reach a temperature in excess of 200°C above ambient.

### 2.1.23 Means for gas pressure measurement

Means shall be provided to allow the gas pressure in the appliance to be measured while the appliance 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 diameter or equivalent restriction.

### 2.1.24 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 5.5.)

## 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.

### 2.2.2 Materials containing asbestos

Materials containing asbestos shall not be used.

### 2.2.3 Materials in contact with gas

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

### 2.2.4 Material used in gas appliances

Materials used in gas appliances shall comply with the following Standards, or equivalent, where applicable:

- (a) Medium or higher grades of black steel pipe to AS 1074.
- (b) Copper-brazed double wall low carbon steel tubing (Bundyweld) to AS 1751. This shall be lead-tin coated or equivalent where corrosion protection is necessary.
- (c) Welded and cold drawn low carbon steel tubing to AS 1450 (S.A.E.-525B).
- (d) Copper pipe to AS 1432.
- (e) Stainless steel tubing to AS 1769.
- (f) Cast iron fittings to AS 1832. Threads to AS 1722.1, taper external and parallel internal.
- (g) Flanges in cast iron, carbon steel, steel alloy or copper alloy to AS 2129, Section 3.
- (h) Steel fittings to AS D26.
- (i) Copper alloy fittings to AS D26.
- (j) Copper alloy fittings to AS 3688.
- (k) Copper capillary fittings to AS 3688 with silver brazing rod to AS 1167.1, Table 2, alloy classification B2 or a comparable rod.

### **2.2.5 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) under the conditions of MOT 2.2.5 (c) the alloy shall not swell, crumble or develop cracks.

### **2.2.6 Components required to be placed in a flame**

Pilot burners, 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 effect. Nickel alloys having less than 1% nickel, such as AISI 416 steel, shall be acceptable.

### **2.2.7 Materials used in electrical construction**

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

- (a) Electrical insulation shall be of a moisture resistant material.
- (b) High-tension wiring shall be temperature resistant.
- (c) Insulation shall have adequate mechanical and dielectric strength.

### **2.2.8 Spark electrodes**

Spark electrodes shall:

- (a) Be made of high grade alumina cement or equivalent.
- (b) Have the firing tip made of nickel-chromium steel or equivalent.

### **2.2.9 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.

### 2.2.10 Thermal insulation

Thermal insulation shall not produce obnoxious odours or fumes or corrode materials with which it is in contact.

### 2.2.11 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) The nominal outside diameter of the tube shall not exceed 20 mm.
- (c) Loose olives, where used, shall be symmetrical to prevent incorrect assembly.
- (d) Shear olives, where used, may be asymmetrical.
- (e) 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 3.4.

**TABLE 2.2**  
**TORQUE VALUES**

| Nominal size<br>mm | Torque<br>Nm |
|--------------------|--------------|
| 6                  | 15           |
| 8                  | 20           |
| 10                 | 35           |
| 15                 | 50           |
| 20                 | 75           |

- (f) 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 the 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 Accessibility to electrical components

Accessibility shall be provided to adequately service the electrical 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—

- (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 AS/NZS 3100.

### **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 AS/NZS 3100.

### **2.3.7 Motor bearings suitability**

Details and specifications shall be supplied by the manufacturer showing that bearings of motors, blowers or fans are of a type suitable for the temperatures to which they are subjected in normal operation.

Normal operation shall mean operating at nominal gas consumption with the fan operating at all fan speeds (including the OFF position if the appliance will function in that condition).

## **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 or a certified quick-connect device.

### **2.4.3 Access to connections**

The gas inlet connection shall be so located that sufficient free space is available for the union connection to be made or disconnected.

## **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 incapable of being incorrectly assembled. They shall be securely attached to their spindles and shall not contain loose parts which may become detached when they 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:

- (a) Aeration controls. (It is acceptable for the adjustment to be finalized with the burner removed, provided the setting will not be disturbed during removal.)
- (b) Pilots.
- (c) Thermostat bypasses where provided.
- (d) Thermostat calibration.
- (e) Regulator adjustments.
- (f) Ignition devices.
- (g) Safety devices.
- (h) Slow lighting adjusters.

#### **2.5.5 Accessibility for replacement**

Components that require to be removed for service 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) Injector nipples.
- (d) Thermostats complete including sensing elements. Thermostat valve plug and bypass adjuster to be separately removable.
- (e) Filters.
- (f) Pilot head assemblies, pilot jets.
- (g) Clocks and timers.
- (h) Door springs or other door control mechanisms.
- (i) Burners.
- (j) Ignition devices.
- (k) Radiant elements.
- (l) Flue baffles when flue cleaning is necessary.
- (m) Slow lighting adjusters.
- (n) Automatic control equipment.
- (o) Safety shut off systems.
- (p) Fans, electric motors and drives.

#### **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.

## 2.6 PRESSURE REGULATORS

### 2.6.1 Provision of a pressure regulating device

A certified gas pressure regulator shall be provided with each appliance intended for operation on natural gas, town gas, and tempered LPG. Where practicable the regulator should be fitted within the perimeter of the appliance.

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) overheating and the risk of ignition of any gas leaking from the breather holes is minimized.

## 2.7 GAS CONTROLS AND SAFETY SHUT OFF SYSTEMS

### 2.7.1 General

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

### 2.7.2 Accessibility by the user

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

### 2.7.3 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 in use.

### 2.7.4 Fitting of self-latching valves

Self-latching valves other than pilot valves shall be fitted unless—

- (a) the valve handles are concealed;
- (b) a flame safeguard is fitted;
- (c) automatic ignition is provided; or
- (d) the valve is spring loaded to return positively to the off position.

### 2.7.5 Provision of flame safeguard

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

### 2.7.6 Flueless appliances—additional shut off provision

Indoor flueless appliances shall be equipped with a system which shuts off gas supply before incomplete combustion occurs.

### 2.7.7 Tilt shut off

All appliances, except those designed only for fixed installation, shall be equipped with a system which shuts off gas supply to all burners (including pilots) in the event of the appliance being tipped in any direction through an angle of 45° from the vertical.

### **2.7.8 Main burner shut off provision**

Appliances equipped with thermostatic control shall have provision to shut off gas to the main burner without extinguishing any permanent pilot.

This provision shall be clearly marked.

### **2.7.9 Automatic reignition means**

Thermostatically controlled burners shall include a bypass or other means to ensure automatic reignition of the burner. However, safety shut off valve(s) shall not be bypassed.

### **2.7.10 Safety controls for exposed burners**

Appliances fitted with exposed burners shall not have exposed controls capable of activating and sustaining ignition by momentary operation.

### **2.7.11 Main burner automatic shut off valve**

For appliances with automatic ignition 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.

## **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 airflow 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 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.

### **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 designed so that—

- (a) each burner has a flame safeguard; or
- (b) there is safe and reliable cross ignition between the burners (see Clause 4.6).

### **2.9.6 Means for turning off pilot burner gas supply**

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

### **2.9.7 Viewing of flames**

It shall be possible to view burner flames either directly or by use of a mirror with doors closed and a panel or part removed.

### **2.9.8 Proving of burner or pilot ignition**

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 lighting tubes**

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

### **2.9.10 Support of pilots, igniters and flame sensing devices**

Pilot burners, 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 and pilot burners, which may be exposed in their normal operation to falling particles, 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 pilot burners.

### **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.

## 2.10 FLUEING REQUIREMENTS

### 2.10.1 Design of air entry and combustion product discharge

Appliances shall be so designed that flueway 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.

### 2.10.2 Design of flue connection

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

- (a) Horizontal flue connections on other than balanced flue appliances having a maximum gas consumption of up to 50 MJ/h shall be a rectangular spigot conforming to the following external dimensions:

Width: 247 mm  $\begin{smallmatrix} +0 \text{ mm} \\ -5 \text{ mm} \end{smallmatrix}$

Depth: 45 mm  $\begin{smallmatrix} +0 \text{ mm} \\ -5 \text{ mm} \end{smallmatrix}$

Minimum length of engagement: 25 mm.

The use of an adaptor whose termination conforms to these dimensions and which is supplied with the appliance shall be considered satisfactory.

- (b) Vertical flue connections on appliances having a maximum gas consumption of up to 50 MJ/h shall be a spigot suitable for connection to twin wall metal flue complying with AS 4567 and shall have a minimum length of engagement of 13 mm. The use of an adaptor meeting this requirement and supplied with the appliance shall be considered satisfactory.
- (c) Flue connections, both vertical and horizontal, for appliances having a gas consumption greater than 50 MJ/h shall be designed to accommodate both single wall and twin wall circular or rectangular metal flue pipe. The use of an adaptor to achieve this purpose will be considered satisfactory.
- (d) Flue connections or adaptors designed for twin wall metal flue pipe shall comply with the requirements of AS 4567.
- (e) Flue connections or adaptors designed for single wall metal flue pipe shall conform to the dimensions in Table 2.3 and Table 2.4.

**TABLE 2.3**  
**CIRCULAR FLUE CONNECTION**

millimetres

| Nominal pipe diameter | Diameter of flue connection                          |                                                      |
|-----------------------|------------------------------------------------------|------------------------------------------------------|
|                       | Internal dimension of socket                         | External dimension of spigot                         |
| 75                    | 78 $\begin{smallmatrix} +3 \\ -0 \end{smallmatrix}$  | 73 $\begin{smallmatrix} +0 \\ -3 \end{smallmatrix}$  |
| 100                   | 104 $\begin{smallmatrix} +3 \\ -0 \end{smallmatrix}$ | 98 $\begin{smallmatrix} +0 \\ -3 \end{smallmatrix}$  |
| 125                   | 129 $\begin{smallmatrix} +3 \\ -0 \end{smallmatrix}$ | 123 $\begin{smallmatrix} +0 \\ -3 \end{smallmatrix}$ |
| 150                   | 153 $\begin{smallmatrix} +3 \\ -0 \end{smallmatrix}$ | 148 $\begin{smallmatrix} +0 \\ -3 \end{smallmatrix}$ |

**TABLE 2.4**  
**RECTANGULAR FLUE CONNECTION (SPIGOT)**

millimetres

| Nominal size | Dimensions of flue connection   |                                |
|--------------|---------------------------------|--------------------------------|
|              | Width                           | Depth                          |
| 250 × 50     | 247 <sup>+0</sup> <sub>-5</sub> | 45 <sup>+0</sup> <sub>-5</sub> |
| 300 × 65     | 295 <sup>+0</sup> <sub>-5</sub> | 60 <sup>+0</sup> <sub>-5</sub> |

In all cases, the minimum length of engagement shall not be less than 13 mm for vertical flue connection and 25 mm for horizontal flue connection.

### 2.10.3 Flue terminal and draught diverter construction

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

### 2.10.4 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.

### 2.10.5 Safety shutdown—combustion products limits

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) In the case of an appliance fitted with an atmosphere sensing device shut down before the air free CO concentration of the atmosphere in the test room exceeds 200 ppm by volume.
- (b) In the case of an appliance fitted with a combustion products discharge safety device shut down within the times given in Table 2.5.

**TABLE 2.5**  
**SHUT DOWN TIMES**

| Degree of blockage                                         | Area of plate opening                            | Maximum shut down time (sec) |                      |
|------------------------------------------------------------|--------------------------------------------------|------------------------------|----------------------|
|                                                            |                                                  | On/Off                       | Modulating           |
| Complete blockage                                          | 0                                                | 200                          | $200 \times Q_n/Q_m$ |
| Partial blockage (natural draft appliances)                | 0.6 A                                            | 600                          |                      |
| Partial blockage (appliances with fan assisted combustion) | Area as determined in Paragraph B3.5.4, Item (c) | 600                          |                      |

where:

A is the internal area of the test flue at its top

$Q_n$  is the nominal input of the appliance

$Q_m$  is the input for appliances with modulation or turndown

- (c) Nuisance shutdowns shall not occur.
- (d) Where safety shutdown occurs, automatic restart shall only be possible after a minimum waiting time of 10 min. The manufacturer shall state in the instructions the actual waiting time.

## 2.11 MARKINGS AND LABELS

### 2.11.1 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.

### 2.11.2 Markings on packaging or appliance

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' except for portable and mobile appliances;
- (b) the maximum packaged weight in kilograms; and
- (c) the methods of installation for which the appliance is certified.

### 2.11.3 Flueless appliances additional markings on packaging

The packaging of every indoor flueless appliance shall be marked in a prominent manner and in a prominent position with—

- (a) the warnings for flueless appliances according to Figure A1 (excepting that the symbol can be excluded for packing case warnings); and
- (b) the emission classification of the appliance in the following format using bold capital letters—

'EMISSION CLASS X APPLIANCE', where 'X' is '1' or '2', as appropriate.

#### NOTES:

- 1 Refer to Clause 5.11.5 for the determination of appliance emission class.
- 2 Flued appliances may be marked as emission class 0.

### 2.11.4 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. Its colour shall be that appropriate to the gas specified as shown in the schedule in Clause 2.11.6.

### 2.11.5 Appliances for use with a flexible connection

For appliances which may be installed with a hose assembly, the gas type label shall—

- (a) be fixed as close as possible to the point of connection; and
- (b) carry additional wording referring the installer to the network operator or gas supplier for confirmation of the gas type, if in doubt.

### 2.11.6 Gas type colour code

Where a colour code 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

### 2.11.7 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 2.11.6 is acceptable. Alternatively the injector size may be marked on the appliance.

### 2.11.8 Marking of radiants

Radiants intended for replacement by the user shall be permanently marked in such a manner as to enable users to obtain correct replacements and to indicate correct location.

### 2.11.9 Marking of fans

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

### 2.11.10 Markings on appliances

Appliances shall be provided with clear and permanent markings readily accessible and easy to read and such markings shall include 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) Nominal gas consumptions in MJ/h, test point pressures in kPa for each gas nominated in (d) above.
- (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 appropriate warning label/s as shown in Figure A1, and for direct fired air heaters, as shown in Figure A1A.  
  
This/these label/s shall be located on the outside of the appliance in a position where it/they can be easily read by the operator when the appliance is in the installed position.
- (k) The label shown in Figure A1 for indoor flueless appliances shall indicate the minimum room size in which the appliance may be installed, according to Table 2.6.

**TABLE 2.6**

#### **MAXIMUM INPUT FOR DETERMINATION OF MINIMUM ROOM SIZE**

| Appliance type                  | Maximum input per cubic metre of room volume<br>MJ/h |
|---------------------------------|------------------------------------------------------|
| Thermostatically controlled     | 0.4                                                  |
| Not thermostatically controlled | 0.2                                                  |

- (l) For indoor flueless appliances, the emission classification of the appliance in the following format using bold capital letters not less than 3 mm in height—

‘EMISSION CLASS X APPLIANCE’, where ‘X’ is ‘1’ or ‘2’, as appropriate.

NOTES:

- 1 Refer to Clause 5.10.4 for the determination of appliance emission class.
  - 2 Flued appliances may be marked as emission class 0.
- (m) Where an appliance is required to be installed on a non-combustible floor, the marking ‘TO BE INSTALLED ON A NON-COMBUSTIBLE FLOOR’.
  - (n) Special conditions of installation as required by Clause 2.12.2(j).
  - (o) Instructions as required in Clause 2.12.3(e).
  - (p) Any additional information called for in other sections of this Standard (refer to Clause 2.11.14).
  - (q) In the case of appliances fitted with rear registers:
    - (i) The heat output that can be diverted (see Clause 5.3.4).
    - (ii) Whether or not the appliance incorporates an air path to prevent the operation of the air circulating fan lowering the pressure in the room where the appliance is installed. If a return air path is not incorporated a warning that a relief grille may be required between the two rooms to equalize the air pressure.

#### 2.11.11 Marking of doors and covers

Those doors, covers, and other components to be left open, closed or removed during operation shall be indicated with a permanent marking. Access panels that are required to be left in position during operation shall be indicated by a permanent marking.

#### 2.11.12 Warning label regarding removing of components

If the removal of any part of any appliance could cause interference with flueing or the entry of combustion air, a suitable warning label shall be attached to the appliance.

#### 2.11.13 Flue terminal marking

A 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.

#### 2.11.14 Markings for primary guards

An appliance that is fitted with a primary guard shall have a label attached that carries the following minimum information in bold capital letters not less than 3 mm in height:

‘THE GUARD IS FITTED TO THIS APPLIANCE TO REDUCE THE RISK OF FIRE OR INJURY FROM BURNS AND NO PART OF IT SHOULD BE PERMANENTLY REMOVED.

FOR PROTECTION OF YOUNG CHILDREN OR THE INFIRM, A SECONDARY GUARD IS REQUIRED.’

#### 2.11.15 Energy label

The energy label, as illustrated in Figure A15, and incorporating the annual energy consumption and star rating (see Clause 5.16) shall be affixed in a prominent position on each appliance.

### 2.11.16 Emission label

The emission label, as illustrated in Figure A16, and incorporating the NO<sub>2</sub> emission rate and star rating (see Clause 5.17) shall be affixed in a prominent position on each appliance.

## 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

#### 2.12.2.1 General

Each appliance shall be supplied with installation instructions that include reference to:

- (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 the appliance data plates.
- (c) The requirements of the local authority - gas, electricity, etc.
- (d) Overall dimensions of the appliance and location by measurement of connecting points of gas, electricity, etc.
- (e) The alternative types of installations which may be made.
- (f) As applicable (which is whenever an appliance is not intended or designed for a fireplace installation), the following note:  
 ‘NOTE: NOT INTENDED FOR FIREPLACE INSERT’
- (g) Details of the methods of connection and alternatives. In the case of flueless appliances this is to include the statement:  
 ‘NOT TO BE CONNECTED TO AN LPG GAS CYLINDER LOCATED INDOORS’
- (h) Details of the methods of connection and alternatives.
- (i) Required surroundings of the appliance, clearance from cupboards and fixings, walls, curtains, floors, or other combustible materials. This requirement also applies to rear registers fitted to wall furnaces.
- (j) Special conditions of installation that may be required as the result of the certification test.
- (k) Special conditions which shall be avoided, e.g. marine environment, and any conditions necessary to ensure optimum performance.
- (l) Details of any assembly work required to be done by the installer.
- (m) Definite instructions to test the operation of the appliance before leaving.
- (n) Details of the necessary testing and instructions for minor adjustments.
- (o) Instructions on the procedure to be adopted if the appliance cannot be adjusted to perform correctly.
- (p) Wiring diagram of electrical connections to the unit.
- (q) In the case of appliances fitted with rear registers, the heat output that can be diverted (see Clause 5.3.4).

### 2.12.2.2 *Console appliances*

Console appliances shall be provided with a clearly defined and prominent instruction warning against building the appliance into bookcases, walls etc. Where manufacturers provide an insulated outer casing specifically designed to allow installation in walls, clear instruction shall be given for its use.

### 2.12.2.3 *Built-in appliances*

Appliances intended as 'built-in' units shall be provided with clearly defined and prominent instructions for its installation shall specify the use of non-combustible materials for the immediate surrounds of the appliance, unless certified for direct installation.

## 2.12.3 **Operating instructions**

### 2.12.3.1 *General*

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—

- (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 shut down where incorrect procedures can result in a hazardous condition;
- (f) where necessary, a safe purge before the appliance is re-lit;
- (g) 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;
- (h) where symbols are used to indicate the functions of operating controls, the meanings of these symbols; and
- (i) appliances incorporating a live fuel effect, and designed to operate with luminous flames, may exhibit slight carbon deposition.

### 2.12.3.2 *Safety warnings*

The instructions shall contain the statement:

‘DO NOT PLACE ARTICLES ON OR AGAINST THIS APPLIANCE.

DO NOT USE OR STORE FLAMMABLE MATERIALS NEAR THIS APPLIANCE.

DO NOT SPRAY AEROSOLS IN THE VICINITY OF THIS APPLIANCE WHILE IT IS IN OPERATION.

DO NOT MODIFY THIS APPLIANCE.’

#### 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.
- (c) parts replacement:
  - (i) Fan.
  - (ii) Glass panel.
  - (iii) Over-temperature cut-out device.
  - (iv) Heat exchanger.
- (d) adjustments:
  - (i) Pilot.
  - (ii) Aeration.
  - (iii) Thermostat calibration, where applicable.
  - (iv) Ignition (spark gap).
- (e) fault finding chart;
- (f) wiring diagram; and
- (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 shut down of the appliance, it will be necessary to take appropriate action to find the cause, and if necessary, remedy the discharge fault.
  - (iv) The actual waiting time for an appliance with automatic reset.

#### 2.12.5 Inclusion of warning to prohibit unauthorized servicing

Servicing instructions remaining with the consumer shall contain a warning that servicing shall be carried out only by authorized personnel.

Servicing instructions shall clearly state 'DO NOT MODIFY THIS APPLIANCE'.

## SECTION 3 PRELIMINARY TESTS — LINE GASES

### 3.1 GENERAL

#### 3.1.1 Introduction

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.

#### 3.1.2 Test gases

Tests in all parts of this Standard (except Section 4 which requires the use of some 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) Universal LPG appliances are intended for use with propane, butane or any mixture of propane and butane and shall be tested with test gas 'X' for all performance tests except for Sections 5.7 and 5.8 where test gas 'Y' shall be used.

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

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

#### NOTES:

- 1 See Table 1.1 for gas characteristics.
- 2 Where an appliance is being tested for multi-gas certification, provided that the actual gas consumptions are not lower than for other gases, performance results for one gas may be deemed to apply for other gases for tests in Sections 5.7 and 5.8.

#### 3.1.3 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 (earth leakage)

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 not be less than 1 megohm. The resistance for double insulated equipment shall not be less than 10 megohms.

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

### **3.2.2 Setting up appliance for testing**

The appliance shall be set up in accordance with the manufacturer's instructions unless otherwise specified in these certification test requirements and checked 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 3.1.2) with the inlet pressure set at normal test gas pressure (see Clause 1.3.71).

### **3.2.3 Appliance regulators not to be removed during testing**

Appliance 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 during tests except as necessitated by the requirements.

### **3.2.6 Gas 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.

The following also applies to the test gas meter:

- (i) A saturator is used with a wet test gas meter to ensure saturation of the gas.
  - (ii) 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 PRIMARY GUARD AND GRILLE**

### **3.3.1 Primary guard attachment**

Primary guards shall be permanently attached to the appliance and withstand a pull of 20 N in various directions without permanent damage or distortion. The attachment may be by a hinge(s) provided that a catch or similar device holds the guard in place in the closed position.

### 3.3.2 Primary guard openings

Openings in a primary guard or openings between the edge of the guard and the appliance shall comply with the following requirements:

- (a) Major dimensions excluding horizontal openings, where the minor dimension exceeds 6 mm: not greater than 150 mm.

NOTE: Limitations on vertical openings are intended to prevent entry of fabrics.

- (b) Minor dimension: less than 6 mm or greater than 12 mm where finger entrapment is possible, but not greater than 35 mm.

NOTE: An opening with dimensions within the range 6 mm to 12 mm is such that a child's finger may be inserted with relative ease, but may be withdrawn only with difficulty.

### 3.3.3 Protection from contact with the heat source

When the cone specified in accordance with Figure L1 is applied to any opening in or around the guard with a force not exceeding 5 N, the cone shall not contact any heat source which has a temperature exceeding 200°C above ambient when the appliance, at its maximum setting, has been discharging heat at steady rate for a period of not less than 30 min.

### 3.3.4 Fabric drape test

A piece of fabric material shall not ignite or smoulder within 10 s of being placed over and in contact with an operating appliance.

### 3.3.5 Impact resistance

- (a) With the exception of guards that include slats of glass or similar material packed along side each other, guards that include glass or similar material shall withstand impact energy of 0.50 J without damage.
- (b) Guards that include slats of glass or similar material packed along side each other shall withstand impact energy of 0.25 J without permanent damage.

### 3.3.6 Surface finish

All exposed surfaces of a primary guard shall be smoothly finished to prevent the possibility of abrasion or laceration to the user, or the snagging of clothing.

## 3.4 GAS LEAKAGE

### 3.4.1 Gas circuit soundness

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

- (a) on initial set-up; and
- (b) at the conclusion of all certification tests.

### 3.4.2 Control of bleed line gas

Bleed lines from diaphragm type automatic valves shall terminate in a location such that—

- (a) ignition of the bleed gas by the main burner or pilot is assured; and
- (b) blockage of the bleed line tip is prevented.

## 3.5 GAS CONSUMPTION

### 3.5.1 Tolerance on determined gas consumption

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

### 3.5.2 Determined gas consumption of permanent pilots

The determined gas consumption of each continuously burning pilot shall not be more than 0.5 MJ/h except where:

- (a) Heat is employed for operating a safety device, in which case it shall not exceed 1.0 MJ/h.
- (b) It is used as part of an oxygen depletion system.

## 3.6 GAS PRESSURE REGULATORS

### 3.6.1 Pressure regulator performance

Except for LPG operated appliances, the regulator outlet pressure shall not vary by more than  $\pm 20\%$  from the nominal outlet pressure when the appliance inlet pressure is varied from 1.13 kPa up to 5.0 kPa for natural gas appliances and 0.75 kPa up to 3.0 kPa for town gas and TLP gas appliances.

## 3.7 IGNITION AND SAFETY SHUT OFF SYSTEMS

### 3.7.1 Requirements applicable to all

#### 3.7.1.1 *Aerated pilots*

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 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.

#### 3.7.1.2 *Ignition at reduced pilot rate*

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.

#### 3.7.1.3 *Means of ignition other than permanent pilot*

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 appliance shuts down safely.

#### 3.7.1.4 *Multi-port pilots*

Multi-port pilots shall conform with 3.7.1.1, 3.7.1.2 and 3.7.1.3 with all ports blocked other than the one activating the flame safeguard sensor.

#### 3.7.1.5 *Holding time for thermoelectric flame safeguard*

On carrying out the normal lighting procedure on a manually ignited burner protected by a thermoelectric flame safeguard system, the flame safeguard shall hold open within 1 min of igniting the operating flame.

#### 3.7.1.6 *Flame safeguard required*

Burner systems ignited by automatically or remotely controlled ignition systems shall be supervised by a certified flame safeguard system.

#### 3.7.1.7 *Flame travel at ignition*

Flames shall travel freely to all ports on a burner when gas is ignited on any one port.

**3.7.1.8** *Cessation of ignition spark*

The ignition spark or other means of ignition shall cease at the end of the start flame establishment period except where an interrupted pilot is used and then it may continue until the main flame is established, provided that after the pilot flame establishment period is completed, the electric spark shall not be able to activate the pilot flame detector.

**3.7.1.9** *Commencement of ignition after purge period*

Where a pre-ignition purge period is included, the means of ignition shall commence immediately after the purge period is completed.

**3.7.1.10** *Proving of start flame*

Gas shall not flow beyond the start flame establishment period unless the start flame has been proven. Where the start rate is less than the maximum rate the start flame shall be proven before the gas rate increases beyond the start flame rate.

**3.7.1.11** *Self-check for safety shut off systems*

Safety shut off systems shall incorporate a self-check of integral circuitry to prove that the system is not in the flame proved condition prior to start-up. Manually-operated thermoelectric flame safeguards are exempt from this requirement.

**3.7.1.12** *Flame failure*

Flame failure of the supervised burners shall result in lockout in accordance with Clause 2.7.5 (see Clause 3.7.2.1.4 for reignition attempt conditions for automatic atmospheric burners).

**3.7.1.13** *Flame establishment period for intermittent pilot*

Where an interrupted or intermittent pilot is used, the main flame establishment period shall not exceed 5 s.

**3.7.1.14** *Shut off time for safety shut off system*

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—

- (a) 90 s where atmospheric type main burners are used and the total gas consumption is up to and including 50 MJ/h;
- (b) 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; or
- (c) for all other types of main burner 3 s, or up to 6 s provided the appliance satisfactorily meets delayed ignition tests up to twice the flame failure response period.

**3.7.1.15** *Interrupted pilot*

Where an interrupted pilot is used the main flame shall be proved on its own at the end of the main flame establishment period.

**3.7.2 Automatic burner ignition systems—Additional requirements**

NOTE: Systems based on permanent pilots are exempted from this Clause.

**3.7.2.1** *Atmospheric burners***3.7.2.1.1** *Start flame establishment period*

The start flame establishment period shall not exceed 5 s except—

- (a) for start gas rates up to 50 MJ/h (15 s); or
- (b) for start gas rates up to 4 MJ/h (90 s).

### 3.7.2.1.2 Ignition gas flow rate

The gas flow rate at the time of ignition shall meet one of the following criteria—

- (a) the gas flow rate in MJ/h shall not exceed  $200 \frac{V}{T}$

where

$V$  = the volume of the combustion chamber in m<sup>3</sup>; and

$T$  = the start flame establishment period in s; or

- (b) the energy released during the start flame establishment period shall not exceed 0.1 MJ; or
- (c) the energy released during the start flame establishment period shall satisfactorily meet delayed ignition tests up to twice the flame establishment period.

NOTE: As this is a safety test under abnormal operation, 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.

### 3.7.2.1.3 Start flame proving period

Where the nominal gas consumption of the supervised burner exceeds the maximum gas flow rate permitted in Clause 3.7.2.1.2, then there shall be a start flame proving period of not less than the flame failure response time or 5 s, whichever is the greater.

### 3.7.2.1.4 Number of reignition attempts

The total number of reignition cycles after flame failure, and prior to lockout, shall be limited to five.

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 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.

### 3.7.2.2 Forced or induced draught burners

#### 3.7.2.2.1 Ignition gas flow rate

The gas flow rate at the time of ignition shall meet one of the following criteria—

- (a) the gas flow rate in MJ/h shall not exceed  $200 \frac{V}{T}$

where

$V$  = the volume of the combustion chamber in m<sup>3</sup>; and

$T$  = is the start flame establishment period in s; or

- (b) throughout the flame establishment period, the gas concentration in relation to the proved air flow rate for that period shall not exceed 50% of the lower explosive limit (LEL) for natural and town gases, or 25% of the LEL for other fuels provided that—
  - (i) the gases during the start gas flame establishment period are thoroughly mixed with the air flow except in the immediate vicinity of the burner, and
  - (ii) the preheated air temperature does not exceed 400°C; or
- (c) the energy released during the start flame establishment period shall satisfactorily meet delayed ignition tests. These tests shall be carried out at various delay periods up to twice the flame establishment period.

NOTE: As this is a safety test under abnormal operation, 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.

#### **3.7.2.2.2** *Start flame proving period*

Where the nominal gas consumption of the supervised burner exceeds the maximum gas flow rate permitted in Clause 3.7.2.2.1, then there shall be a start flame proving period of not less than 5 s.

#### **3.7.2.2.3** *Number of re-ignition attempts*

Up to five re-ignition attempts after flame failure may be made prior to lockout provided—

- (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 re-ignition commences with a pre-ignition purge and the requirements of Clause 3.7.2.2.1 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.

#### **3.7.2.2.4** *Pre-ignition purge period*

A pre-ignition purge period sufficient to ensure purging of at least five times the heat exchanger volume shall be provided immediately prior to any ignition attempt except where purging is continuous during the burner 'OFF' period.

## SECTION 4 LIMIT GAS TESTS

### 4.1 GENERAL

Appliances shall comply with the requirements listed below 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; and                                                    |
| (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/CO<sub>2</sub> RATIO LIMITS FOR ANY INDEPENDENT SURFACE COMBUSTION BURNER—UNDERLOAD

The CO/CO<sub>2</sub> ratio of the combustion products of any independent surface combustion burner of an appliance operating at the test conditions specified below, shall not exceed—

- (a) 0.007 after 5 min for an indoor flueless appliance; or
- (b) 0.02 after 10 min for any other type of appliance.

Burners intended for luminous effect and with adjustable aeration setting shall be tested at the minimum aeration setting.

The limiting conditions specified in Table B5 shall apply.

### 4.3 CO/CO<sub>2</sub> RATIO LIMITS FOR ANY INDEPENDENT BURNER—OVERLOAD

The CO/CO<sub>2</sub> ratio of the combustion products of any independent burner of an appliance operating at the test conditions specified below, shall not exceed—

- (a) 0.007 after 5 min for an indoor flueless appliance; or
- (b) 0.02 after 10 min for any other type of appliance.

Burners intended for luminous effect and with adjustable aeration setting shall be tested at the minimum aeration setting.

The limiting conditions shall be as listed in Table B6.

#### 4.4 CO/CO<sub>2</sub> RATIO LIMITS FOR PERMANENT PILOTS—OVERLOAD

The CO/CO<sub>2</sub> ratio of the combustion products of a permanent pilot of an appliance operating at the test conditions specified below, shall not exceed—

- (a) 0.007 after 5 min for an indoor flueless appliance; or
- (b) 0.02 after 10 min for any other type of appliance.

Pilots shall be tested using the appliance inlet pressures in Table B7.

#### 4.5 FLAME ABNORMALITY

The burner on any appliance shall exhibit no flame abnormality (see Clause 1.2.32) or safety shutdown shall occur at maximum and minimum limiting conditions whether the appliance is hot or cold (5°C).

An open flued appliance fitted with a draught diverter or similar device shall comply in the following conditions:

- (a) When the flue outlet of the appliance is closed.
- (b) When a downdraught having a velocity head of up to 7.5 Pa is applied to the flue outlet for 1 min.
- (c) When an updraught having a velocity head of up to 7.5 Pa is applied to the flue outlet for 1 min.

An open flued appliance not fitted with a draught diverter or similar device shall comply if a backpressure of 140 Pa is applied to the flue outlet and shall shut down safely if the flue is blocked.

The limiting conditions shall be as specified in Table B8.

#### 4.6 BURNER IGNITION AT MAXIMUM AND MINIMUM LIMITING CONDITIONS

On carrying out the normal lighting procedure, a burner (other than a pilot burner) shall ignite completely and quietly within 5 s for all gases, at maximum and minimum limiting conditions, specified in Table B9, whether the appliance is hot or cold (5°C). 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 nominal 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.

#### 4.7 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 whether the appliance is hot or cold (5°C):

- (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.

NOTE: As this is a safety test under abnormal operation, 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.

Burners intended for luminous effect and with adjustable aeration setting shall be tested at the minimum aeration setting.

The limiting conditions shall be as specified in Table B10.

#### **4.8 REIGNITION AT TURNDOWN UNDER DRAUGHT CONDITIONS**

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

The limit gases in Table B11 shall be used.

#### **4.9 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.

#### **4.10 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.

#### **4.11 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 when:

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

The limiting conditions in Table B12 shall be used.

#### **4.12 EFFECT OF OPENING AND CLOSING DOORS AT TURNDOWN CONDITION**

With an 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 in Table B13 shall be used.

#### **4.13 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 specified in Table B14.

#### **4.14 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 pilot burners, the tests required in Section 4 shall be repeated with such interference conditions operating.

#### **4.15 BLOCKED FLUEWAY TERMINAL**

When a flueway terminal is likely to be blocked, the burner shall exhibit no flame abnormality when the flueway terminal is blocked.

The limiting conditions shall be as specified in Table B15.

#### **4.16 CASE PRESSURE**

Appliances which are intended to be built into cavities in walls or partitions, cupboard recesses, or areas that communicate with other rooms or spaces, shall not exhibit flame abnormality and the CO/CO<sub>2</sub> ratio of the combustion products shall not exceed 0.02 when the cavity is subjected to any pressure between 25 Pa positive and 25 Pa negative providing the air flow required to produce such pressures does not exceed 250 L/sec.

The maximum limiting condition shall be as specified in Table B16.

The minimum limiting condition shall be as specified in Table B17.

#### **4.17 SOOTING—LUMINOUS EFFECT APPLIANCES**

Appliances specifically designed for a luminous effect shall not produce sooting in excess of No. 2 as measured on the Baccarach scale after 1 h and shall not cause visible accumulation of carbon when operated for 8 h.

Burners intended for luminous effect and with adjustable aeration setting shall be tested at the minimum aeration setting.

NOTE: For the purpose of assessing this requirement, minor deposits on parts exposed to flames are permitted.

The limiting conditions shall be as specified in Table B18.

#### **4.18 LIGHT BACK IN UNFLUED APPLIANCES WITH CONCEALED BURNER(S)**

Sustained light back in unflued appliances with concealed burner(s) shall not be possible.

The limiting conditions shall be as specified in Table B19.

## SECTION 5 PERFORMANCE TESTS

### 5.1 GENERAL

Before commencing testing in this Section refer to Clause 2.1.1.

### 5.2 FLUE OPERATION

#### 5.2.1 Diversion of combustion products

The flueway terminal of an indoor flueless appliance shall divert combustion products away from any wall so that the gases impinging on the wall do not contain more than 1% CO<sub>2</sub>.

#### 5.2.2 Spillage of combustion products

There shall be no leakage or spillage of combustion products from an open flued appliance, its flue system, or draught diverter, 5 min after ignition when the appliance is operated at nominal gas consumption.

#### 5.2.3 Circulating air system

Appliances shall be so constructed that there is no leakage of circulating air into the heat exchanger or of flue products into the circulating air system.

#### 5.2.4 Performance with updraught, downdraught and blocked flue

##### 5.2.4.1 *Natural draught, open flued appliances*

For all appliances with natural draught, open flued combustion systems equipped with a draught diverter or alternative system, the CO/CO<sub>2</sub> ratio shall not exceed 0.02 when operated with:

- (a) The flue terminal of the appliance blocked.
- (b) A downdraught having a velocity head of up to 7.5 Pa applied progressively to the flue terminal for one minute.
- (c) An updraught having a velocity head of up to 7.5 Pa applied progressively to the flue terminal for one minute.

NOTE: A velocity head of 7.5 Pa is equivalent to a flow velocity of 3.5 m/s

During testing the appliance is operated at nominal hourly gas consumption and in the case of appliances with turndown or modulating controls, the appliance shall be tested down to the lowest setting and sufficient intermediate points which characterise the appliance performance.

##### 5.2.4.2 *Forced or induced draught, open flued appliances*

For all appliances with forced or induced draught open flued combustion systems or fan assisted fluing systems, the CO/CO<sub>2</sub> ratio shall not exceed 0.02 when operated under the following conditions:

- (a) The flue terminal is progressively blocked until safety shut down occurs. In addition, lockout shall not occur at back-pressures less than 140 Pa.
- (b) Updraughts having a total head of up to 17.5 Pa are progressively applied to the flue terminal.
- (c) Downdraughts with back pressures up to 12.5 Pa are applied to the flue if the flue system incorporates a draught diverter or similar device.

During testing the appliance is operated at nominal hourly gas consumption and in the case of appliances with turndown or modulating controls, the appliance shall be tested down to the lowest setting and sufficient intermediate points which characterise the appliance performance.

### **5.3 THERMAL EFFICIENCY**

#### **5.3.1 General**

The thermal efficiency of an appliance, based upon gross heating value, shall be within the limits specified below:

(a) Radiant heaters:

Minimum radiant efficiency 30%.

(b) Convection and radiant convection heaters:

(i) Natural convection—total efficiency not less than 60%.

(ii) Forced convection—total efficiency not less than 70%.

(c) Room sealed heaters:

Total efficiency not less than 70%.

#### **5.3.2 Flued forced convection and flued forced radiant convection heaters**

Flued forced convection and flued forced radiant convection heaters shall comply with Clause 5.3.1(b)(ii) when tested at all fan speeds and shall comply with Clause 5.3.1(b)(i) with the fan off.

#### **5.3.3 Reduction in thermal efficiency with maximum flue length**

When subjected to a flue pull equivalent to a length of flue terminating 4.5 m above floor level, the thermal efficiency of a forced convection space heater shall not be less than 60% and for a natural convection space heater shall not be less than 50%.

#### **5.3.4 Rear registers**

Where a heater is fitted with a rear register for heating a room at the rear of that in which the heater is located, the manufacturer shall state the output which can be diverted through the register when it is in the fully open position. In addition the register when in the fully closed position shall not allow leakage in excess of 5% of the heat output of the heater.

#### **5.3.5 Thermal efficiency in wind conditions**

The CO<sub>2</sub> content of the flue products of power flued or room sealed heaters shall not fall by more than 10% of its original value when winds of 15 km/h are directed onto the flue terminal irrespective of direction.

#### **5.3.6 Flue gases temperatures**

The temperature of flue gases at the flue connection of appliances shall not exceed the temperature limit specified in AS 5601 for either the specified material of the flue connection or of the specified flue pipe. For metal flue connections and pipes the temperature shall not exceed 270°C above ambient.

### **5.4 NOISE OF OPERATION**

There shall be no excessive chattering or other objectionable noise from the appliance or its components while the appliance is in operation.