

Australian Standard<sup>®</sup>

## Overhead radiant tube gas heaters



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The following are represented on Committee AG-001:

- AGA (Network Operators)
  - AGA Certification Services
  - Appliance and Component Testing
  - Australian Liquefied Petroleum Gas Association
  - CSIRO Energy Technology
  - Committee AG-001-03
  - Consumers' Federation of Australia
  - Energy Retailers Association of Australia
  - Gas Appliance Manufacturers Association of Australia
  - Gas Technical Regulators Committee
- 

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Australian Standard<sup>®</sup>

## Overhead radiant tube gas heaters

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## PREFACE

This Standard was prepared by the Standards Australia Committee AG-001 Gas Appliances to supersede AG 403—1986, *Overhead radiant tube gas heaters*.

The objective of this Standard is to provide manufacturers, designers, regulatory authorities, testing laboratories and similar organizations with uniform minimum requirements for the safety, performance and use of overhead radiant tube gas heaters.

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

In its preparation, consideration has been given to—

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

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

The principal differences between this edition and AG 403—1986, are:

- Inclusion of all amendments in Australian Gas Association Technical Bulletins 86 to 104.
- Inclusion of tests on ‘Z’ gas.
- Updating of temperature hazard tests.
- Rearrangement of a number of Appendices, and transfer of some requirements previously in Appendices to the body of the Standard.

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.

## CONTENTS

|                                                                                                     | <i>Page</i> |
|-----------------------------------------------------------------------------------------------------|-------------|
| <b>SECTION 1 SCOPE AND DEFINITIONS</b>                                                              |             |
| 1.1 SCOPE .....                                                                                     | 5           |
| 1.2 DEFINITIONS .....                                                                               | 5           |
| <b>SECTION 2 DESIGN AND CONSTRUCTION</b>                                                            |             |
| 2.1 GENERAL .....                                                                                   | 13          |
| 2.2 MATERIALS AND STANDARDS .....                                                                   | 14          |
| 2.3 ELECTRICAL SYSTEMS .....                                                                        | 16          |
| 2.4 INSTALLATION REQUIREMENTS .....                                                                 | 17          |
| 2.5 MAINTENANCE REQUIREMENTS .....                                                                  | 17          |
| 2.6 PRESSURE REGULATORS .....                                                                       | 19          |
| 2.7 GAS CONTROLS AND FLAME SAFEGUARDS .....                                                         | 19          |
| 2.8 COMBUSTION AIR SUPPLY AND CONTROLS .....                                                        | 19          |
| 2.9 IGNITION, PILOTS AND MAIN BURNERS .....                                                         | 20          |
| 2.10 FLUEING REQUIREMENTS .....                                                                     | 20          |
| 2.11 MARKINGS .....                                                                                 | 21          |
| 2.12 INSTRUCTIONS .....                                                                             | 23          |
| <b>SECTION 3 PRELIMINARY TESTS - LINE GASES</b>                                                     |             |
| 3.1 GENERAL REQUIREMENTS .....                                                                      | 25          |
| 3.2 PREPARATION FOR TESTING .....                                                                   | 25          |
| 3.3 GAS LEAKAGE .....                                                                               | 26          |
| 3.4 GAS CONSUMPTION .....                                                                           | 27          |
| 3.5 GAS PRESSURE REGULATORS .....                                                                   | 27          |
| 3.6 IGNITION AND FLAME SAFEGUARD SYSTEMS .....                                                      | 27          |
| <b>SECTION 4 TESTS USING LIMIT PRESSURES</b>                                                        |             |
| 4.1 GENERAL .....                                                                                   | 32          |
| 4.2 CO/CO <sub>2</sub> RATIO LIMITS OF ANY INDEPENDENT SURFACE COMBUSTION<br>BURNER—UNDERLOAD ..... | 32          |
| 4.3 CO/CO <sub>2</sub> RATIO LIMITS OF ANY INDEPENDENT BURNER—OVERLOAD .....                        | 32          |
| 4.4 CO/CO <sub>2</sub> RATIO OF PERMANENT PILOTS—OVERLOAD .....                                     | 32          |
| 4.5 CO/CO <sub>2</sub> RATIO FLUE BACK PRESSURE AND BLOCKED FLUE .....                              | 33          |
| 4.6 FLAME ABNORMALITY .....                                                                         | 33          |
| 4.7 BURNER IGNITION AT MAXIMUM AND MINIMUM LIMITING CONDITIONS<br>.....                             | 33          |
| 4.8 DELAYED IGNITION AT MAXIMUM AND MINIMUM LIMITING<br>CONDITIONS .....                            | 33          |
| 4.9 BURNER REIGNITION UNDER DRAUGHT CONDITIONS .....                                                | 33          |
| 4.10 BURNER INTERFERENCE AT IGNITION OR DURING COMBUSTION .....                                     | 33          |
| <b>SECTION 5 PERFORMANCE TESTS</b>                                                                  |             |
| 5.1 FLUE OPERATION .....                                                                            | 34          |
| 5.2 THERMAL EFFICIENCY .....                                                                        | 34          |
| 5.3 FLUE GAS TEMPERATURES .....                                                                     | 34          |
| 5.4 NOISE OF OPERATION .....                                                                        | 34          |
| 5.5 CONDENSATION .....                                                                              | 35          |
| 5.6 COMBUSTION AIR SUPPLY AND CONTROLS .....                                                        | 35          |
| 5.7 SHUTDOWN .....                                                                                  | 35          |

|      |                                               |    |
|------|-----------------------------------------------|----|
| 5.8  | TEMPERATURE HAZARDS .....                     | 36 |
| 5.9  | HEAT RESISTANCE.....                          | 38 |
| 5.10 | EXPLOSION RESISTANCE .....                    | 38 |
| 5.11 | STRENGTH AND STABILITY .....                  | 38 |
| 5.12 | NOISE OF EXTINCTION.....                      | 38 |
| 5.13 | BURNER STABILITY WHEN CHANGING SETTINGS ..... | 39 |

#### APPENDICES

|   |                                                        |    |
|---|--------------------------------------------------------|----|
| A | FIGURES A1 TO A3.....                                  | 40 |
| B | METHODS OF TEST.....                                   | 45 |
| C | GUIDELINES FOR SERVICING INSTRUCTIONS .....            | 88 |
| D | METER VOLUME CORRECTION FACTORS.....                   | 89 |
| E | FLUE GAS SAMPLING AND TEMPERATURE MEASUREMENT .....    | 91 |
| F | TYPICAL OPERATING SEQUENCE FOR AUTOMATIC BURNERS ..... | 94 |
| G | LIST OF REFERENCED DOCUMENTS .....                     | 95 |

STANDARDS AUSTRALIA

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**Australian Standard**

**Overhead radiant tube gas heaters**

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SECTION 1 SCOPE AND DEFINITIONS

**1.1 SCOPE**

These requirements apply to overhead radiant tube heaters intended for use with natural gas, town gas, liquefied petroleum gas and tempered liquefied petroleum gas with gas consumptions not exceeding 500 MJ/h.

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

**1.2 DEFINITIONS**

For the purposes of this Standard, the following definitions apply:

**1.2.1 Appliance regulator**

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

**1.2.2 Atmospheric burner**

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

**1.2.3 Authority**

Means the authority having jurisdiction or such authority as delegated. (Technical Regulator).

**1.2.4 Automatic burner**

A burner system which, on starting, follows a self-acting sequence that has been manually or automatically initiated, to provide gas and ignition to the burner without any intermediate manual operation.

**1.2.5 Automatic ignition**

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

**1.2.6 Automatic operation**

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

**1.2.7 Automatic shut off valve**

An automatic valve used to shut off gas supply to an appliance when a signal is generated indicating that a dangerous condition has developed.

**1.2.8 Available gas (Line gas)**

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

### 1.2.9 Certified/Certification

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

### 1.2.10 Certifying Body

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

### 1.2.11 Compression fitting

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

#### 1.2.11.1 Type 1 (non-manipulative) compression fitting

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

#### 1.2.11.2 Type 2 (manipulative) compression fitting

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

### 1.2.12 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.

### 1.2.13 Determined gas consumption

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

### 1.2.14 Excess air

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

### 1.2.15 Flame abnormality

A flame condition which results in lifting, floating, lighting back, appreciable yellow tipping, carbon deposition 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.

### 1.2.16 Flame detector

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

### 1.2.17 Flame establishment period

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

### 1.2.18 Flame failure response time

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

### 1.2.19 Flame lift

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

### 1.2.20 Flame proving period

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

### 1.2.21 Flame safeguard

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

### 1.2.22 Flame safeguard system

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

### 1.2.23 Flue

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

### 1.2.24 Flue connection

A device incorporated in an appliance for the connection of a flue or draught diverter, barometric device, fan or similar part.

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

### 1.2.25 Flue gases

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

### 1.2.26 Flueway terminal

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

### 1.2.27 Forced draught burner

A burner system where all or part of the air for combustion is provided under pressure.

### 1.2.28 Gas

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

#### 1.2.28.1 Natural gas (NG)

A hydrocarbon gas consisting mainly of methane.

#### 1.2.28.2 Simulated natural gas (SNG)

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

#### 1.2.28.3 Town gas (TG)

A gas manufactured from coal or petroleum feedstocks.

#### 1.2.28.4 Tempered liquefied petroleum gas (TLP)

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

**1.2.28.5 Liquefied petroleum gas (LPG)**

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

**1.2.29 Gas consumption**

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

**1.2.30 Heating value, gross (at constant pressure)**

The number of megajoules 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 based upon ISO 6976 given in AS 4646.

**1.2.31 Hose**

Flexible tube or pipe of multiple construction.

**1.2.32 Indoor flueless appliance**

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

**1.2.33 Induced draught burner**

A burner system where all or part of the air for combustion is introduced by providing suction in the combustion chamber by mechanical means.

**1.2.34 Interlock**

A device or function which ensures that the operation of items of equipment is dependent upon the fulfilment of pre-determined conditions by other items of equipment.

**1.2.35 Intermittent pilot**

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

**1.2.36 Interrupted pilot**

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

**1.2.37 Jointing compound**

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

**1.2.38 Jointing material**

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

**1.2.39 Light back**

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

**1.2.40 Limit device**

A device which is actuated by the approach to a hazardous situation in an appliance due to abnormal conditions, and when actuated, causes the gas supply to all burners to shut off with lockout.

**1.2.41 Lockout**

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

**1.2.42 Lower explosive limit (LEL)**

The lowest percentage of gas in air in which combustion can be self-sustaining at standard temperature (15°C) and absolute pressure (101.325 kPa) conditions.

**1.2.43 LPG**

See Gas.

**1.2.44 Natural gas**

See Gas.

**1.2.45 Nominal gas consumption**

The appliance gas consumption, in megajoules per hour, 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.

**1.2.46 Nominal test point pressure**

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

**1.2.47 Normal test gas pressure**

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

**1.2.48 Open flued appliance**

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

**1.2.49 Outdoor appliance**

An appliance designed for outdoor installation or use.

**1.2.50 Overhead radiant heater**

A space heater fitted at high level and designed to provide an effective output mainly of radiation below the level of the heater.

**1.2.51 Overload gas consumption**

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

**1.2.52 Permanent pilot**

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

**1.2.53 Pilot**

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

**1.2.54 Primary aeration control**

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

**1.2.55 Primary flue**

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

### 1.2.56 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 —
  - (i) sensors and/or other input devices;
  - (ii) data links and/or other communication paths; or
  - (iii) 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 —
  - (i) microprocessors;
  - (ii) programmable controllers (PCs);
  - (iii) programmable logic controllers (PLCs);
  - (iv) programmable state controllers; or
  - (v) other computer based devices.
- 4 A PES can include a microprocessor-based temperature, pressure, air/fuel ratio, or level controller or monitor.

### 1.2.57 Programmed ignition

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

### 1.2.58 Purge

To replace air or other gases which may become a hazard from pipe work, fittings or appliances.

### 1.2.59 Reference gas

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

### 1.2.60 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.

### 1.2.61 Safety shutdown

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

### 1.2.62 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 an unsafe condition.

### 1.2.63 Simulated natural gas (SNG)

See Gas.

### 1.2.64 Start gas flame establishment period

The period during which the start gas safety shut off system is permitted to be open before the flame safeguard is required to supervise the start gas flame.

**1.2.65 Start gas rate**

The restricted gas flow rate admitted either to a separate pilot burner or to the main burner during the start gas flame establishment period.

**1.2.66 Surface combustion burner**

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

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

See Gas.

**1.2.68 Test gases**

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

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

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

**1.2.69 Town gas**

See Gas.

**1.2.70 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.

**1.2.71 Valve**

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

**1.2.72 Wobbe index (Wobbe number)**

The Wobbe index of a gas is:

$$\frac{\text{Heating Value}}{\sqrt{\text{Relative Density}}}$$

TABLE 1.1  
TEST GAS TABLE

| Test gas | Application | Composition percent |         |         |           |        |          | *Characteristics |                                 |                  |                               |
|----------|-------------|---------------------|---------|---------|-----------|--------|----------|------------------|---------------------------------|------------------|-------------------------------|
|          |             | Hydrogen            | Methane | Propane | Propylene | Butane | Nitrogen | Air              | Heating value MJ/m <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                          |
| 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                          |
| D        | TG          | 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 Individual component or specification study

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

#### 2.1.3 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 Standards(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 (PES)

Where a 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 AS 4625 and EN 298 (or equivalent).

#### 2.1.5 Manual shut off 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

Where a safety shut off system is required, 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 Clauses 2.7.4 and 2.7.5 for fitting of safety shut off systems.

#### 2.1.7 Requirements for electrical components and their installation

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

### **2.1.8 Sharp edges**

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

### **2.1.9 Continuation of satisfactory operation**

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

### **2.1.10 Protection of vitreous enamel**

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

### **2.1.11 Means of support**

The appliance shall be provided with adequate means of support.

### **2.1.12 Compliance in alternative forms**

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

### **2.1.13 Locking means for adjusting devices**

Adjusting devices shall be provided with locking arrangements which 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.

### **2.1.14 Alteration of programmed ignition**

Programmed ignition shall be sealed against alteration to settings.

### **2.1.15 Locking of dampers**

Dampers, where fitted, for the control or adjustment of combustion air flow or flue gas flow shall be fitted with a minimum stop and with a locking feature to obtain sufficient air at minimum burner output.

### **2.1.16 Means for gas pressure adjustment**

#### **2.1.16.1 Means to allow the gas pressure to be measured**

Means shall be provided to allow the gas pressure to be measured and adjusted while the appliance is in operation.

#### **2.1.16.2 Pressure test points**

Pressure test points shall contain a limiting orifice not exceeding 0.7 mm or equivalent restriction.

### **2.1.17 Protection of bearings**

Fan and motor bearings shall be protected from dust and lint.

### **2.1.18 Construction of primary aeration controls**

Primary aeration controls shall be constructed so that lint build-up shall have a minimum effect on the flame characteristics.

## **2.2 MATERIALS AND STANDARDS**

### **2.2.1 Suitability of materials and finishes**

Materials and finishes, including dressings and lubricants used in the construction of an appliance shall be suitable for the conditions of use (e.g. corrosion, temperature, handling, etc.).

### 2.2.2 Materials in contact with gas

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

### 2.2.3 Materials containing asbestos

Materials containing asbestos are prohibited.

### 2.2.4 Materials used in 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) Aluminium tubing to AS/NZS 1867, alloy 1200 and temper H14 (half hard).
- (f) Stainless steel tubing to AS 1769.
- (g) Cast iron fittings to AS 1832. Threads to AS 1722.1, taper external and parallel internal (for commercial appliances only).
- (h) Flanges in cast iron, carbon steel, steel alloy or copper alloy to AS 2129—2000, Section 3.
- (i) Steel fittings to AS D26.
- (j) Copper alloy fittings to AS D26 and AS 3688.
- (k) Copper capillary fittings to AS 3688 with silver brazing rod to AS/NZS 1167.1—2005, 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; and
- (b) the temperature shall not exceed 80°C.
- (c) the alloy shall not swell, crumble or develop cracks when exposed to saturated water vapour at 97°C for 10 days.

### 2.2.6 Components 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 Protection of aluminium tubing

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

### 2.2.8 Construction of primary aeration controls

Primary aeration control(s) where fitted should be constructed of a rust resistant material except when the type of material or construction employed will prevent sticking or corroding in position. Cast iron air shutters are considered acceptable.

### 2.2.9 Outdoor appliances—protection against corrosion

Outside casings of heaters for outdoor installation shall be protected against corrosion.

### 2.2.10 Compression fittings

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

- (a) They shall be made to an acceptable standard and the mating surfaces shall be compatible.
- (b) 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 Section 3.3.
- (f) The component parts shall be made of materials with a melting point not less than 430°C.

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

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

## 2.3 ELECTRICAL SYSTEMS

### 2.3.1 Accessibility to electrical components

Accessibility shall be provided to adequately service the electrical installation in the appliance.

### 2.3.2 Connection of electrical components

Electrical components or assemblies which may be required to be removed from the 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).

### 2.3.3 Plug and socket connections

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

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

### **2.3.4 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.

### **2.3.5 Provision of electrical lead and plug**

Appliances designed to be connected to a general purpose electrical outlet shall be provided with an electrical lead and plug.

### **2.3.6 Protection of controls for and wiring—outdoor installation**

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

### **2.3.7 Details of bearings**

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 operation at nominal gas consumption with the fan operating at any fan setting.

## **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 AS 1722.1.

### **2.4.3 Access to gas connection**

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

### **2.4.4 Means for mounting**

Appliances shall be designed for adequate mounting in accordance with the manufacturer's installation instructions.

## **2.5 MAINTENANCE REQUIREMENTS**

### **2.5.1 Special tools**

Special tools beyond those normally carried by a service fitter shall not be required for adjusting or replacing any component or integral part except those referred to in Clause 2.3.2.

### **2.5.2 Dismantling and replacement**

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.

### **2.5.3 Insertion and removal of gas injectors**

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

### 2.5.4 Assembly and attachment of handles, dials and pointers

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

### 2.5.5 Accessibility for adjustment

Components and integral parts which 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 replacement.)
- (b) Pilots.
- (c) Thermostat bypasses where provided.
- (d) Thermostat calibration.
- (e) Regulator adjustments.
- (f) Ignition devices.
- (g) Safety devices.

### 2.5.6 Accessibility for replacement

Components which 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 man, 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 injectors.
- (g) Door springs or other door control mechanisms.
- (h) Burners.
- (i) Ignition devices.
- (j) Radiant elements.
- (k) Flue baffles when flue cleaning is necessary.
- (l) Slow lighting adjusters.
- (m) Automatic control equipment.
- (n) Flame safeguards.
- (o) Fans, electric motors and drives.

### **2.5.7 Threaded connections**

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

### **2.5.8 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 pressure regulators**

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 regulators**

Regulators shall be so placed that breather holes cannot easily be blocked, and overheating and the possibility of ignition of gas leaking from the breather holes are minimized.

## **2.7 GAS CONTROLS AND FLAME SAFEGUARDS**

### **2.7.1 Accessibility by the user**

Controls and working parts shall be accessible and easily operated by the user.

### **2.7.2 Accidental changes of setting**

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

### **2.7.3 Indication of function**

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

### **2.7.4 Fitting of safety shut off system**

A safety shut off system shall be incorporated in each appliance.

### **2.7.5 Main burner automatic shut off valves**

Two certified safety shut off controls in series shall be fitted to every appliance intended for automatic operation to shut off all gas to the appliance in the event of flame failure at the point of supervision.

Any start gas rate may be controlled by the upstream valve.

## **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 a non-pulsating air flow adequate for all operating conditions specified by the manufacturer.

### **2.8.2 Combustion air flow proving interlock**

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

### **2.8.3 Prevention of combustion air backflow**

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

## **2.9 IGNITION, PILOTS AND MAIN BURNERS**

### **2.9.1 Pilot burner shut off**

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

### **2.9.2 Viewing of burner 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.

### **2.9.3 Proving ignition**

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

### **2.9.4 Support of pilot burners, 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.

### **2.9.5 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.

### **2.9.6 Burner supports**

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

### **2.9.7 Fixing of gas manifolds**

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

### **2.9.8 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.

### **2.9.9 Restriction on gauze over primary air ports**

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

### **2.9.10 Aeration adjustments 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 flue terminals, draught diverter relief openings and openings for the entry of air for combustion are part of the appliance structure and are unlikely to be obstructed by cabinets, walls or partitions on or in which the appliance is installed.

### 2.10.2 Design of flue connection—blockage

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

### 2.10.3 Design of flue connection—compatibility

Flue connections, both vertical and horizontal, shall be suitable for connection to circular or rectangular metal flue pipe and shall conform to the dimensions given in Tables 2.3(a) and 2.3(b). The use of an adaptor whose termination conforms to these dimensions and which is supplied with the appliance shall be considered satisfactory.

**TABLE 2.3(a)**  
**CIRCULAR FLUE CONNECTION**

| Nominal pipe diameter<br>mm | Diameter of flue connection<br>mm                    |                                                      |
|-----------------------------|------------------------------------------------------|------------------------------------------------------|
|                             | 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 2.3(b)**  
**RECTANGULAR FLUE CONNECTION (SPIGOT)**

| Nominal size<br>mm | Dimensions of flue connection<br>mm                  |                                                     |
|--------------------|------------------------------------------------------|-----------------------------------------------------|
|                    | Width                                                | Depth                                               |
| 250 x 50           | 247 $\begin{smallmatrix} +0 \\ -5 \end{smallmatrix}$ | 45 $\begin{smallmatrix} +0 \\ -5 \end{smallmatrix}$ |
| 300 x 65           | 295 $\begin{smallmatrix} +0 \\ -5 \end{smallmatrix}$ | 60 $\begin{smallmatrix} +0 \\ -5 \end{smallmatrix}$ |

### 2.10.4 Design of flue connection—engagement

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.

## 2.11 MARKINGS

### 2.11.1 Label related to domestic use

A permanent label shall be attached in a prominent position on each appliance and its carton stating:

‘THIS APPLIANCE IS NOT CERTIFIED FOR INDOOR DOMESTIC USE’.

### 2.11.2 Markings on packaging—installation

Except for portable and mobile appliances, the packing case of every appliance shall be marked in a prominent position:

‘TO BE INSTALLED ONLY BY AN AUTHORISED PERSON’.

The packing case of every appliance shall display a clear marking indicating the maximum packaged weight in kilograms.

### 2.11.3 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 2.11.4.

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

### 2.11.4 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.

### 2.11.5 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 2.11.4 is acceptable. Alternatively the injector size may be marked on the appliance.

### 2.11.6 Direction of rotation of fans

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

### 2.11.7 Other permanent markings on appliances

Appliances shall be provided with clear and permanent markings readily accessible and easy to read when the appliance is in the installed position and such markings shall include the following:

- (a) Manufacturer's trade name.
- (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) Electrical markings as required by the appropriate electricity authority.
- (g) Wiring diagrams.
- (h) The certification number.
- (i) A label in a prominent position reading either —
  - (i) 'THIS APPLIANCE MUST BE FLUED'or, for units which are also certified for flueless operation —

- (ii) 'ADEQUATE VENTILATION MUST BE PROVIDED IN ACCORDANCE WITH THE REQUIREMENTS OF THE APPROPRIATE AUTHORITY'.

(j) Any additional information called for in other sections of this Standard.

### **2.11.8 Markings of doors and covers**

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

### **2.11.9 Marking of parts that may affect combustion**

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

## **2.12 INSTRUCTIONS**

### **2.12.1 Installation**

#### **2.12.1.1 *Instructions attached to the appliance***

Each appliance shall be supplied with written and diagrammatic installation instructions that include reference to at least the following:

- (a) Model or type of appliance.
- (b) Gas or gases for which the appliance is intended and data such as gas consumption, pressures, etc., or reference to the appliance data plates.
- (c) Installation shall be in accordance with the manufacturer's installation instructions, local gas fitting regulations, municipal building codes, electrical wiring regulations, AS 5601, and any other relevant statutory regulations, as well as the requirements of the local gas or electricity authority.
- (d) Overall dimensions and sufficient diagrams to indicate all measurements 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) Details of the methods of connection and alternatives.
- (g) Required surroundings of the appliance, clearance from fixings, walls, floors, or other combustible materials.
- (h) Special conditions of installation, which may be required as the result of the certification test.
- (i) Special conditions which must be avoided, e.g. marine environment, and any conditions necessary to ensure optimum performance.
- (j) Details of any assembly work required to be done by the installer.
- (k) Definite instructions to test the operation of the appliance before leaving.
- (l) Instructions with regard to the removal of any transit protection.
- (m) Details of the necessary testing and instructions for minor adjustments.
- (n) Instructions on the procedure to be adopted if the appliance cannot be adjusted to perform correctly.
- (o) Fitting of a means of manual isolation to each appliance.
- (p) In the case of unflued appliances, ventilation requirements for flueless heaters in accordance with local authority rules or AS 5601.

- (q) Reference to AS 5601 for pipe sizing details.
- (r) Recommended location of the appliance; clearance from fixings, walls, floors, or other combustible materials.
- (s) Method of installation where this affects other trades. Details should be given for the other trades e.g. where electrical connections are required, details should be given for electrician.
- (t) Gas inlet connection, details of:
  - (i) Size and type of gas inlet connection.
  - (ii) Location of and/or alternative locations of gas inlet connections.
- (u) Flueing of appliance, details of:
  - (i) Size.
  - (ii) Position of flue outlet.
  - (iii) Materials and methods which may be used and respective locations, i.e. termination of all types of flueing recommended.
- (v) Ventilation, details of:
  - (i) Size and location of combustion air openings.
  - (ii) Size and location of openings for draught diverter dilution.
  - (iii) Where an appliance can be installed in a housing or is designed to be installed in a housing, diagrams showing method of installation, ventilation requirements, clearances and minimum dimensions of housing.

## 2.12.2 Operating

### 2.12.2.1 *Operating instructions supplied with appliance*

Operating instructions shall be supplied with each appliance, covering each separate function of the appliance and such dismantling, cleaning and assembly as is necessary for the user.

### 2.12.2.2 *Abnormal operation, maintenance schedule, service and replacement parts*

The instructions shall—

- (a) assist the user to recognize abnormal operation which requires service;
- (b) recommend a maintenance schedule for the life expectancy of the appliance; and
- (c) include a reference as to where service and any necessary replacement parts may be obtained.

### 2.12.2.3 *Warning statement*

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.’

## 2.12.3 Servicing

### 2.12.3.1 *Servicing instructions remaining with the customer*

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

## SECTION 3      PRELIMINARY TESTS - LINE GASES

### 3.1 GENERAL REQUIREMENTS

#### 3.1.1 Nominal gas consumption

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 shall be carried out using the following test gases (see Table 1.1 for characteristics):

- (a) Appliances intended for use with natural gas shall be tested using available natural gas but in the case of dispute or borderline results test gas 'N' shall be used.
- (b) Appliances intended for use with town gas shall be tested using available town gas but in the case of dispute or borderline results test gas 'D' shall be used.
- (c) Appliances intended for use with propane only shall be tested with test gas 'X'.
- (d) Appliances intended for use with butane only shall be tested with test gas 'Y'.
- (e) Appliances intended for use with universal LPG shall be tested with test gas 'X' for all performance tests except for Clauses 5.8 and 5.9 where test gas 'Y' shall be used.  
NOTE: Nominal gas consumption shall be rated on test gas 'X' and this is the figure to be stated on the appliance data plate.
- (f) Appliances intended for use with tempered LPG shall be tested with test gas 'T'.

### 3.2 PREPARATION FOR TESTING

#### 3.2.1 Electrical safety requirements

The appliance shall comply with the following electrical safety requirements:

- (a) When the appliance is disconnected from the power supply the measured resistance between the earth pin of the plug and any exposed metal on the appliance shall not exceed 1  $\Omega$  for rotating parts and 0.1  $\Omega$  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 M $\Omega$ . The resistance for double insulated equipment shall not be less than 10 M $\Omega$ .

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

#### 3.2.2 Setting up the appliance for testing

The appliance shall be set up in accordance with the manufacturer's instructions unless otherwise specified in this Standard and checked to ensure that gas consumption, aeration, temperature settings and other adjustments have been made in accordance with the manufacturer's recommendations. Adjustments should be made with the test gas which is applicable (see Clause 3.1.2) with the inlet pressure set at normal test gas pressure (see Clause 1.2.47).

### 3.2.3 Appliance regulator 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 that shall—
  - (i) be calibrated before use;  
NOTE: A graph should be provided showing the error or correction factor of the meter over as wide a range as possible.
  - (ii) be used with a saturator to ensure saturation of the gas.  
NOTE: It is permitted to use a calibrated dry gas meter or a calibrated flow meter for test purposes but, in case of dispute, the wet meter shall be the reference standard.
- (b) An adjustable regulator of adequate capacity fitted to the meter inlet.
- (c) Pressure gauges connected to meter inlet, appliance inlet and pressure test point, to read to the nearest 10 Pa.
- (d) A thermometer, graduated to at least 0.5°C installed to measure the gas temperature. The meter water temperature gives a sufficiently accurate figure.
- (e) A barometer to measure atmospheric pressure in the laboratory correct to 30 Pa.
- (f) A means of determining within 1% the heating value of the gas being used.
- (g) A means of determining within 2% the relative density of the gas being used.

## 3.3 GAS LEAKAGE

### 3.3.1 Gas tightness

The fully assembled appliance shall be gas tight when subjected to a gas pressure of 14.0 kPa.

### 3.3.2 Gas tightness after testing

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

### 3.3.3 Control of bleed lines

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.

### 3.4 GAS CONSUMPTION

#### 3.4.1 Tolerance on determined gas consumption

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

#### 3.4.2 Determined gas consumption of continuously burning pilots

The determined gas consumption of each continuously burning pilot shall not be more than 0.5 MJ/h except where heat is employed for operating a safety device, in which case it shall not exceed 1.0 MJ/h.

### 3.5 GAS PRESSURE REGULATORS

#### 3.5.1 Pressure regulator performance

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

### 3.6 IGNITION AND FLAME SAFEGUARD SYSTEMS

#### 3.6.1 All ignition and flame safeguard systems

The requirements of all parts of Clause 3.6.1 apply to all ignition and flame safeguard systems.

##### 3.6.1.1 *Aerated pilots*

Ignition systems with aerated pilots 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.

##### 3.6.1.2 *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.

##### 3.6.1.3 *Multi-port pilots*

Multi-port pilots shall conform with Clauses 3.6.1.1 and 3.6.1.2 with all ports blocked other than the one activating the flame safeguard sensor.

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

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

##### 3.6.1.5 *Flame safeguard*

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

##### 3.6.1.6 *Flame travel at ignition*

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

### 3.6.1.7 *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.

### 3.6.1.8 *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.

### 3.6.1.9 *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.

### 3.6.1.10 *Flame safeguard system—self check*

Flame safeguard systems other than ‘thermoelectric’ types shall incorporate a self-check of integral circuitry to prove that the system is not in the flame proved condition prior to start-up.

### 3.6.1.11 *Flame failure*

Flame failure of the supervised burners shall result in lockout in accordance with Clause 2.7.5.

### 3.6.1.12 *Flame establishment period—intermittent pilot*

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

### 3.6.1.13 *Flame safeguard system—shut off time*

The combined time for the flame safeguard 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;
- (c) 45 s where atmospheric type main burners are used and the total gas consumption exceeds 150 MJ/h up to and including 500 MJ/h;
- (d) 15 s for all other types of main burner up to and including 150 MJ/h; and
- (e) 3 s for all other types of main burner.

## 3.6.2 **Atmospheric burners with automatic burner ignition systems — additional requirements**

In addition to the requirements of Clause 3.6.1, the requirements of this Clause 3.6.2 apply to atmospheric burners with automatic burner ignition systems. Systems based on permanent pilots are exempted from this Clause.

### 3.6.2.1 *Start flame establishment period*

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

- (i) for start gas rates up to 50 MJ/h—15 s; and
- (ii) for start gas rates up to 4 MJ/h—90 s.

### 3.6.2.2 Gas flow rate at ignition

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 is the volume of the combustion chamber in m<sup>3</sup>

T is the start flame establishment period in seconds.

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—

- (i) there is no damage to the appliance;
- (ii) the burner does not light back; and
- (iii) there is no danger to persons or adjacent property.

### 3.6.2.3 Start flame proving period—gas flow rate exceeds Clause 3.6.2.2

Where the nominal gas consumption of the supervised burner exceeds the maximum gas flow rate permitted in Clause 3.6.2.2, 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.

### 3.6.2.4 Number of reignition attempts

The total number of reignition cycles after flame failure, and prior to lockout, shall be limited to 5.

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

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

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

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

### 3.6.3 Forced or induced draught burners with automatic burner ignition systems—additional requirements

In addition to the requirements of Clause 3.6.1, the requirements of this Clause 3.6.3 apply to forced or induced draught burners with automatic burner ignition systems. Systems based on permanent pilots are exempted from this Clause.