

Australian Standard™

**Industrial and commercial gas-fired
appliances**



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Australian Standard™

Industrial and commercial gas-fired appliances

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PREFACE

This Standard was reviewed by the Standards Australia Committee, AG-011, Gas Components and Industrial Equipment, to supersede AS 3814/AG 501—2002, *Industrial and commercial gas-fired appliances*. The Standard is republished without technical alterations.

The objective of this Standard is to provide uniform minimum requirements for the safe operation of gas-fired industrial appliances, and other large appliances used for commercial applications, which are not covered by any other Standard.

This Standard should not be regarded as a design specification or as an instruction manual; it has been prepared with due regard for gas rules and regulations now in force. In its preparation, consideration has been given to—

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

Explosions are the main hazard on the firing side of the equipment covered by the Standard, the basic cause being ignition of a combustible mixture in the combustion chamber or associated ductwork. The magnitude and intensity of the explosion will depend on both the quantity of combustibles present and the proportion of air with which the combustibles are mixed.

Explosions may be the result of one or more of the following—

- (i) improper design of equipment or control systems;
- (ii) equipment or control system malfunction, including valve leakage;
- (iii) interruption and restoration of gas or air supply causing loss of flame followed by delayed ignition of the resultant accumulation of a combustible mixture; or
- (iv) flame failure on a burner and subsequent ignition of the resultant accumulation of a combustible mixture.

The presence of a well-trained, reliable and competent operator provides a major contribution to safety.

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

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

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STANDARDS AUSTRALIA

Australian Standard

Industrial and commercial gas-fired appliances

SECTION 1 SCOPE, APPLICATION AND DEFINITIONS

1.1 SCOPE

1.1.1 General

This Standard provides minimum requirements for the design, construction and safe operation of Type B appliances that use town gas, natural gas, simulated natural gas, liquefied petroleum gas, tempered liquefied petroleum gas or any combination of these gases either together or with other fuels.

Construction requirements given relate only to matters affecting gas-firing or to any interconnection between the gas-firing system and the safety requirements of the appliance.

NOTE: Additional information regarding safety principles for industrial appliances is given in AS 1375.

The Standard does not cover all the requirements for the safety of the process carried out in the appliance. Other statutory and regulatory requirements may be applicable to the appliances and/or installations that fall within the scope of this Standard. It is the installer/manufacture's responsibility to ensure that appliances and/or installations comply with these requirements.

Installation requirements for appliances covered by this Standard are detailed in AS 5601.

1.1.2 Exclusions from Standard

The following appliances are excluded from this Standard:

- (a) Manually operated bunsen type burners.
- (b) Simple atmospheric burners that are not fitted into a combustion chamber and burn in an open ventilated space under the control of an operator.
- (c) Engines other than stationary engines.

1.2 APPLICATION

1.2.1 General

The requirements of this Standard shall be used in conjunction with, but do not take precedence over, the requirements of the technical regulator. The technical regulator may determine the extent of application of this Standard.

This Standard applies to—

- (a) the appliance; and
- (b) the component parts of the appliance whether supplied with the appliance or separately; and

- (c) Type B appliance approvals commenced after its publication date.

NOTES:

- 1 'Commenced', for the purpose of this Clause, means the point at which Type B acceptance has begun.
- 2 Appliances should comply with requirements of all authorities before being placed into service (e.g. electrical, water, environmental, occupational health and safety etc).

1.2.2 Appliance installation

Before an appliance is connected to a gas supply a submission containing the standard and technical data specified by the technical regulator shall be forwarded to the technical regulator, in accordance with the administrative procedures of the technical regulator.

NOTE: Typical data and procedural requirements are given in Appendices A and B.

1.2.3 New materials and methods

Materials or methods not prescribed in this Standard shall—

- (a) not necessarily be excluded from use if they are not specifically referred to; and
- (b) only be used if they are acceptable to the technical regulator.

1.2.4 Unusual installations

Certain gas installations or portions of installations that are unusual due to particular circumstances or methods may not be covered in detail by this Standard. Details of such gas installations shall be submitted to the technical regulator, and be acceptable, before any work commences.

1.2.5 Modification or relocation of an appliance

Where an appliance is modified or relocated, it shall be upgraded to meet the requirements of this Standard current at the time of the modification or relocation and be re-submitted to the technical regulator for approval, unless the technical regulator advises to the contrary.

1.3 REFERENCED DOCUMENTS

A list, with titles, of documents referred to in this Standard is given in Appendix C.

1.4 DEFINITIONS

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

1.4.1 Accessible

Access can be gained without hazard or undue difficulty for inspection, repair, renewal, or operational purposes.

1.4.2 Air curtain

A direct-fired air heater that discharges a curtain of air across an opening direct to outside.

1.4.3 Air-gas mixing machine

Any combination of proportioning control devices, blowers or compressors that supply mixtures of gas and air to burners where control and/or safety devices are installed between the mixing device and burner.

1.4.4 Appliance

An assembly, other than a vehicle refuelling appliance (VRA), part of which uses gas to produce flame, heat, light, power or special atmosphere and includes the following:

1.4.4.1 Type A appliance

An appliance for which a certification scheme exists.

1.4.4.2 *Type B appliance*

An appliance, with gas consumption in excess of 10 MJ/h, for which a certification scheme does not exist.

NOTE: A Type A appliance when used in an industrial/commercial application for which it was not intended is considered to be part of a Type B appliance. An example of this is a certified direct-fired space heater used as the heating/ventilating device in a spray/bake paint booth.

1.4.5 **Approved**

Acceptable to, and meeting the prescribed standards of, the technical regulator.

1.4.6 **Atmospheric burner**

See 'Burner'.

1.4.7 **Authorized installer**

A person appointed, licensed, authorized or otherwise permitted to carry out gasfitting work.

1.4.8 **Auto-ignition temperature**

The lowest temperature at which the rate of self-heating of a gas-air mixture exceeds the rate of heat loss to the surroundings, thus causing the mixture to ignite.

1.4.9 **Automatic burner**

See 'Burner'.

1.4.10 **Automatic ignition**

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

1.4.11 **Bleed line**

A small diameter pipe or tube that conveys gas to a safe place from a gas component that discharges small rates of gas as part of its normal operation.

1.4.12 **Burner**

For the purpose of this Standard the following is to apply:

1.4.12.1 *Atmospheric burner*

A system where all of the air for combustion is produced by the inspirating effect of the gas or the natural draught in the combustion chamber or combination of the two without mechanical assistance.

1.4.12.2 *Automatic burner*

A burner system that, 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.

1.4.12.3 *Forced draught burner*

A system where all of the air, oxygen or a mixture of the two used for combustion is provided under pressure.

1.4.12.4 *Induced draught burner*

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

1.4.12.5 *Multi-fuel alternative burner*

A multi-fuel burner that can use only one fuel at a time.

1.4.12.6 Multi-fuel burner

A burner that can use more than one fuel.

1.4.12.7 Multi-fuel simultaneous burner

A multi-fuel burner that can use more than one fuel at a time.

1.4.12.8 Part automatic burner

A burner system that includes any self-acting operation.

1.4.13 Burner unit

A number of burners, fed from the same manifold, controlled together, having one supervised ignition source and performing as a single burner.

1.4.14 Certified/Certification

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

1.4.15 Certifying body

A body acceptable to the technical regulator that provides assurance of compliance of appliances and components with nominated Standards and other accepted safety criteria.

1.4.16 Combination gas control

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

1.4.17 Combustion products

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

1.4.18 Common flue

See 'Flue'.

1.4.19 Critical time

The time required to build up a pocket or concentration of unignited gas of such quantity and proportions that, if ignited, the pressure of the resultant explosion could equal the permissible safe internal pressure of the appliance.

1.4.20 Cross lighting

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

1.4.21 Damper

An adjustable device for controlling—

- (a) air flow in a forced or induced draught air system;
- (b) the flow of flue products in a flue system;
- (c) the recirculation of air, flue gases or process gases; or
- (d) the flow of any other fluids.

1.4.22 Direct-fired air heater

An appliance for heating a forced air stream where the combustion products are released with the heated air.

1.4.23 Direct-fired oven

An oven in which the combustion products flow through the oven compartment.

1.4.24 Double block and vent

See 'Safety shut off system double block and vent'.

1.4.25 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.

1.4.26 Electronic flame safeguard

A flame safeguard utilising electronic components to perform its function.

1.4.27 Excess air

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

1.4.28 Flame abnormality

A flame condition which results in flame lift, floating, light back, appreciable yellow tipping, carbon deposition or objectionable odour.

1.4.29 Flame detector

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

1.4.30 Flame establishment period

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

1.4.31 Flame failure response time

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

1.4.32 Flame lift

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

1.4.33 Flame proving period

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

1.4.34 Flame safeguard

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

1.4.35 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.

1.4.36 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. Types of flue include:

1.4.36.1 Common flue

A flue conveying the flue gases from two or more appliances.

1.4.36.2 Natural draught flue

A flue in which the draught is provided by the buoyancy effect of the hot gases in it.

1.4.37 Flue gases

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

1.4.38 Flue system

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

1.4.39 Flue terminal

The point at which flue gases discharge from a flue.

1.4.40 Flued appliance

See 'Open flued appliance'.

1.4.41 Flueless appliance

See 'Indoor flueless appliance'.

1.4.42 Forced draught burner

See 'Burner'.

1.4.43 Forced or induced draught combustion system

A combustion system where all or part of the air for combustion is provided by a fan or other mechanical device which is an integral part of the combustion system.

1.4.44 Gas

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

1.4.44.1 Natural gas (NG)

A hydrocarbon gas consisting mainly of methane.

1.4.44.2 Simulated natural gas (SNG)

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

1.4.44.3 Town gas (TG)

A gas manufactured from coal or petroleum feedstocks.

1.4.44.4 Tempered liquefied petroleum gas (TLP)

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

1.4.44.5 Liquefied petroleum gas (LP gas)

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

1.4.45 Gas consumption

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

1.4.46 Gasfitting work

Refer to technical regulator regulations or requirements.

1.4.47 Gas, high pressure

Gas supplied at pressures of over 200 kPa and not exceeding 1050 kPa.

1.4.48 Gas, low pressure

Gas supplied at pressures of 7 kPa or less.

1.4.49 Gas, medium pressure

Gas supplied at pressures of over 7 kPa and up to 200 kPa.

1.4.50 Gas pressure regulator

A device that automatically regulates the outlet pressure of the gas passing through it to a predetermined value.

1.4.51 Gas tight

Meets the leak testing requirements of the appropriate Standard.

1.4.52 High gas pressure detector

A sensing device that is actuated when pressure rises above a pre-set value.

1.4.53 Hose

Flexible tube or pipe of multiple layer construction.

1.4.54 Hose assembly

Flexible hose complete with end couplings.

1.4.55 Hot water boiler

Any vessel wherein water is intended to be heated to a temperature exceeding 99°C by the application of heat from the combustion products to the vessel without the generation of steam.

1.4.56 Ignition temperature

The lowest temperature at which heat is generated by combustion faster than heat is lost to the surroundings, and combustion thus becomes self-propagating.

1.4.57 In service

An appliance connected to the gas supply irrespective of the on or off status of the isolation valve.

1.4.58 Indoor flueless appliance

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

1.4.59 Induced draught burner

See 'Burner'.

1.4.60 Injector

A device that 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 tube or throat.

1.4.61 Interlock

A device or function that ensures that the operation of items of equipment is dependent upon the fulfilment of predetermined conditions by other items of equipment.

1.4.62 Intermittent pilot

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

1.4.63 Interrupted pilot

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

1.4.64 Leakage detection system

A means of checking that the safety shut off valves and the vent valves, where fitted, of a safety shut off system are gas tight.

1.4.65 Light back

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

1.4.66 Limit device

A device that 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.

1.4.67 Lockout

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

1.4.68 Lower explosive limit (LEL)

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

1.4.69 Low-gas-pressure detector

A sensing device that is actuated when the gas pressure falls below a pre-set value.

1.4.70 Manual ignition

The lighting of gas at a burner by a manual operation whenever gas flows from the burner.

1.4.71 Mixing blower

A motor-driven blower, the suction side of which is supplied with a mixture of air and gas from an appropriate proportioning device, which supplies a burner(s) in the immediate vicinity of the blower and has no control and/or safety device between the blower and burner.

1.4.72 Mixing tube

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

1.4.73 Modification

An upgrade to any or all of: gas valve train equipment; combustion/purge air system; flame safeguard system; burner management system (not involving like for like exchange of components) that changes the safety integrity of the existing system or takes the gas appliance out of its original certification criteria.

1.4.74 Multi-fuel alternative burner

See 'Burner'.

1.4.75 Multi-fuel burner

See 'Burner'.

1.4.76 Multi-fuel simultaneous burner

See 'Burner'.

1.4.77 Natural draught

The flow produced by the tendency of warmed gases to rise.

1.4.78 Natural draught burner

See 'Atmospheric burner' under 'Burner'.

1.4.79 Natural draught flue

See 'Flue'.

1.4.80 Nominal gas consumption

The appliance gas consumption, in megajoules per hour, stated in specifications, data plates, instructions and general communications.

1.4.81 Non-return valve

A device designed to operate automatically to prevent reversal of flow in a pipe.

1.4.82 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.

1.4.83 Operating pressure

The gas pressure that the consumer piping or the appliance is or will be subjected to under normal operating conditions.

1.4.84 Over-pressure protection system

A system preventing the pressure in piping or in an appliance from exceeding a predetermined value.

1.4.85 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 from exceeding a predetermined level.

1.4.86 Over-temperature limiting device

See 'Relief device'.

1.4.87 Part automatic burner

See 'Burner'.

1.4.88 Permanent pilot

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

1.4.89 Pilot

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

1.4.90 Position indicator switch

A switch that is activated when a particular position is reached.

1.4.91 Closed position indicator switch

A switch which indicates 'closed' when the valve is within 1 mm of the closed position or has reduced the flow to 10% or less of the equivalent fully open flow for a given pressure differential.

1.4.92 Open position indicator switch

A switch that indicates 'open' when the valve is within 10% of the fully open position.

1.4.93 Position-proving system

A means of checking that the safety shut off valves and vent valves of a double block and vent safety shut off system are in the correct position.

1.4.94 Process after-burner

A gas-fired appliance used specifically for the incineration of exhaust gases containing combustible gases or dust in concentrations below the lower explosive limit.

1.4.95 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.

1.4.96 Programming flame safeguard

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

1.4.97 Proof-of-closure switch

A switch fitted to a safety shut off valve that is only activated after the valve is closed and incorporates over-travel of the valve past the position where the valve is just closed.

1.4.98 Protected pilot

A pilot that is fitted with a flame safeguard.

1.4.99 Purge (or purging)

With respect to an appliance means the removal of combustibles.

1.4.100 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.

1.4.101 Rated working pressure

The maximum allowable inlet pressure specified by the manufacturer.

1.4.102 Regulator

See 'Gas pressure regulator'.

1.4.103 Relief device

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

1.4.104 Safe start check

A check of a flame safeguard system that will prevent an ignition attempt from occurring if the system is in the flame proved condition before any gas valves are energized as part of an ignition attempt.

1.4.105 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.

1.4.106 Safety shut off system

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

1.4.107 Safety shut off system, double block and vent

A safety shut off system that incorporates two safety shut off valves in series, with the space between the two valves automatically vented. These valves are interlocked so that when the safety shut off valves are closed, the vent valve is open and vice versa.

1.4.108 Safety shut off valve

An automatic shut off valve that meets the requirements of AS 4629 and is used to shut off gas supply to an appliance when a signal is generated indicating the approach of an unsafe condition.

1.4.109 Set pressure

The mean pressure at which a device will actuate at a specific adjustment.

1.4.110 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.

1.4.111 Steam boiler

Any vessel wherein steam is intended to be generated at a pressure above that of the atmosphere by the application of heat from the combustion products to the vessel.

1.4.112 Stoichiometric combustion

The theoretical combustion of fuel in air such that no combustible agent or residual oxygen remains in the combustion products.

1.4.113 Supervised burner

A burner fitted with a flame safeguard system.

1.4.114 Supervised pilot

See 'Protected pilot'.

1.4.115 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).

1.4.116 Temperature limit device

A device that automatically causes the gas supply to be interrupted when the temperature at the control point reaches a predetermined limit.

1.4.117 Test firing valve

A manual shut off valve which can be used for turning a burner on or off in order to test it for satisfactory ignition, flame stability, etc.

1.4.118 Thermostat

A device that automatically maintains a predetermined temperature in an appliance.

1.4.119 Valve

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

1.4.120 Valve train

A combination of valves, regulators, pipe pieces, unions, etc., which form an integrated system for flow or pressure control and safe operation of a burner.

1.4.121 Vent line

A pipe that is connected to a gas pressure regulator, relief valve or a double block and vent safety shut off system, and will convey gas to a safe location.

1.4.122 Vent valve, double block and vent safety shut off system

A valve in the vent line of a double block and vent safety shut off system that automatically opens when de-energized and automatically closes when energized.

1.4.123 Water heater

An appliance for the supply of water at a temperature not exceeding 99°C.

SECTION 2 REQUIREMENTS FOR DESIGN AND CONSTRUCTION

2.1 GENERAL REQUIREMENTS

2.1.1 Appliance design

Appliance design shall comply with the requirements of AS 1375 in regard to the overall safety of the process.

NOTE: Requirements for the prevention and relief of explosions due to such process hazards as combustible gases, vapours or dusts are given in AS 1375.

2.1.2 Suitability for location

An appliance shall be designed to ensure safe, satisfactory and reliable operation in its intended location.

2.1.3 Controls and indicating devices

Controls and indicating devices fitted to an appliance shall—

- (a) be sufficient to provide complete and safe control of the appliance; and
- (b) where frequent observation or adjustment is required, be conveniently located.

2.1.4 Design of adjustable devices

An adjustable device that affects an appliance shall be designed so that it—

- (a) can be readily and conveniently adjusted as required;
- (b) is, if important to the safety of the equipment, protected against unauthorized interference;
- (c) is not unduly influenced by temperature change;
- (d) is not susceptible to sticking or seizing under normal operating conditions of use; and
- (e) incorporates a locking or holding arrangement to prevent subsequent movement through accident, vibration, or expansion.

NOTE: The tightening of any such locking device should not alter any setting.

2.1.5 Appliance to be well constructed

All component parts of an appliance shall be installed in accordance with the manufacturer's specification and be suitable for the application, well fitted and not warped, bent, broken, or otherwise damaged.

2.1.6 Appliance parts to be secure against accidental displacement

Every part of an appliance shall be secure against accidental displacement.

2.1.7 Appliance parts to be secure for satisfactory operation

Essential parts of an appliance shall be secured to maintain their position to ensure satisfactory operation of the appliance.

NOTE: This requirement is to ensure that essential parts of the appliance maintain their relationship during normal operation and after any maintenance; e.g. flame detector in relation to the burner.

2.1.8 Appliance to be free of sharp edges

All parts of an appliance with which a person may come in contact during normal operation, adjustment or servicing shall be free from sharp projections or edges and projecting screw ends.

2.1.9 Appliance supports to be of adequate strength

Appliance supports shall be of adequate strength to withstand the total weight of the appliance in service.

2.1.10 Provision to be made for sampling flue gases

Provision shall be made for obtaining samples of flue gas for analysis.

2.2 CONTROLS, BURNER AND SAFETY DEVICE ACCESS

All controls, burners and safety devices shall be accessible for any of the following:

- (a) Normal operation.
- (b) Normal servicing.
- (c) Functional adjustment.
- (d) Testing.
- (e) Replacement.

NOTE: Manifold assemblies that permit removal of control(s) intact for servicing are considered to meet this requirement. Removal of an access door to a control compartment is considered acceptable.

2.3 FLAME VISIBILITY

2.3.1 Flame to be visible to maintenance personnel

It shall be possible for maintenance or adjusting personnel to safely view a flame, either by direct sight or by means of a remote viewing device equivalent to direct sight.

NOTES:

- 1 The removal of a panel or part to allow viewing is permissible provided that there is no hazard involved and combustion is not significantly affected (see Clause 3.6.1).
- 2 The location of a viewing device in or adjacent to an explosion relief panel, or other similar area designed to relieve pressure or allow the passage of flame, gas or combustion products is not considered to meet this requirement.

2.3.2 Visual indication of flame to operator

It shall be possible for an operator to:

- (a) At any time, safely ensure visually that the main or pilot burner is alight.

NOTE: Reflected glare or indicator lamps may be considered adequate for this purpose.

- (b) Where manually operated final burner controls are fitted, have a clear view of the main and pilot flames.

2.4 TEMPERATURES OF SURFACES AND COMPONENTS

Appliance design shall ensure that the surface temperatures of appliance controls intended to be operated shall not present a danger to the user (see Table 2.1).

2.5 RESTRICTION ON ELECTRICAL CONNECTIONS

2.5.1 Ease of connection

Electrical components or assemblies that 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.

NOTE: 'Extra-low voltage' means not exceeding 50 V a.c. and 120 V d.c. as defined by AS/NZS 3000.

2.5.2 Limit on cross-connection

Electrical plug/socket connectors to the start gas valves and the main gas valves shall not be interchangeable.

NOTE: The use of a wiring loom or arrangement that does not allow interchange without significant modification will satisfy this Clause.

2.6 ACCESSIBILITY OF MANUAL CONTROLS

Any ladder or step that may be needed to reach manual operating controls on an appliance shall be a permanent fixture.

2.7 MATERIALS

2.7.1 Materials to be adequate for their intended application

To ensure safe operation, materials used for the construction of an appliance shall be—

- (a) strong enough for their intended application;
- (b) sufficiently resistant to heat; and
- (c) sufficiently resistant to corrosion.

TABLE 2.1
RECOMMENDED MAXIMUM TEMPERATURES OF
SURFACES AND COMPONENTS

Surface or component	Maximum temperature °C
Adjacent combustible materials, floors, walls and the like	70
Surfaces intended to be handled, i.e. handles, knobs and the like, when made of— metals or materials with similar high conductivity; porcelain, vitreous enamel or similar medium conductivity material; or plastic, wood, rubber or similar low conductivity material	55
	65
	80
Surfaces likely to be accidentally touched, except those that are obviously hot including— metals or materials with similar high conductivity; porcelain, vitreous enamel or similar medium conductivity material; or plastic, rubber or similar low conductivity material	100
	115
	120
Bodies of valves, cocks, and the like	Maximum specified by the manufacturer
Controls and components containing non-metallic bellows, diaphragms, and the like (unless specifically designed for higher temperature)	65
Electrical and electronic components	Maximum specified by the manufacturer
Copper fuel piping	70

NOTES:

- 1 The above values are based on the temperature limits in the gas appliance Standards. In the gas appliance Standards the limits are given as above ambient values. An ambient of 20°C should be used for comparison purposes.
- 2 The limits specified for knobs, handles, surfaces, etc. are intended to provide a degree of personal protection. It is recognized that equivalent protection may be achieved by the provision of measures such as special protective clothing, gloves, guards. The need for such protection should be indicated by a notice.

2.7.2 Restriction on use of zinc-base die-castings

Zinc-base die-casting alloys shall not be used where—

- (a) failure may result in leakage or ignition of gas;
- (b) temperatures may exceed 90°C; or
- (c) the alloy is in contact with water.

2.7.3 Materials to be suitable for gas

Materials in contact with gas shall be suitable for use with the gas for which the equipment has been designed.

2.8 GAS PIPEWORK AND VALVE TRAINS

NOTE: Typical valve train arrangements are given in Appendix D.

2.8.1 Gas pipework and valve trains

Pipework and valve trains on an appliance shall—

- (a) comply with the requirements for pipework and fittings in AS 5601, and
- (b) be gas tight at operating pressure when assembled.

NOTE: Pipework may be required to be tested to higher pressures to meet the requirements of AS 5601. It may be necessary to isolate specific sections of the pipework to undergo this test.

2.8.2 Enclosure for a valve train

An enclosure for a valve train shall be ventilated at high and low level in accordance with the ventilation of gas equipment requirements in AS 5601.

2.8.3 Pressure rating of valve train components

2.8.3.1 *Upstream of and including appliance gas pressure regulator*

Piping and valve train components upstream of and including the appliance gas pressure regulator shall have a rated working pressure not less than—

- (a) the inlet pressure to the next upstream regulator; or
- (b) the setting of any over-pressure protection system fitted to the next upstream regulator.

2.8.3.2 *Downstream of appliance gas pressure regulator*

Piping and valve train components downstream of the appliance gas pressure regulator shall have a minimum rated working pressure not less than the inlet pressure of the appliance regulator unless over-pressure protection is fitted which complies with Clause 2.10.

2.8.4 Requirements where pressurized air, oxygen or a standby gas is to be used

Where pressurized air, oxygen or a standby gas is to be used in conjunction with a gas valve train or burner, a suitable protective device(s) shall be installed in the piping as close as possible to and upstream of the point of interconnection of any gas and air, oxygen or standby gas lines, to prevent cross-contamination.

NOTE: Suitable protective devices include:

- (a) A check valve preferably fitted with a soft seat of non-metallic material that is compatible with gas.
- (b) A three-way valve that completely closes one outlet before opening the other.
- (c) A reverse-flow detector that controls a positive shut off valve.

- (d) A device, which mixes gas and combustion air and incorporates a double-diaphragm zero regulator, used in conjunction with a proportional mixing device, where the air or oxygen supply pressure does not exceed 7 kPa.

2.8.5 Multi-position manual control valves

Manual control valves having more than one operating position shall have the function of each position clearly indicated.

2.8.6 Design of valve handles, dials and pointers

Valve handles, movable dials and pointers shall be designed so that they—

- (a) are not capable of being incorrectly assembled;
- (b) are securely attached to their spindles; and
- (c) do not contain loose parts that may become detached when the valve handle, dial or pointer is removed.

2.8.7 Appliance isolating valve

2.8.7.1 *Appliance isolating valve to be fitted*

A quarter-turn manual shut off valve shall be fitted to isolate all gas to the appliance.

2.8.7.2 *Requirements for appliance isolating valve*

The appliance isolating valve shall comply with all of the following:

- (a) Subject to (b) meet the Type 1 requirements of AS 4617 and be certified.
- (b) Be capable of being connected to the inlet piping such that, when the outlet piping is disconnected from it, the valve will remain securely attached to the inlet piping.
- (c) Be suitable for the application.

2.8.7.3 *Location of appliance isolating valve*

The appliance isolating valve shall be—

- (a) located upstream of—
 - (i) all other controls, and
 - (ii) the start gas line;
- (b) in close proximity to the appliance; and
- (c) accessible to enable quick isolation of the gas supply.

2.8.7.4 *Identification of appliance isolating valve*

Where the location of the appliance isolating valve is such that the valve is not readily identifiable, a notice shall be provided to clearly indicate—

- (a) the function of the valve; and
- (b) the appliance that it isolates.

2.8.7.5 *Connection of appliance isolating valve*

The valve train shall be connected to the appliance isolating valve by means of a flange or union.

NOTE: This is to enable the valve train to be disconnected from the gas supply.

2.8.8 Main burner isolation for commissioning

For the purposes of commissioning at the start gas rate, a permanent means shall be provided to prevent gas from flowing at rates other than the start gas rate specified in Clause 3.2.3.

NOTE: Suitable means of isolation include the following:

- (a) A manual shut off valve (test firing valve) located immediately downstream of the main gas safety shut off valve(s).
- (b) A test firing valve located between the start gas take-off point and the first main gas safety shut off valve.
- (c) A clearly marked removable electrical plug, positive action switch or link in the electrical supply to the main-gas safety shut off valves (or the main-gas control function within the safety shut off valves), which cannot be inadvertently or incorrectly reconnected to the electrical supply. Disconnection of electrical wiring does not satisfy this requirement.

2.8.9 Restriction on test firing valve

A test firing valve, if fitted, shall not be used to regulate gas input to the main burner under normal operating conditions.

2.8.10 Pilot burner isolating valve

A manual shut off valve shall—

- (a) be fitted to the gas supply line of a pilot burner;
- (b) enable the gas supply to a pilot burner to be turned off independently of the main burner; and
- (c) meet the Type 1 requirements of AS 4617 and be certified.

NOTE: The use of a manually-opened pilot take-off port incorporated in a certified thermoelectric flame safeguard, meeting the requirements of AS 4620 or AS 4624, will satisfy the requirements of this Clause.

2.9 GAS PRESSURE REGULATION

2.9.1 Gas pressure regulator to be fitted

A gas pressure regulator shall be fitted to—

- (a) the main gas supply to a burner or group of burners, unless some other equally effective means of pressure control is provided, other than the service regulator; and
- (b) the start gas supply, unless both the following apply—
 - (i) the start gas take-off point is downstream of the main gas pressure regulator; and
 - (ii) the main gas pressure regulator complies with Clause 2.9.3 at the start gas rate.

NOTE: In the case of a pilot burner, significant flame shrinkage of the pilot should not occur during the main-flame establishment period.

2.9.2 Requirements for a gas pressure regulator

The requirements for a gas pressure regulator are as follows—

- (a) a regulator with a maximum design inlet pressure not exceeding 7 kPa and of a nominal size not exceeding 50 mm shall meet the Grade 10 requirements of AS 4618 and be certified; or

- (b) a regulator shall be of the lock-up type with a lock-up pressure not greater than 25% above the set outlet pressure where any of the following apply—
 - (i) the nominal inlet pressure for the regulator exceeds 7 kPa;
 - (ii) the design pressure drop across the regulator is greater than 20% of the nominal inlet pressure; or
 - (iii) the nominal size exceeds 50 mm.

2.9.3 Gas pressure regulator accuracy

Over the controlled flow rate range, a gas pressure regulator shall maintain the outlet pressure within plus or minus 10% of the set pressure.

2.9.4 Position of gas pressure regulator

A gas pressure regulator shall be positioned so that—

- (a) it complies with the requirements of Clause 2.2;
- (b) the breather vent outlet cannot be readily blocked; and
- (c) the possibility of ignition of any gas leaking from the breather vent outlet is minimized.

NOTE: A gas pressure regulator should be located upstream of the safety shut off valves unless a downstream location will not adversely affect burner light-up, and the requirements of Clause 2.9.1 are met.

2.9.5 Venting of gas pressure regulator

A gas pressure regulator shall be vented in accordance with AS 5601.

NOTE: A restricting orifice in a regulator breather vent outlet may be fitted, provided it does not adversely affect the operation of the regulator.

2.10 GAS OVER-PRESSURE PROTECTION

2.10.1 Requirement where over-pressure protection shuts off the gas supply

Where an over-pressure protection system shuts off the gas supply, it shall require a manual reset to restore the supply.

2.10.2 Where over-pressure protection system is to be fitted

An over-pressure protection system shall be fitted where any of the following apply:

- (a) The rated working pressure of any piping or valve train component downstream of the appliance gas pressure regulator does not otherwise comply with the requirements of Clause 2.8.3.2.
- (b) The inlet pressure to the last regulator before a burner exceeds 7 kPa and is more than 35% above the minimum operating outlet pressure, unless the burner can maintain satisfactory combustion, in accordance with Clause 3.6.1, with the regulator in the wide open position.

NOTE: Where a component performs the function of both gas pressure regulator and air/gas ratio control in response to combustion air pressure changes, the minimum operating gas pressure is taken to be the outlet pressure at the maximum gas flow rate.

- (c) The failure of a regulator could result in the start gas rate exceeding the maximum allowable in Clause 3.2.3.

2.10.3 Setting of over-pressure protection system

The over-pressure protection system shall be set to ensure that—

- (a) no piping or valve train component can be subjected to a pressure in excess of its rated working pressure; and
- (b) where Clause 2.10.2(b) applies, the following requirements are met:
 - (i) Where a separate flow rate control valve is used, the shut off pressure at the system sensing point shall not exceed 35% above the minimum operating pressure with the appliance operated over its entire firing range.
 - 1 A higher set pressure may allow the air-gas ratio to fall below 84% of the stoichiometric rate (i.e. air/gas mixture is fuel rich), and allow carbon monoxide to be formed in sufficient quantities to form an explosive mixture.
 - 2 In the case where the pressure at the burner exceeds the critical ratio, then the setting of the overpressure switch ensures that at the trip point the aeration level should not fall below 84% of stoichiometric.
 - (ii) Where a combination gas control performs the function of both gas pressure regulator and air/gas ratio control in response to combustion air pressure changes, the shut off pressure at the system sensing point shall be as low as possible without causing nuisance shutdowns but shall not exceed 35% above the pressure at the highest normal firing rate.

NOTE: In order to prevent the production of excessive quantities of carbon monoxide at less than the maximum burner firing rate, the shut off pressure should be set to the lowest setting possible without nuisance shutdowns occurring.

2.10.4 Location of over-pressure protection system sensing point

The sensing point for the over-pressure protection system shall be located—

- (a) to ensure that the requirements of Clause 2.10.3(a) can be met; and
- (b) downstream of a gas pressure regulator; or
- (c) downstream of a combination gas control performing the function of both gas pressure regulator and air/gas ratio control in response to combustion air pressure changes.

NOTE: The sensing point should not be located between double block valves.

2.11 GAS LOW-PRESSURE PROTECTION

2.11.1 Low-gas-pressure detector to be fitted

A low-gas-pressure detector shall be fitted where a reduction in supply pressure may cause a burner to become unstable or combustion to become unsatisfactory before the flame safeguard system goes to lockout.

NOTE: A low-pressure trip valve on the gas pressure regulator or a low-pressure switch connected into the safety shut off circuit are acceptable methods.

2.11.2 Requirements of low-gas-pressure detector

A low-gas-pressure detector shall—

- (a) be downstream of the appliance gas pressure regulator; and
- (b) cause safety shutdown of all burners affected by an under-pressure condition.

2.12 GAS PRESSURE TEST POINTS

2.12.1 Location of pressure test points

A gas pressure test point shall be provided at the outlet of each component in the valve train including the appliance isolating valve.

2.12.2 Maximum orifice size of a pressure test point

The diameter of a restricting orifice in a non-self-sealing gas pressure test point shall not exceed 1 mm.

2.12.3 Sealing of a pressure test point

A gas pressure test point shall be provided with a means of sealing the outlet and, where the operating pressure exceeds 7 kPa, it shall be of a self-sealing type or fitted with a manual shut off valve.

2.13 GAS FILTER

2.13.1 Filter to be fitted

A filter shall be fitted where the nominal inlet pressure to the appliance regulator for the main burner or start gas supply exceeds 7 kPa.

2.13.2 Requirements and location of filter

The filter(s) required by Clause 2.13.1 shall—

- (a) prevent the passage of foreign particles larger than 1 mm;
- (b) be located so that gas to all safety shut off valves is filtered; and
- (c) be located downstream of the appliance isolating valve and not more than 5 m upstream from the first safety shut off valve.

NOTES:

- 1 Where possible, the location of the filter should be immediately downstream of the appliance isolating valve.
- 2 A safety shut off valve that incorporates a filter in its design may meet these requirements.

2.14 SAFETY SHUT OFF SYSTEMS

2.14.1 Safety shut off valve and vent valve

Safety shut off valves and vent valves shall comply with AS 4629 and be certified except where a safety shut off valve is part of a thermoelectric flame safeguard, in which case it shall comply with AS 4620 or AS 4624 and be certified.

NOTE: Where a class of automatic shut off valve or vent valve is referred to, the following classification of valves applies:

- (a) Class 1—An automatic shut off valve having the tightest shut off requirements with respect to closure against reverse flow conditions.
- (b) Class 2—An automatic shut off valve with a lower shut off requirement than a Class 1 valve with respect to closure against reverse flow.
- (c) Class 3—An automatic shut off valve with no closure requirements against reverse flow.

2.14.2 Function of safety shut off system

A safety shut off system shall be connected such that it will shut off at the approach or presence of an unsafe condition.

NOTE: The need for a safety shut off valve system is dependent on the fitting of flame safeguards and limit devices etc. that may be required by other Sections of this Standard. There may be occasions where none of these is fitted, e.g. in the case of a permanently manned, fully manual operation of a small open atmospheric burner where adequate operating instructions are displayed. In such a case, the function of the safety shut off valve system is performed by the operator closing a manual valve.

2.14.3 Safety shut off valve system requirements for main and start gas supplies

2.14.3.1 General

Except as permitted by Clauses 2.14.3.2 to 2.14.3.8, the main burner gas supply and the start gas supply shall be fitted with separate safety shut off valve systems that comply with the following minimum requirements, selected on the basis of the gas rate through the individual system:

- (a) Valves are to be of the Class 1 automatic shut off type.
- (b) For a gas rate not exceeding 5 GJ/h (1.4 MW), the valve arrangement is to be two valves in series.
- (c) For a lighter-than-air gas where the gas rate exceeds 5 GJ/h (1.4 MW) but does not exceed 20 GJ/h (5.5 MW), the valve arrangement is to be double block and vent.
- (d) For a lighter-than-air gas where the gas rate exceeds 20 GJ/h (5.5 MW) the valve arrangement is to be—
 - (i) double block and vent with a position-proving system; or
 - (ii) double block with a leakage detection system.
- (e) For a heavier-than-air gas where the gas rate exceeds 5 GJ/h (1.4 MW), the valve arrangement is to be double block with a leakage detection system.

NOTE: On multiple burner appliances the minimum requirement is double block on main gas for each individual burner.

2.14.3.2 Concession for atmospheric burner not exceeding 500MJ/h

An atmospheric burner not exceeding 500 MJ/h (140 kW), fitted with an intermittent or permanent pilot, or which is manually ignited, may use a single Class 3 safety shut off valve or a thermoelectric flame safeguard for the gas supply to both main and pilot burners.

2.14.3.3 Concession for atmospheric burner not exceeding 1GJ/h

An atmospheric burner not exceeding 1 GJ/h (275 kW), fitted with a permanent pilot or which is manually ignited, may use—

- (a) a single Class 1 safety shut off valve for the main burner gas supply and either a single Class 3 safety shut off valve or thermoelectric flame safeguard for the pilot burner gas supply; or
- (b) two Class 2 safety shut off valves for the main burner gas supply and a single Class 2 safety shut off valve for the pilot burner gas supply.

2.14.3.4 Concession for forced or induced draught burner up to 200MJ/h

A forced or induced draught burner not exceeding 200 MJ/h (60 kW) may use two Class 2 safety shut off valves for the main burner gas supply and a single Class 2 safety shut off valve for the start gas supply.

2.14.3.5 Concession for forced or induced draught burner up to 1GJ/h

A manually operated forced or induced draught burner not exceeding 1 GJ/h (275 kW) may use a single Class 1 safety shut off valve provided that the valve is only actuated by a flame safeguard or limit device.

2.14.3.6 Concession for a main burner up to 1 GJ/h igniting at low rate

A burner not exceeding 1 GJ/h (275 kW) that employs ignition of the main burner at a low rate in order to comply with Clause 3.2.3 may be fitted with one double block safety shut off valve system, to cover both main and start gas rates, provided the downstream safety shut off valve is a two-stage valve which employs an independently energized second stage such that energizing the second stage alone does not open the valve; and either—

- (a) incorporates a position indicator switch to ensure that the second stage is not operated before or during the start gas establishment period; or
- (b) incorporates a closed position indicator switch that complies with AS 4629 and is certified.

2.14.3.7 Concession for a burner using a separate start gas line

A start gas line may use a single Class 1 safety shut off valve provided the start gas rate—

- (a) does not exceed 500 MJ/h (140 kW); and
- (b) does not exceed 40% of the maximum rate specified in Clause 3.2.3.

2.14.3.8 Provision for start gas to be taken from between safety shut off valves

A start gas supply may be taken from between two main gas safety shut off valves provided the following requirements are complied with:

- (a) For a main burner with a total input not exceeding 500 MJ/h (140 kW) no additional start gas safety shut off valve is required provided—
 - (i) the downstream safety shut off valve is fitted with a closed position indicator switch; and
 - (ii) the start gas rate is not more than 40% of the rate permitted in Clause 3.2.3.

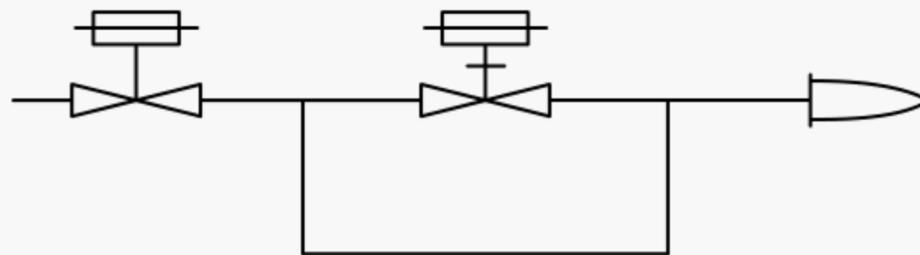


FIGURE 2.1 BURNERS UP TO 500 MJ/h (140 kW)

- (b) For a main burner with a total input exceeding 500 MJ/h (140 kW) but not exceeding 5 GJ/h (1.4 MW)—
 - (i) an additional Class 1 safety shut off valve is fitted in the start gas line; and
 - (ii) the downstream main gas safety shut off valve is fitted with a closed position indicator switch.

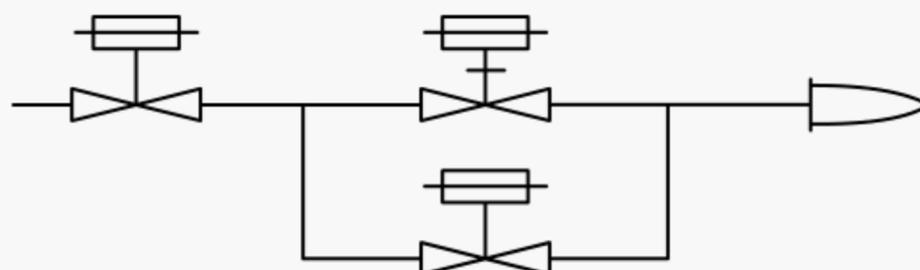


FIGURE 2.2 BURNERS OVER 500 MJ/h (140 kW) AND UP TO 5 GJ/h (1.4 MW)

- (c) For a main burner with a total input exceeding 5 GJ/h (1.4 MW) but not exceeding 20 GJ/h (5.5 MW) an additional Class 1 safety shut off valve is fitted in the start gas line and either—
- (i) a leakage detection system is fitted; or
 - (ii) the downstream main gas safety shut off valve is fitted with a proof-of-closure switch.

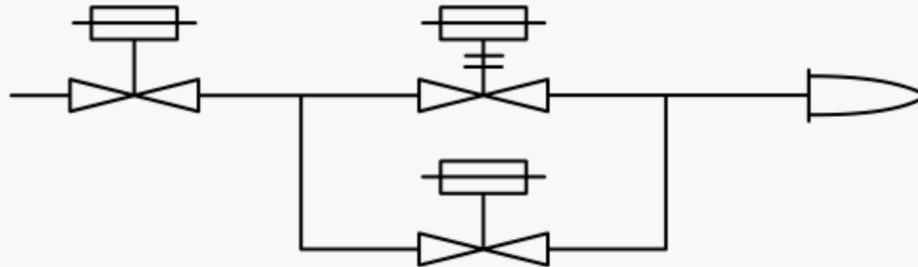


FIGURE 2.3 BURNERS OVER 5 GJ/h (1.4 MW) AND UP TO 20 GJ/h (5.5 MW)

- (d) For a main burner with a total input exceeding 20 GJ/h (5.5 MW) an additional Class 1 safety shut off valve is fitted in the start gas line and either—
- (i) a leakage detection system is fitted; or
 - (ii) all the safety shut off valves are fitted with proof-of-closure switches.

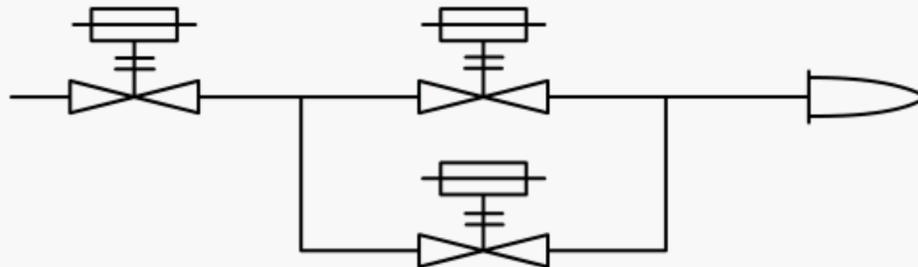


FIGURE 2.4 BURNERS OVER 20 GJ/h (5.5 MW)

NOTE: The use of leakage detection system is an alternative.

2.14.4 Energizing of automatic safety shut off valves

In a system which complies with Clause 2.14.3.8 no safety shut off valve shall be energized, except as part of a program in a leakage detection system, unless the following apply immediately prior to start-up—

- (a) all closed position indicator switches where fitted indicate correct valve position; and
- (b) all proof-of-closure switches where fitted prove correct valve position; and
- (c) a leakage detection system where fitted proves correct valve positions.

2.14.5 Ignition of main burner by separate pilot

Where a main burner is ignited by a separate pilot and the flow rate through the main burner safety shut off valve system exceeds 1 GJ/h (275 kW) at start-up, one of the safety shut off valves in the main burner gas supply, downstream of the pilot gas take off, shall have an opening time of not less than 5 s.

2.14.6 Requirements for a safety shut off valve and vent valve

2.14.6.1 Rated working pressure

The operating pressure of a safety shut off valve and vent valve shall not exceed the maximum rated working pressure.

2.14.6.2 Orientation

A safety shut off valve or vent valve shall be fitted in an orientation for which it is designed.

2.14.6.3 Size of vent valve for a double block and vent safety shut off system

Except as permitted in Clause 2.14.6.4, the minimum size of a vent valve that is part of a double block and vent safety shut off system shall comply with Table 2.2.

2.14.6.4 Size of vent valve for a leakage detection system

The size of the valve in the vent line of a leakage detection system shall not be less than 8 mm.

2.14.6.5 Arrangement for manual reset vent valve

A manual reset vent valve used in a double block and vent safety shut off system shall be arranged to prevent gas escaping through the vent line when the upstream safety shut off valve is open.

2.14.7 Safety shut off system not to be bypassed

A safety shut off system shall not be bypassed unless the bypass is fitted with a safety shut off system.

2.14.8 Vent line requirement

A vented safety shut off system shall be fitted with a vent line complying with AS 5601.

2.14.9 Requirements for a position-proving system**2.14.9.1 Safety shut off valve**

All safety shut off valves used in a position-proving system shall incorporate a proof-of-closure switch.

2.14.9.2 Vent valve

A vent valve used in a position-proving system shall—

- (a) comply with Table 2.2; and
- (b) incorporate a position indicator switch.

TABLE 2.2
MINIMUM SIZE OF VENT VALVE

Nominal size of largest safety shut off valve mm	Minimum size of vent valve mm	
	Double block and vent systems	Position proving systems
Less than 20	Same as SSOV	Same as SSOV
20-40	20	15
50	25	15
65	32	20
80	40	20
100	50	25
150	65	32
200	80	50

2.14.9.3 *Position-proving system to be interlocked to prevent burner start-up*

The valves used in conjunction with a position-proving system shall be interlocked to prevent burner start-up (including pre-purge) where—

- (a) both safety shut off valves are not proved ‘closed’; or
- (b) the vent valve is not proved ‘open’.

2.14.9.4 *Alarm interlock*

The valves used in conjunction with a position-proving system controlling a gas consumption in excess of 20 GJ/h (5.5 MW) shall be interlocked to actuate an alarm where either of the following conditions apply immediately after any controlled or safety shutdown:

- (a) Any safety shut off valve is not proved ‘closed’.
- (b) The vent valve is not proved ‘open’.

NOTE: The nature and location of an alarm (i.e. audible, visible etc.) should be such that the operator’s attention is attracted.

2.14.10 Requirements for a leakage detection system

2.14.10.1 *Compliance with Standard*

A leakage detection system shall comply with the requirements of AS 4630.

NOTE: Where the system is commercially available, it must be certified to AS 4630. However where the system is not commercially available, i.e. purpose-designed, compliance with AS 4630 should be checked for acceptability by the technical regulator.

2.14.10.2 *Leakage detection system to be interlocked to cause lockout*

A leakage detection system shall be interlocked to cause lockout where the leakage rate exceeds the maximum allowed under Clause 2.14.10.5 before any source of ignition is energized or introduced into the combustion chamber.

2.14.10.3 *Commencement of leakage detection test*

The commencement of a leakage detection test shall occur as follows:

- (a) For an appliance, other than an appliance with an induced draught burner, during or immediately before the pre-purge cycle.
- (b) For an appliance with an induced draught burner, immediately before the pre-purge cycle commences.

2.14.10.4 *Alarm interlock*

A leakage detection system controlling a gas consumption in excess of 20 GJ/h (5.5 MW) shall be interlocked to actuate an alarm if any one of the valves is not proved sufficiently gas tight immediately after any controlled or safety shutdown.

NOTE: The nature and location of an alarm (i.e. audible, visible etc.) should be such that the operator’s attention is attracted.

2.14.10.5 *Maximum allowable leakage rate*

The maximum allowable leakage rate into or out of the space between the safety shut off valves shall be the lesser of—

- (a) 0.05% of the maximum gas rate through the system; or
- (b) 10 MJ/h.

2.14.10.6 *Leakage detection system which uses gas at line pressure*

Where a leakage detection system using gas at line pressure as the testing medium is employed, the following additional requirements are to be met:

- (a) When pressurizing the space between the safety shut off valves:
 - (i) the gas rate used shall satisfy the requirements of Clause 3.2.3; or
 - (ii) the upstream safety shut off valve shall not be open for more than 2 s, and the downstream safety shut off valve is to incorporate a position indicator switch.
- (b) Separate pressure switches shall be used to monitor—
 - (i) the rise from atmospheric pressure; and
 - (ii) the fall from line pressure;

NOTE: Line pressure shall be no less than the outlet pressure of the next upstream regulator.
- (c) The pressure settings of switches referred to in (b) shall not overlap.
- (d) Where the contents of the space between the safety shut off valves are to be released into the combustion chamber all of the following shall apply:
 - (i) The contents of the space are to be released through the burner head.
 - (ii) A Class 1 safety shut off valve is to be used.
 - (iii) The average flow rate is to comply with the requirements of Clause 3.2.3.
 - (iv) The valve used is not to be open for more than 5 s.
 - (v) The purge air flow is to be—
 - (A) proved before the valve is opened; or
 - (B) programmed to start immediately upon completion of a successful leakage detection cycle.
 - (vi) The pre-purge requirements of Clause 2.19 are to be met after the valve has closed as part of the leakage detection cycle.

2.14.11 **Function of interlocks**

Where a safety shut off system controls a gas consumption in excess of 20 GJ/h to a burner(s) which fires into a combustion chamber either connected to a common flue or with multiple burners firing into it, then the interlocks required by Clauses 2.14.9.3 and 2.14.10.2 shall—

- (a) where the appliance is unattended, act on all burners sharing the combustion chamber or common flue; or
- (b) where an operator is in attendance, activate an alarm.

NOTE: The nature and location of an alarm (i.e. audible, visible etc.) should be such that the operator's attention is attracted.

2.14.12 **Requirements of safety shut off system actuators**

2.14.12.1 *Individual actuators to be fitted*

All valves in a double block and vent safety shut off system shall be individual valves fitted with their own individual actuators unless the valve fulfils the requirements of either Clause 2.14.12.2 or 2.14.12.3.

2.14.12.2 *Single three-way valve permitted*

The combining of a safety shut off valve and a vent valve in a single three-way valve is permitted provided that all the following conditions are met:

- (a) The safety shut off valve is the downstream safety shut off valve.
- (b) When energized the valve is open from inlet to outlet and closed to vent.
- (c) When de-energized the valve is open from inlet to vent and closed to the outlet.

2.14.12.3 *Use of rigidly coupled actuators*

Where the valves of a double block and vent safety shut off system are to be rigidly coupled to a common actuator all of the following requirements shall be met:

- (a) The coupled vent and safety shut off valves are to be downstream of another safety shut off valve.
- (b) The upstream safety shut off valve is to be fitted with an independent actuator.
- (c) The failure of an interlock which serves all burners is to cause all safety shut off valves to close and all vent valves to open.
- (d) Any condition requiring lockout of an individual burner or burner unit is to cause all safety shut off valves to close and all vent valves to open on the individual burner or burner unit.
- (e) The means of connecting the rigidly coupled valves is to be constructed so that it is not readily interfered with.

NOTE: A fixed cover is an acceptable means of preventing interference.

2.15 COMBUSTION AIR SUPPLY—GENERAL REQUIREMENTS

2.15.1 Combustion air supply equipment to be correctly sized

Combustion air supply equipment shall be correctly sized and arranged to ensure that the air flow is—

- (a) non-pulsating except in the case of purpose designed pulse combustion systems; and
- (b) adequate for all operating conditions specified by the equipment manufacturer.

2.15.2 Combustion air quality

Combustion air shall be free of contaminants such as suspended particles, flue gases, water or other gases or fuels that may adversely affect the combustion process.

NOTE: Flue gases, vapours or flammable substances introduced into the combustion air for emission or process control should not be considered as contaminants.

2.15.3 Air openings to be of adequate size

Air openings shall be adequate to allow satisfactory combustion in compliance with Clause 3.6.1.

2.15.4 Air openings not to be obstructed

Measures shall be taken to prevent air openings from being obstructed.

2.16 COMBUSTION AIR FOR ATMOSPHERIC BURNERS

2.16.1 Primary aeration controls to be corrosion-resistant

Primary aeration control(s) shall be corrosion-resistant.

NOTE: Controls may be made of corrosion-resistant material or have a corrosion-resistant finish.

2.16.2 Effect of foreign matter on primary aeration controls to be minimal

Primary aeration controls shall be constructed so that any build-up of foreign matter does not adversely affect the flame characteristics.

2.17 FORCED AND INDUCED DRAUGHT BURNERS

2.17.1 Draught characteristics to be specified by burner manufacturer

The air flow and pressure characteristics of a forced or induced draught combustion system shall be specified by the burner manufacturer.

2.17.2 Proving air flow

An appliance shall be fitted with devices for proving adequate air flow during the pre-purge, ignition and operation of the burner including—

- (a) static or differential pressure sensing, where it can be shown that this provides satisfactory and reliable proof of air flow during pre-purge, ignition and subsequent firing; and
- (b) flow-sensing, where tapping points of a differential system should be arranged so that the static pressure difference, in a system with a closed damper, does not result in an apparent flow signal being given.

NOTE: Proof of adequate air flow is normally obtained by one of the methods in (a) or (b), however this list is not exhaustive and other methods may be acceptable to the technical regulator.

2.17.3 Self-check of air flow proving device

2.17.3.1 Self-check to be carried out

The air flow proving device shall be proved in the no-flow state, prior to start-up.

2.17.3.2 Failure of air flow proving device during self-check

Failure of the air flow proving device during a self-check shall cause—

- (a) start-up to be prevented; or
- (b) lockout.

2.17.4 Safety shutdown to occur if air flow fails

Air flow failure at any time during the pre-purge, ignition or operation of the burner, shall cause the air flow proving device to initiate safety shutdown within 1 s.

NOTES:

- 1 Following safety shutdown due to incorrect air pressure or air flow, automatic restart is permitted provided that repetitive recycling could not cause a hazard.
- 2 The contactors of a combustion air fan and purging air fan (where fitted) should be interlocked to cause safety shutdown in the event of the contactors opening.

2.17.5 Air-gas mixtures

2.17.5.1 Air-gas mixing machines and mixing blowers

Air-gas mixing machines and mixing blowers shall comply with the requirements of Clause 5.3.

2.17.5.2 Maximum temperature of mixtures

The temperature of an air-gas mixture to a burner(s) shall not exceed 50% of the auto-ignition temperature of the gas in degrees Celsius.

NOTE: Typical values for auto-ignition temperatures are given in Table 2.3.

TABLE 2.3
TYPICAL VALUES FOR AUTO-IGNITION TEMPERATURES OF GASES

Fuel gas	Auto-ignition temperature °C
Natural gas	540
Simulated natural gas	450
Tempered liquefied petroleum gas	450
Liquefied petroleum gas (Butane)	406
Liquefied petroleum gas (Propane)	450
Town gas	560

2.18 DAMPERS

2.18.1 Requirements for a fixed or adjustable damper

A damper shall maintain satisfactory combustion in accordance with the requirements of Clause 3.6.1 and be—

- (a) secure against accidental displacement;
- (b) interlocked to prevent the pre-purge period proceeding unless the damper is in the correct position and remains there for the full pre-purge period; and
- (c) interlocked to prevent ignition of the burner unless the damper is in the correct position for ignition.

2.18.2 Requirements for an automatic damper control system

2.18.2.1 *Automatic damper to maintain satisfactory combustion*

An automatic damper control system shall maintain satisfactory combustion over the entire range of burner operation.

2.18.2.2 *Failure of damper mechanism*

Where failure occurs in the control mechanism of an automatically-operated damper—

- (a) the damper shall assume a position which will ensure that satisfactory combustion is maintained; or
- (b) lockout shall occur.

2.18.2.3 *Manual damper control*

Where dampers are intended to be manually adjusted during operation they shall be fitted with—

- (a) fixed stops to contain the adjustment within normal operational limits; and
- (b) a device to indicate the damper position.

2.19 APPLIANCE PRE-PURGING

2.19.1 General requirements

2.19.1.1 *Function of pre-purge*

A pre-purge shall ensure that the concentration of any combustible mixture present in an appliance is reduced to a safe level by dilution with the purging medium.

2.19.1.2 *Appliance or process to be pre-purged*

An appliance or process shall be pre-purged unless—

- (a) the purge medium continues during the burner off cycle and the conditions of purging comply with Clause 2.19.2.2 (b) and (c);
- (b) reignition is being attempted after flame failure as permitted by Clause 3.5.5.2; or
- (c) flame failure of a burner occurs in a multiple-burner installation where—
 - (i) all burners fire into a single combustion chamber;
 - (ii) the individual main burners are fitted with independent supervised ignition and flame safeguard systems; and
 - (iii) at least one of the burners remains alight.

2.19.1.3 *Pre-purging using an inert medium*

Where it is hazardous to purge with air, an inert purging medium shall be used.

2.19.1.4 *Supply of inert purging medium to be proved*

Failure to prove an adequate supply of the purging medium prior to the commencement of the pre-purge shall result in lockout.

2.19.2 **Pre-purging by mechanical means**

2.19.2.1 *Mechanical pre-purging required under certain conditions*

Pre-purging shall be by mechanical means—

- (a) unless a natural draught pre-purge is permitted by Clause 2.19.3.1;
- (b) where the combustion chamber is fitted with a forced or induced draught burner, and combustible vapours, dusts or gases may accumulate in the combustion chamber; or
- (c) where the appliance has an atmospheric burner and the natural draught pre-purge does not comply with Clause 2.19.3.1.

2.19.2.2 *Conduct of mechanical pre-purge*

A mechanical pre-purge shall be carried out such that all of the following conditions are met:

- (a) The duration of the pre-purge period is sufficient to ensure that the volume of the purging medium used is at least 5 times the purge volume.
- (b) The flow rate of the purging medium is not less than 25 % of the maximum flow rate of the combustion air.
- (c) The circulation of the purging medium is such that no zone in the purge volume remains unpurged.

NOTES:

- 1 Consideration should be given to options that will restrict the purge period to a maximum of 15 min. Additional fans or dampers may be used specifically for this purpose.
- 2 Variations to the value of the purge volume or purge time may be acceptable to the technical regulator where satisfactory plug flow conditions are shown to exist. However the minimum purge requirement under these conditions should not normally be less than 60% of the purge required by this Clause.
- 3 Where the burner system cannot provide a total adequate pre-purge of the appliance (because of special requirements) then steps should be taken, in consultation with the technical regulator, to increase the level of safety from the minimum specified by the Standard.

2.19.3 Pre-purging using natural draught

2.19.3.1 Requirements for an appliance using natural draught

A natural draught pre-purge shall not be permitted unless all of the following apply:

- (a) No forced or induced draught burner is fitted.
- (b) Openings during the entire pre-purge period provide a total area of not less than $0.2 \text{ m}^2/\text{m}^3$ of the purge volume.
- (c) Openings during the entire pre-purge period are positioned to ensure that the purge volume is completely purged of any of the following, which may be present at start-up or operating temperatures—
 - (i) lighter-than-air gases;
 - (ii) heavier-than-air gases;
 - (iii) combustible vapours;
 - (iv) combustible dusts; and
 - (v) flammable liquids.

2.19.3.2 Pre-purge period using natural draught

For an appliance using natural draught the pre-purge period after flame failure shall be not less than 5 min unless the requirements of Clause 3.5.5.2 are met.

NOTE: Heavier-than-air gases may require longer purge periods than lighter-than-air gases, to allow for dilution of the gases.

2.19.3.3 Pre-purge period included in operating instructions

Where a burner is manually ignited the pre-purge period shall be included in the operating instructions and indicated on a notice placed in a prominent position on the appliance.

2.19.3.4 Pre-purge where appliance doors are opened

Where an appliance is pre-purged by means of opening the appliance doors or other closures, then the doors or other closures shall be—

- (a) open during the pre-purge period and remain open until the flame is established; and
- (b) fitted with interlocks unless—
 - (i) the burner is manually ignited; and
 - (ii) the purge volume is less than 10 m^3 .

2.19.4 Pre-purge timer

Where an appliance or process requires a pre-purge period and automatic controls are incorporated, the following shall apply:

- (a) A purge timer is to be interlocked with the burner safety shut off system to ensure that the required pre-purge period has elapsed before a source of ignition is energized.
- (b) The timer is to be sealed or locked to prevent unauthorized or accidental change of setting and the minimum timer setting clearly displayed immediately adjacent to the timer.

NOTES:

- 1 The timer may be an integral component of a flame safeguard unit.
- 2 The minimum purge period should also be displayed on the appliance data plate in accordance with Clause 4.1.1(f).

2.19.5 Pre-purge interlocks

2.19.5.1 *Purge flow proving device to be fitted*

An appliance fitted with a mechanical means for pre-purging shall be fitted with a device for proving adequate air flow during the pre-purge.

2.19.5.2 *Self-check of purge flow proving device*

The pre-purge shall be prevented from commencing unless the purge flow proving device is proved in the 'no-flow' state prior to start-up.

2.19.5.3 *Purging to cease if purge flow fails*

Failure of the purge flow at any time during the pre-purge period shall cause the purge flow proving device to abort the pre-purge until the correct flow is re-established.

2.19.5.4 *Pre-purge to reset when purge flow is re-established*

When correct flow is re-established, the pre-purge cycle shall recommence from its start point.

2.20 PROCESS CONTROLS

2.20.1 Requirements where appliance safety depends on process

Where safety or correct operation of an appliance is dependent on the correct operation of a process, interlocks shall—

- (a) prevent the gas-firing equipment from operating until the process equipment is operating correctly; and
- (b) initiate a safety shutdown in the event of a process malfunction.

2.20.2 Process limit device to cause lockout

The operation of a process limit device that shuts down gas-fired equipment shall cause lockout of the gas supply to the gas-fired equipment.

2.20.3 Requirements where appliance safety and operation depend on flow

Where the safe or correct operation of the gas-firing equipment is dependent on flow, flow-proving device(s) shall be fitted to cause lockout or prevent an ignition attempt if—

- (a) the device is not proven in the 'no-flow' state prior to the flow commencing; and
- (b) loss of flow occurs during operation.

NOTE: Where an electrical device creating flow is energized through contactors, safety shutdown should be initiated in the event of the contactors opening.

2.21 IGNITION SYSTEMS

2.21.1 Ignition to be safe, reliable and smooth

The ignition of main and pilot burners, regardless of the method used, shall be safe, reliable and smooth under all operating conditions.

2.21.2 Manual ignition systems

2.21.2.1 *Requirements for a manually-inserted gas torch*

A manually-inserted gas lighting torch shall be connected by means of a hose assembly which—

- (a) complies with AS/NZS 1869;
- (b) is of the minimum practicable length for the application but does not exceed 3 m; and
- (c) has a certified manual isolating valve, immediately upstream of the hose assembly.

2.21.2.2 *Point of ignition to be accessible*

The point of ignition of a manually-ignited burner shall be readily accessible while the appropriate gas controls are being operated.

2.21.2.3 *Explosion relief to be provided for a manually-ignited burner*

Where a manually-ignited burner fires into an enclosure in which an explosive accumulation of gas can occur, the enclosure shall have a fixed area for explosion relief in accordance with the requirements of AS 1375.

2.22 PILOT BURNERS

2.22.1 Requirements for a pilot burner with a single main burner

Where a pilot burner is fitted it shall be stable, supervised and provide the ignition energy necessary to—

- (a) immediately ignite the main burner safely and reliably under all operating conditions; and
- (b) ignite the main burner safely and reliably when the pilot burner is turned down to the point where it will just actuate the flame safeguard system.

WARNING: IN ORDER TO PROVE THIS REQUIREMENT, IT MAY BE NECESSARY TO CARRY OUT A PILOT TURNDOWN TEST. THIS TEST HOWEVER, SHOULD ONLY BE CARRIED OUT BY EXPERIENCED PERSONNEL USING EXTREME CAUTION.

2.22.2 Requirements for supervised pilot burners with multiple main burners

Where multiple burners are operated as a unit, a sufficient number of supervised pilots shall be used to accomplish safe and reliable ignition.

2.22.3 Flames to travel freely to all ports of a multi-port pilot

Flames shall travel freely to all burner ports of a multi-port pilot when gas is ignited at any one port.

2.22.4 Bleed lines not to affect ignition of main burner

The location of a bleed line shall not affect the operation of a pilot burner in providing main burner ignition.

2.22.5 Protection from blockage

A port or injector of a pilot burner that may be exposed to falling particles during normal operation shall be protected against blockage.

2.23 MAIN BURNERS

2.23.1 Ignition to be in combustion chamber

Ignition of the main burners shall occur totally within any combustion chamber provided.

2.23.2 Main burners subdivided into zones or sections

A main burner assembly that is subdivided into sections or zones shall—

- (a) be installed so that gas is supplied to the main burner section closest to the supervised pilot first;
- (b) sequence the adjacent burners so that they ignite safely and reliably from each other;

- (c) where in excess of 1 GJ/h, be supervised at the end or ends of the burner assembly furthest from the source of ignition; and
- (d) where the length of a (main burner) line burner, or pipe burner exceeds 1.5 m, have the sensing of the main flame at the furthest end from the source of ignition.

2.23.3 Requirements for a burner which can be retracted or swivelled

A burner(s), with the exception of a hand held torch or lighting torch, which can be retracted or swivelled from the operating position without the use of tools shall have a reliable means of preventing—

- (a) inadvertent movement from the operating position;
- (b) an unsafe leakage of gas if the supply is disconnected; and
- (c) start-up or continued operation in other than the operating position.

2.23.4 Requirements for cross-ignition

Where cross lighting is necessary to accomplish satisfactory ignition, more than one series of cross-ignition ports shall be used.

Other methods that ensure satisfactory cross-ignition may be acceptable to the technical regulator.

2.23.5 Protection from blockage

A port or injector of a main burner that may be exposed to falling particles during normal operation shall be protected against blockage.

2.24 FLAME SAFEGUARD SYSTEMS

2.24.1 Requirements for a flame safeguard system

A flame safeguard system shall incorporate a certified flame safeguard that complies with—

- (a) AS 4620 for thermoelectric types; or
- (b) AS 4625 for electronic types.

2.24.2 Flame safeguard system to be fitted

Each burner shall have a flame safeguard system fitted as an integral part of the burner system, except where any of the following apply:

- (a) A manually-ignited burner of up to 500 MJ/h (140 kW) is firing into an open area or open combustion chamber and a flame abnormality or flame failure is obvious to the operator so that remedial action can be taken.
- (b) Except as required by Clause 2.24.9 the burner ignites smoothly and reliably under all operating conditions from another burner that is fitted with a flame safeguard system and the unsupervised burner cannot be operated unless the supervised burner is already operating.
- (c) The appliance is in continuous operation and—
 - (i) is manually ignited and supervised, in an approved manner, until a temperature in excess of 750°C is reached after annual shutdown or any unplanned outage;
 - (ii) the combustion chamber surfaces operate continuously at a temperature in excess of 750°C; and
 - (iii) the heat retention of the combustion chamber surfaces is such that the time taken for the surfaces to cool to a temperature of 750°C is in excess of 1 h.

2.24.3 Flame safeguard to comply with classification

A flame safeguard system shall comply with Table 2.4.

2.24.4 Maximum hold-time for a thermoelectric flame safeguard

The magnetic valve of a thermoelectric flame safeguard shall hold open within 60 s of igniting the operating flame.

TABLE 2.4
FLAME SAFEGUARD CLASSIFICATION

Appliance burner type	Burner input MJ/h	Flame safeguard classification (To meet AS 4625, AS 4620 or AS 4624 as required)							
		1A	2A	2B	2Ca	2Cb	2D	3D	Thermo-electric
Atmospheric	0 to 200	Y	Y	Y	Y	Y	Y1	Y1	Y2
	0 to 500	Y	Y	Y	Y		Y1	Y1	Y2
	500 to 1000	Y	Y	Y	Y		Y1	Y1	Y3
	1000 to 5000	Y	Y	Y			Y1	Y1	
	5000 to 20000	Y	Y				Y1	Y1	
	Over 20000	Y	Y4						
Forced or induced draught	0 to 2000	Y	Y		Y		Y1	Y1	
	2000 to 20000	Y	Y				Y1	Y1	
	Over 20000	Y	Y4						

LEGEND:

Y	May be used for this application.
Y1	Programming functions required from an external source.
Y2	45 s flame failure response time.
Y3	15 s flame failure response time.
Y4	Appliance must be shut down at least once per day.

NOTES:

- The following explanation of the classification of electronic flame safeguards applying to the table has been taken from AS 4625:
 - Class 1—Has a safe start check and a continual self-check of the flame safeguard and flame detector.
 - Class 2—Has a safe start check of the flame safeguard and flame detector.
 - Class 3—Has no safe start check or continual self-check of the flame safeguard or flame detector.
- Five further sub-divisions apply to Class 1 and 2 as follows:
 - A Programming without reignition—prescribed timings.
 - B Programming without reignition—less rigorous timings.
 - Ca Programming with reignition—prescribed timings.
 - Cb Programming with reignition—less rigorous timings.
 - D Non-programming.

Class 3 flame safeguards are limited to Type D, non-programming.
- Unless otherwise recommended by the flame safeguard manufacturer, all non-continuous self-checking flame safeguards operating on a continuous basis should undergo a controlled shutdown at least once every 24 h.
- Additional information to assist users in the selection of a unit appropriate for the application is provided in Appendix H.

2.24.5 Maximum shut off time following flame failure

The flame safeguard response time shall not exceed—

- (a) 45 s, where—
 - (i) a main atmospheric burner(s) is used, which is either manually-ignited or fitted with a manually-ignited permanent pilot(s); and
 - (ii) the total input to the combustion chamber or connected combustion chambers does not exceed 500 MJ/h (140 kW).
- (b) 15 s, where—
 - (i) a main atmospheric burner(s) is used, which is either manually-ignited or fitted with a manually-ignited permanent pilot(s); and
 - (ii) the total input to the combustion chamber or connected combustion chambers where the burner(s) are fitted exceeds 500 MJ/h (140 kW), but does not exceed 1 GJ/h (275 kW);
- (c) 3 s, where (a) and (b) do not apply.

2.24.6 Requirements for a flame detector

A flame detector shall—

- (a) meet the requirements of AS 4625 for the electronic type and be certified; or
- (b) meet the requirements of AS 4620 for the thermoelectric type and be certified; and
- (c) be accessible.

2.24.7 Flame simulation to be prevented

Flame simulation in a flame detector shall be prevented.

2.24.8 Detector not to detect other flame

A flame detector shall not detect any flame other than the one it is supervising except that the pilot flame detector required by Clause 2.24.10 may detect the main flame served by that pilot.

2.24.9 Requirements for a pilot used on atmospheric burner(s) exceeding 1 GJ/h (275 kW), or forced or induced draught burner(s)

Where an intermittent or permanent pilot is used on atmospheric burner(s) exceeding 1 GJ/h (275 kW), forced or induced draught burner(s), either two electronic flame safeguard systems or two electronic flame detectors connected to one flame safeguard system shall be used.

2.24.10 Detectors to supervise separate flames

Where an intermittent or permanent pilot is used on atmospheric burner(s) exceeding 1 GJ/h (275 kW), forced or induced draught burner(s), the flame detector(s) required by Clause 2.24.9 shall be fitted so that one will supervise the pilot and the other will supervise the main flame.

2.24.11 Requirements for two flame detectors used with one system

Where two flame detectors are used in conjunction with one flame safeguard system—

- (a) the safe start check shall ensure that both flame detectors are in the no flame position prior to start-up;
- (b) the safe start check on the main burner flame detector shall continue on through the pilot flame ignition sequence; and

- (c) the loss of flame signal from either flame detector shall cause lockout of the associated pilot and main burner.

NOTE: It is recommended that a proprietary flame safeguard system that performs the required functions without alteration be used.

2.24.12 Detector to ensure cross lighting is complete

Where cross lighting is necessary to accomplish satisfactory ignition of supervised burners, the flame detector(s) shall be positioned to ensure cross lighting is completed within the flame establishment period.

2.25 BLEED LINES

2.25.1 General requirements for a bleed line termination

Except as permitted in Clause 2.25.2, a bleed line shall be vented to outside atmosphere and comply with the requirements of AS 5601 for vent lines.

2.25.2 Terminating bleed lines in a combustion chamber

2.25.2.1 *Combustion chamber to have a supervised burner*

A combustion chamber in which a bleed line terminates shall have a supervised burner so that—

- (a) the supervised burner is alight whenever the bleed line can discharge gas; and
- (b) the bleed gas is ignited by the supervised burner.

2.25.2.2 *Bleed line requirements*

A bleed line that terminates in a combustion chamber shall—

- (a) originate downstream of a safety shut off valve;
- (b) be metallic;
- (c) have an internal diameter not less than 4 mm and a nominal wall thickness not less than 0.8 mm;
- (d) have a suitable burner tip;
- (e) not be used to provide the ignition source for any burner; and
- (f) not interfere with the main burner ignition from the pilot.

2.25.2.3 *Bleed line termination to be protected against blockage*

The termination of a bleed line that may be exposed to falling particles during normal operation shall be protected against blockage.

2.26 APPLIANCE/BURNER CONTROL CIRCUITS

2.26.1 Requirements of control circuits

Control circuits shall be designed so that—

- (a) failure of a single component cannot cause a hazardous condition;
- (b) where programmable electronic system (PES) control circuitry is used for a burner management system, then its performance under fault conditions shall at least match that achieved by conventional technology. Any single failure, or any dormant condition followed by another single failure, shall be protected against, so that critical timings and sequence operations remain safe. This applies right through the electronic system, from the CPU, memory, etc., through to output devices. The safe state is complete burner shutdown with lockout.

NOTE: Control circuits should be designed to facilitate the detection of fault conditions; e.g. by means of fault indicating lights.

2.26.2 Gas-actuated controls

Gas-actuated controls shall be of a type where there is no continuous bleed during the off period.

2.26.3 Requirements for a programmable electronic system (PES)

A Programmable Electronic System (PES) shall not be installed or modified without the approval of the technical regulator.

To gain technical regulator acceptance for a PES on a Type B appliance the following conditions apply:

- (a) All systems that perform safety-related functions shall be hard-wired.
- (b) If a PES controller (logic solver and its associated I/O module) is used to perform safety-related functions—
 - (i) it shall be a safety-related PES controller and possess a TÜV safety certificate to the appropriate safety integrity level (SIL) of AS 61508 or some equivalent certificate using only TÜV certified ‘firmware’ (or equivalent); or
 - (ii) where a customer/contractor insists on using a non-safety-related PES controller to perform safety-related functions the safety-integrity of the PES controller shall be independently verified, to the required SIL, by an appropriate institution.
- (c) Contractors submit the following to the technical regulator:
 - (i) A relevant flow sheet written in plain English containing the description of events to occur within the PES. (Typically this would be done prior to writing the PES program).
 - (ii) The relevant parts (only) of the PES program.
 - (iii) The hard-wired electrical schematic diagram clearly indicating connection to the PES.
 - (iv) A copy of the TÜV safety certificate together with the TÜV documentation, on any restrictions applying to that PES controller.
 - (v) The qualitative SIL for the appliance application to be evaluated.
 - (vi) The quantitative SIL determination of the individual safety instrument system (SIS) loops to be evaluated to ensure the appropriate level of protection is provided by the PES based installation.
 - (vii) The quantitative SIL to be validated through either a simplified equation or a fault tree analysis as described in AS 61508 or equivalent.

to be assessed, together with other parts of the submission, by the technical regulator for conformity to the regulations.

Like computer programs, the only true way of assessing a PES user-program to ensure that it functions the way it was designed, is to test run the program. It is not possible to inspect a PES program in its entirety by visual examination and conclude that the program does what it is required to do under all possible operating situations. In order to ensure the integrity of the PES user software, the person/company who designed the system shall have quality accreditation, and shall have adhered to the principles outlined in AS 61508. The designer responsible for the development of the program, shall test-run the program by simulating the inputs, and prove that the outputs occur at the right time and duration. A signed written statement to that effect shall be submitted to the technical regulator (see Appendix I).

S E C T I O N 3 O P E R A T I O N

3.1 APPLIANCE OPERATION DETAILS

Appliance operation shall be consistent with details displayed on the appliance data plate (refer to Section 4.1).

3.2 IGNITION

3.2.1 Starting sequence interlocks

Where interlocks are required by this Standard or are fitted, they shall ensure that burner ignition is not initiated until—

- (a) power supply is available (if required);
- (b) any damper fitted for combustion air or flue gas control is in the correct position;
- (c) the pre-purge cycle has been completed;
- (d) any leakage detection cycle has been satisfactorily completed;
- (e) the combustion air sensor is checked and proved; and
- (f) all applicable limit devices are in the operational position.

NOTE: Limit devices may include one or more of the following—

- (a) low liquid level;
- (b) excess pressure;
- (c) excess temperature;
- (d) high gas pressure;
- (e) low gas pressure; or
- (f) essential process limits.

3.2.2 Ignition sequence

3.2.2.1 Commencement of ignition

Where a pre-purge period is required by this Standard, the ignition spark or other means of ignition shall commence immediately after the pre-purge period is completed, unless an air flow is maintained up to ignition to ensure a safe level of dilution of any combustibles which may be present.

3.2.2.2 Completion of ignition

The ignition spark or other means of ignition shall cease at the end of the start gas flame establishment period.

3.2.2.3 Start gas flame establishment period

The start gas flame establishment period for a burner with an automatic ignition system shall not exceed—

- (a) 15 s for a pilot on an atmospheric burner where the pilot gas rate does not exceed the lesser of:
 - (i) 1% of the main burner gas rate, or
 - (ii) 5 MJ/h.
- (b) 5 s in all other cases.

3.2.3 Start gas rate

3.2.3.1 Start gas rate not to exceed determined values

Except for a direct-fired air heater, the start gas rate shall not exceed the value determined by one of the following methods—

- (a) throughout the start gas flame establishment period, the gas concentration in relation to the proven air flow rate for that period is not to exceed the percentages of the lower explosive limit (% of LEL) as detailed in Table 3.1, 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 pre-heated air temperature does not exceed 400°C; or

NOTES:

- 1 The gas concentration needs to be within the flammability limits at the burner head to ensure ignition but must be diluted rapidly to the levels specified to ensure that the mixture elsewhere in the combustion chamber could not be ignited inadvertently.
 - 2 For direct-fired air heaters refer to Clause 5.7.6.
- (b) the energy released during the start gas flame establishment period does not exceed 35 kJ per cubic metre of combustion chamber volume; or
 - (c) a start gas rate calculation in accordance with AS 1375.

NOTE: Typical values of LEL for common gases are summarized in Table 3.2.

TABLE 3.1
PERCENTAGE OF LOWER EXPLOSIVE
LIMIT VALUES (LEL) TO MEET CLAUSE 3.2.3.1(a)

Type of gas	% of LEL	% of stoichiometric	% excess air	% O ₂ in flue	% CO ₂ in flue
Natural	50	24	310	16.2	2.7
Town	50	14	600	18.2	1.6
Propane	25	13	690	18.5	1.6
Butane	25	14	610	18.3	1.8
TLP (26% LP Gas)	25	11	790	18.5	1.6
SNG (55% LP Gas)	25	12	720	18.5	1.6

TABLE 3.2
LOWER EXPLOSIVE LIMIT VALUES (LEL)
FOR SELECTED GASES

Type of gas	LEL % gas in mix	Stoichiometric ratio
Natural	5.00	9.55:1
Town	6.00	4.63:1
Propane	2.20	22.80:1
Butane	1.80	30.97:1
TLP (26% LP Gas)	8.46	5.19:1
SNG (55% LP Gas)	4.00	12.09:1

3.3 MAIN BURNERS

3.3.1 Start flame proving period

Where a flame safeguard system is fitted, gas shall not flow to the main burner or burner unit until—

- (a) for an atmospheric burner the start flame has been proved; or
- (b) for a forced or induced draught burner the start flame has been proved for at least 5 s immediately following the start gas flame establishment period.

3.3.2 Main flame establishment period

Where a burner is fitted with a flame safeguard and either—

- (a) an interrupted pilot is fitted; or
- (b) an intermittent or permanent pilot is fitted to a forced or induced draught burner or an atmospheric burner exceeding 1 GJ/h (275 kW),

the main flame establishment period shall be—

- (i) not less than 2 s; and
- (ii) not more than 5 s.

3.3.3 Main burner supervision

3.3.3.1 *Interrupted pilot*

Where a burner is fitted with a flame safeguard and an interrupted pilot, the pilot shall be turned off at the end of the main flame establishment period, to ensure supervision of the main flame alone occurs.

3.3.3.2 *Intermittent or permanent pilot with a forced or induced draught burner or atmospheric burner exceeding 1GJ/h (275kW)*

Where a forced or induced draught burner, or atmospheric burner exceeding 1 GJ/h (275 kW), is fitted with a flame safeguard and an intermittent or permanent pilot, independent supervision of the main burner as required by Clause 2.24.10 shall commence at the end of the main flame establishment period.

3.3.4 Main burner to start at reduced rate

Where the total input into a combustion chamber exceeds 5 GJ/h (1.4 MW), the main burner(s) shall be designed to start at a rate not exceeding one-third of the maximum consumption of each burner firing into the combustion chamber.

3.4 INTERLOCKS AND LIMIT DEVICES

3.4.1 Interlocks and limit devices not to be rendered ineffective

No means shall be provided for an interlock or limit device to be rendered ineffective except as part of an approved automatic programmed checking cycle.

3.4.1.1 *Where an interlock is to be fitted*

An interlock shall be fitted where its absence would create a hazard to personnel.

NOTE: Interlocks should also be provided to protect equipment from damage.

3.4.1.2 *Interlock to be tested*

All interlocks shall be tested on the commissioning of equipment, to confirm that they satisfy design and functional requirements.

NOTE: An interlock should also be tested periodically over the life of equipment with which it is associated, see AS 1375.

3.4.1.3 *Requirements for an interlock*

An interlock shall:

- (a) Operate before an unsafe condition occurs.
- (b) Prevent unsafe operation on interruption and restoration of the interlock power supply.
- (c) Prevent starting any portion of the process until safe conditions are re-established.
- (d) Not be readily defeated.

NOTES:

- 1 Where an interlock disables equipment, the disabling action should—
 - (a) affect the least equipment;
 - (b) take place in the safest manner possible; and
 - (c) activate an alarm, either visual and/or audible to attract the attention of the operator.
- 2 Where an interlock disables equipment, fault detection should be facilitated by means which will readily indicate the fault; e.g. fault indicating light(s).

3.4.2 **Limit devices**

3.4.2.1 *Limit device to be fitted*

A limit device(s) shall be fitted where failure of operating controls would cause a hazardous condition.

3.4.2.2 *Limit device not to be an operating control*

A limit device shall not be used as an operating control.

3.4.2.3 *Requirements for a limit device*

A limit device shall—

- (a) be fitted in compliance with Clauses 2.1 and 2.2;
- (b) be fitted so that its correct operating position is readily determined by observation or testing;
- (c) be locked or sealed unless, when set within its adjustment range, it functions before a hazardous condition is reached;

NOTE: An example of when sealing would not be required would be a high temperature limit device which has a range of 150-200°C but where a hazardous condition does not occur until 210°C is reached.

- (d) when actuated, cause lockout; and
- (e) not allow start-up until the fault that caused the limit device to actuate has been cleared.

3.5 **OPERATION SEQUENCES**

3.5.1 **Ignition sequence after power interruption**

Where interruption of a main power supply causes burner shutdown, ignition and reignition of the burner(s) after resumption of power shall be prevented except where—

- (a) a complete restart cycle, including pre-purge period, is initiated; and
- (b) there are sufficient interlocks to allow safe ignition.

3.5.2 Programmed sequence for automatic or part automatic burner

The programming system used for an automatic or part automatic burner, shall provide the following operation sequence:

- (a) With the exception of thermoelectric types, carry out a self-check of integral circuitry to prove that the system is not in the flame proved condition prior to start-up.
- (b) A self-check of the air flowing proving device(s), where provided, in accordance with Clause 2.17.3 and Clause 2.19.5.2.
- (c) A check of the starting sequence interlocks in accordance with Clause 3.2.1.
- (d) A pre-purge in accordance with Clause 2.19.1.2.
- (e) Provision of a source of ignition immediately after the pre-purge cycle in accordance with Clause 3.2.2.1.
- (f) A start gas flame establishment period that complies with Clause 3.2.2.3.
- (g) Cessation of the source of ignition at the end of the start gas flame establishment period in accordance with Clause 3.2.2.2.
- (h) A start gas flame proving period in accordance with Clause 3.3.1.
- (i) A main flame establishment period in accordance with Clause 3.3.2 which shall be not less than 2 s and not greater than 5 s.
- (j) Continuous monitoring during operation.

NOTE: A typical operating sequence for a forced or induced draught burner with interrupted pilot is given in Appendix E.

3.5.3 Appliance to be left in safe condition

Shutdown of an appliance, regardless of the cause of shutdown, shall leave the appliance and its associated equipment in a safe condition.

3.5.4 Requirement for lockout on flame failure

Flame failure at the point of supervision shall—

- (a) result in lockout of the relevant burner system; or
- (b) result in lockout of all burners, where two or more burners are served by a common valve train; or
- (c) meet the requirements of Clause 3.5.5.

3.5.5 Reignition attempt on flame failure

3.5.5.1 Requirements for forced or induced draught burners

For a forced or induced draught burner, one reignition attempt after flame failure at the point of supervision may be made provided:

- (a) The initial flame failure resulted in a safety shutdown.
- (b) A full restart cycle including any pre-purge is carried out.
- (c) The total energy released during the period commencing at flame failure, and ending at cessation of the reignition attempt (i.e. main burner shutdown time plus start gas establishment time) does not exceed the energy release permitted by Clause 3.2.3.1.
- (d) Failure of the burner to reignite shall result in lockout.

3.5.5.2 *Requirements for atmospheric burners*

For an atmospheric burner, one reignition attempt after flame failure at the point of supervision may be made provided:

- (a) The main burner input does not exceed 1000 MJ/h (275 kW).
- (b) The total energy released during the period commencing at flame failure, and ending at the cessation of the reignition attempt, (i.e. main burner shutdown time plus start gas reignition time) does not exceed the energy release permitted by Clause 3.2.3.1.
- (c) Failure of the burner to reignite results in lockout, and any further ignition attempt incorporates a pre-purge period in accordance with Clause 2.19.3.2.

3.6 COMBUSTION CONDITIONS

3.6.1 Burners to maintain satisfactory combustion conditions

All burners shall maintain satisfactory combustion under all operating conditions by ensuring that—

- (a) ignition is smooth and reliable;
- (b) combustion is completed within the combustion chamber;
- (c) excessive combustion noise and vibration is avoided on start-up, during operation and on shutdown;
- (d) flames are stable, showing no flame abnormality;
- (e) combustion products leaving the appliance are free of carbon particles;
- (f) the CO concentration in the combustion products does not exceed 400 ppm for an open flued appliance across the normal operating range unless the process requires a special atmosphere;
- (g) the CO/CO₂ ratio in the combustion products does not exceed 0.02 for an open flued appliance across the normal operating range unless the process requires a special atmosphere; and
- (h) the CO concentration in the combustion products meets the requirements of Clause 5.7.7.1 for an indoor flueless appliance.

3.6.2 Leakage of combustion products to be prevented

Leakage or spillage of combustion products from the appliance, other than through the flue terminal, shall be minimized under all operating conditions.

NOTE: Minor spillage during loading or similar operations may be permissible provided no hazard results.

3.7 COMMISSIONING

3.7.1 Commissioning checks to be carried out

Before an appliance is placed into service, a systematic check shall be carried out to prove that the following items are installed and function correctly, and operate in the proper sequence:

- (a) Each item of equipment in a gas valve train.
- (b) All controls.
- (c) All limit devices.
- (d) All interlocks.

- (e) Flame safeguard systems.
- (f) Safety shut off systems.

NOTES:

- 1 Steam and hot water boilers should be issued with a 'Certificate of Inspection of Boiler', as required by the appropriate authority, before the appliance is placed into service.
- 2 Refer to Appendix F for a typical commissioning procedure.

SECTION 4 MARKINGS AND INSTRUCTIONS

4.1 MARKINGS

4.1.1 Markings to be displayed

All appliances shall have clear, permanent markings that are readily accessible and easy to read when the appliance is installed. These markings are to include—

- (a) manufacturer's name;
- (b) model identification;
- (c) nominal gas consumption;
- (d) gas type;
- (e) maximum and minimum gas supply pressures;
- (f) purge times;
- (g) gas pressure at the burner head, for the nominal gas consumption;
- (h) combustion chamber volume;
- (i) total volume swept by the combustion products in passing from the burner to the flue connection;
- (j) serial number;
- (k) date of manufacture;
- (l) dilution air volume m^3/min at 20°C (where applicable);
- (m) solvent(s) – type and quantity (L/h), where applicable; and
- (n) any other markings required by the technical regulator.

NOTE: Units of measurement should comply with the SI system.

4.1.2 Marking of controls, dials and gauges

Any controls, dials and gauges fitted shall have clear, permanent markings.

NOTE: Units of measurement should comply with the SI system.

4.1.3 Controls with non-standard operation

Where the method of operation and direction of motion of manual controls does not comply with accepted practice or any applicable regulations and standards, they shall be clearly marked to indicate any variations.

4.2 INSTRUCTIONS

4.2.1 Written instructions to be provided

The manufacturer or supplier of the gas-firing equipment or appliance shall provide written instructions in English to enable safe and satisfactory installation, operation and maintenance of the equipment. These instructions are to include detailed procedures for—

- (a) start-up;
- (b) normal operation;
- (c) normal shutdown;
- (d) emergency operation (where applicable); and
- (e) emergency shutdown.

4.2.2 Instructions for operation

Clear, concise and durable operating instructions shall be displayed adjacent to the operating station.

4.2.3 Limits of safe operation to be specified

Where equipment has been designed to operate in particular conditions, sufficient information and instructions shall be included in the written instructions to ensure that any subsequent alteration to operating procedures, or other factors, will not result in the appliance operating in an unsafe condition.

NOTE: Modification, or relocation of the appliance will require the approval of the technical regulator. See Clause 1.2.5.

SECTION 5 SPECIAL APPLICATION REQUIREMENTS

5.1 GENERAL

The requirements of this Section are additional to all other requirements of this Standard but shall take precedence in cases of conflict.

5.2 HIGH INPUT GAS-FIRED APPLIANCES

5.2.1 General

The requirements of Clauses 5.2.2 to 5.2.6 shall apply to appliances where the total gas consumption of all burners firing into a single combustion chamber exceeds 20 GJ/h (5.5 MW).

5.2.2 Start-up where multiple main burners are fitted

Where multiple main burners are fitted, appliance start-up shall be achieved by the sequential start-up of individual burners, in a pre-determined order, compatible with the appliance design.

5.2.3 Manual ignition where multiple main burners are fitted

Where an appliance is fitted with manually-ignited multiple main burners, the sequential steps for ignition shall be clearly detailed in the operator's instructions.

5.2.4 Automatic ignition where multiple main burners are fitted

Where multiple main burners are fitted with an automatic ignition system and the ignition sequence is critical to the safe start-up of the appliance, an interlock shall be included to ensure that the previous burner in the operating sequence is alight before any attempt to ignite the next burner in the sequence is made.

5.2.5 Burner control

The burner controls shall ensure that no step change in gas rate to the appliance exceeds one-third of the total gas consumption of the appliance.

NOTE: The use of a modulating control system is preferred. However, care should be taken to ensure that the rate of change is not too fast.

5.2.6 Flame safeguards

The following requirements shall apply to a high input gas-fired appliance that is required by Clause 2.24.2 to have a flame safeguard fitted:

- (a) Where a manual or automatic start-up of the appliance or burner(s) is not carried out at least once in any 24 h period, a continuous self-checking flame safeguard (i.e. Class 1A, in accordance with AS 4625) is to be fitted.
- (b) Where a flame safeguard check is carried out by a manual shutdown and start-up, specific reference to this is to be made in the operator's instructions.
- (c) Where more than one burner is monitored by a single safety shut off system, individual ignition and flame detection is to be provided for each burner.

5.3 AIR-GAS MIXING MACHINES AND MIXING BLOWERS

5.3.1 General

An air-gas mixing machine or mixing blower shall be constructed and installed to ensure that an internal explosion will not cause injury to personnel or damage to other equipment.

NOTE: The air supply to an air-gas mixing machine or a mixing blower should be filtered.

5.3.2 Materials

Materials shall be selected to prevent the generation of static electricity.

5.3.3 Strength of pipe and fittings

Pipes and fittings (except blow-out discs) supplied for an air-gas mixing machine or mixing blower shall be designed to withstand a pressure of at least 800 kPa.

5.3.4 Safety shut off system to be fitted

A safety shut off system that complies with Clause 2.14 shall be fitted to the gas supply line upstream of an air-gas mixing machine or mixing blower.

NOTE: The requirements of Clause 2.8.4 may also need to be considered.

5.3.5 Safety shut off system to cause lockout

The safety shut off system required by Clause 5.3.4 shall cause lockout when any of the following apply:

- (a) The air-gas mixing machine or mixing blower is stopped.
- (b) The pressure at the gas inlet connection of the air-gas mixing machine or mixing blower is 20% below the normal static supply pressure.
- (c) The pressure at the gas inlet connection of the air-gas mixing machine or mixing blower is below the pressure at which the air-gas mixing machine or mixing blower will operate satisfactorily.

5.3.6 Air-gas ratio

5.3.6.1 *Locking provision for air-gas ratio from a mixing machine*

Except where air and gas flow rate indicators are fitted, air-gas mixing machines shall have provision for positively locking the air-gas ratio adjustments.

5.3.6.2 *Limiting provision for air-gas ratio from a mixing machine*

A stop or other means shall be provided to effectively prevent air-gas mixing machines that supply non-combustible mixtures from being adjusted to within or approaching the combustible range.

5.3.6.3 *Air-gas ratio from a mixing blower*

The air-gas ratio from a mixing blower shall be automatically maintained within the required limits over the entire turndown range.

5.3.7 Mixing blower outlets

Pipework connecting a burner(s) to a mixing blower shall—

- (a) not exceed 1 m; and
- (b) contain no control or safety device.

5.3.8 Flashback requirements for air-gas mixing machines

Air-gas mixing machines supplying combustible mixtures shall have a blow-out disc in the mixture line as close as practicable to the mixer except that, where the outlet connection of the mixer is less than 65 NB or its equivalent, the blow-out disc may be replaced by a non-return valve specially designed to withstand the reverse pressure created by a flashback.

5.3.9 Rupture of blow-out disc

The rupture of a blow-out disc shall:

- (a) Not endanger personnel.
- (b) Cause lockout of the gas supply to the mixing machine.

5.3.10 Flame arrestor between air-gas mixing machine and burner

A flame arrestor shall be installed as close as practicable to each burner supplied with a combustible mixture from an air-gas mixing machine. Detailed arrangements are to be submitted to the technical regulator for approval.

NOTES:

- 1 The following details are supplied for guidance purposes using natural gas only. Where the size of the pipe and fittings between the flame arrestor outlet and burner inlet is not greater than the flame arrestor outlet connection then the total length of the connection should not exceed—
 - (a) 12 m where the size of the pipe and fittings is not greater than 65 NB; or
 - (b) 6 m where the size of the pipe and fittings is greater than 65 NB.
- 2 Burners with inlet connections less than 40 NB may be permitted to be grouped and supplied through a common flame arrestor.

5.3.11 Flame arrestor at mixing machine

An air-gas mixing machine supplying a combustible mixture and having an outlet connection equal to or greater than 65 NB or its equivalent shall have a flame arrestor fitted in the mixture line as close as practicable to the mixing machine.

NOTE: A flame arrestor installed according to Clause 5.3.10 satisfies this requirement provided the length between the mixing machine outlet and the burner inlet is in accordance with the notes to Clause 5.3.10.

5.3.12 Flame arrestors

A flame arrestor fitted to an air-gas mixing machine shall incorporate a temperature sensitive device, which, in the event of an increase in temperature due to the presence of a flame, will activate to cause—

- (a) either—
 - (i) the automatic safety shut off valve(s) controlling the gas supply to the air-gas mixing machine; or
 - (ii) an automatic safety shut off valve in the mixture line to the flame arrestor to close;
 and
- (b) the system to lockout.

5.3.13 Air-gas mixing machines — requirement for non-return valve

Where burners are fitted with individual safety shut off valves in the mixture line, and flame arrestors are fitted in accordance with Clause 5.3.10, a non-return valve specially designed to withstand the reverse pressure created by a flashback, shall be fitted between the automatic safety shut off valve and the flame arrestor.

NOTE: Non-return valves may also be required to satisfy the requirements of Clause 2.8.4.

5.4 SPECIAL ATMOSPHERES AND ATMOSPHERE GENERATORS

5.4.1 General

This Clause applies to atmosphere generators and the distribution and discharge of special atmospheres prepared from gas.

NOTE: Atmosphere generators, and the special atmospheres produced, can be applied to a wide range of processes and appliances. The technical regulator should be informed when the design, operation, input and other integrated features are known. Additional safety requirements may then be indicated by the technical regulator.

5.4.2 Piping for special atmospheres

Piping used for the distribution or venting of special atmospheres shall meet the appropriate requirements for the supply of gas as given in AS 5601.

5.4.3 Storage of special atmosphere

Where the special atmosphere is to be stored prior to use, interlocks shall be provided to ensure that the special atmosphere supplied to the storage container is within acceptable limits.

NOTE: This requirement may be satisfied by interlocking the compressor with a flame safeguard system, a temperature sensor or an atmosphere analyser located at the outlet of the atmosphere generator.

5.4.4 Storage container for compressed special atmosphere

Where a special atmosphere is to be compressed and stored, approval for the storage container(s) shall be obtained from the appropriate authority.

5.4.5 Venting and disposal of special atmospheres

Provision shall be made for—

- (a) the venting of special atmospheres during start-up and operation from a point adjacent to the generator to a safe place; and
- (b) the safe disposal of special atmospheres from all discharge points.

5.4.6 Discharge using a vent line

A vent line for the special atmosphere from an atmosphere generator or the appliance being supplied with the special atmosphere, shall—

- (a) discharge in a safe place outside the building in accordance with the vent line termination requirements of AS 5601; or
- (b) discharge within the building provided—
 - (i) the special atmosphere is combustible;
 - (ii) a permanent, supervised, ignition source is maintained at the discharge point and is interlocked in accordance with Clause 3.4.1.1;
 - (iii) the discharge point is designed to ensure complete combustion is achieved;
 - (iv) provision is made for the combustion products to be discharged in accordance with the appropriate flueing requirements of AS 5601; and
 - (v) the installation is acceptable to the relevant authority(s).

5.4.7 Start-up of an atmosphere generator

During the entire start-up sequence of an atmosphere generator including the pre-purge period, the following shall apply:

- (a) The vent is to be open.

- (b) The supply line from the generator to the point(s) of use is to be closed during the entire start-up sequence, including the pre-purge period.

5.4.8 Ignition

Where the special atmosphere is combustible and discharges into an appliance that contains air, the following shall apply:

- (a) A supervised ignition source is to be provided which is interlocked in accordance with Clause 3.4.1.1.
- (b) Combustion products are to be discharged in a safe place in accordance with the flueing requirements of AS 5601.

5.4.9 Requirement where the air-gas ratio is variable

Where the air-gas ratio to an atmosphere generator can be varied during operation, flow indicators shall—

- (a) be installed in the air and gas supply lines; and
- (b) be well illuminated and easily read from the generator operating station.

NOTE: A differential pressure gauge across a fixed orifice can be an acceptable method of flow indication.

5.4.10 Requirements where the air-gas ratio is fixed

Where the air-gas ratio to an atmosphere generator is not variable during operation, provision shall be made for positively locking the ratio adjustment.

5.4.11 Automatic relief device

Where the special atmosphere is to be used at a variable rate, an automatic relief device shall be fitted to the special atmosphere line.

5.4.12 Flame arrestor

Where the special atmosphere is combustible, or could form a combustible mixture with air in pipework or equipment prior to the discharge point, a flame arrestor shall—

- (a) be installed; and
- (b) incorporate a temperature sensitive device which in the event of an increase in temperature due to the presence of a flame, will activate to cause the closing of a safety shut off valve(s) controlling—
 - (i) the gas supply to the reaction vessel of the atmosphere generator; or
 - (ii) the flow of the special atmosphere to equipment in which a combustible mixture of air and special atmosphere can be formed.

NOTE: The flame arrestor should be as close as practical to all discharge points that are in the vicinity of an ignition source.

5.4.13 Water-cooled equipment

The outlet for water discharge from water-cooled equipment shall be either—

- (a) permanently open; or
- (b) provided with an over-pressure relief device or flow-proving device.

5.4.14 Exothermic atmosphere generators

5.4.14.1 Flame safeguard requirement

A flame safeguard system shall be fitted to an exothermic atmosphere generator.

5.4.14.2 *Flame safeguard bypass*

The flame safeguard required by Clause 5.4.14.1 shall not be bypassed unless the surface temperature of the combustion chamber wall exceeds 900°C.

5.4.14.3 *Pressure detectors to be fitted*

Where a temperature interlock allowed by Clause 5.4.14.2 is fitted, high and low gas pressure and low combustion air pressure detectors shall be fitted.

5.4.14.4 *Pressure detectors to be interlocked*

A pressure detector required by Clause 5.4.14.3 shall be interlocked to cause lockout.

5.4.14.5 *Interlocking combustible atmosphere flow*

Where the exothermic atmosphere is combustible, the air shut off device or a safety shut off valve(s) controlling the flow of exothermic atmosphere shall be interlocked with the following:

- (a) The flame safeguard system.
- (b) A temperature limit device.
- (c) The high and low gas pressure and low air pressure detectors.

5.4.14.6 *Purging*

The exothermic generator, and any connected piping or appliance that is not isolated and separately vented shall be purged prior to ignition in accordance with Clause 2.19.

5.4.14.7 *Air-gas ratio control*

Where the air-gas ratio of the mixture supplied to the burner(s) has to be manually altered from a start-up to a running condition, the control shall incorporate suitable limit stops.

5.4.15 Endothermic atmosphere generators

5.4.15.1 *Safety shut off valves to be fitted*

A safety shut off system in accordance with Clause 2.14 shall be fitted to control the gas supply for the reaction.

5.4.15.2 *Air shut off device*

A shut off device shall be fitted to control the air supply for the reaction.

5.4.15.3 *Pressure detectors*

High and low-gas pressure detectors and a low-air pressure detector shall be:

- (a) Fitted to the appliance—
 - (i) gas supply line; and
 - (ii) air supply line.
- (b) Interlocked so as to cause lockout on activation.

5.5 PROCESS AFTER-BURNERS

5.5.1 General

Process after-burners shall comply with the requirements of AS 1375 in regard to the overall safety of the process.

5.5.2 Control of process products

5.5.2.1 Requirement for interlocks

Sufficient interlocks shall be provided to ensure hazardous conditions such as the following cannot occur:

- (a) Flame failure.
- (b) The discharge of unburnt process products.
- (c) The ignition of the process afterburner with process products present.
- (d) The passage of process products through the process afterburner at temperatures below the design limits.
- (e) Excessive process products entering the process afterburner.

NOTE: Other Authorities may require interlocks for such purposes as air pollution or odour control.

5.5.2.2 Process products — percentage of LEL

Process products shall be prevented from entering the process afterburner in quantities greater than 25% of the product LEL except in those cases where there is strict compliance with the requirements of incineration as documented in AS 1375.

NOTE: In a minority of installations the design may be such that the process products always enter the afterburner in quantities greater than 25% of the LEL. In these cases the process products should be treated as a fuel. Additionally the use of a flame arrester would normally be required.

5.5.3 Combustion air supply

Combustion air to a process afterburner shall be supplied by mechanical means unless all of the following apply:

- (a) The flow of gases between the process afterburner and the stack terminal incorporates no downward flow section.
- (b) The pressure of the process products is not above atmospheric.
- (c) The connecting openings between the process afterburner and the stack terminal do not affect the flow of products so as to cause unsatisfactory combustion.

NOTE: The air in the process products to be incinerated may be used to supply all or part of the combustion air for the process afterburner.

5.5.4 Shutting down of process afterburner

The safety system shall ensure that during the shutting down of the burner(s) fitted to a process afterburner, an adequate supply of air is maintained for the satisfactory combustion of any residual process products.

5.5.5 Pre-purge

Where an appliance or exhaust system served by a process afterburner incorporates exhaust and/or recirculation fans, then a pre-purge equal to five times the effective volume of the installation in accordance with Clause 2.19.2.2 shall be carried out before the ignition of any burner in the appliance or the process afterburner.

NOTE: The effective volume of the installation is equal to the internal volume of the appliance, which is the source of the process gases to be incinerated, plus the combustion chamber volume of the process afterburner plus the internal volume of all ductwork, passages and fans between the two.

5.6 STEAM AND HOT WATER BOILERS

Refer to AS 5601—2004, Clause 4.2.9 for requirements pertaining to emergency gas isolation valves required for boilers.

NOTES:

- 1 Unattended and limited attendance boilers may be subject to additional requirements as contained in AS 2593.
- 2 Steam and hot water boilers should be issued with a 'Certificate of Inspection of Boiler', as required by the appropriate authority, before the appliance is placed into service.

5.7 DIRECT-FIRED AIR HEATERS AND CURTAINS

5.7.1 General

This Clause applies to the gas-firing equipment on direct-fired air heaters or air curtains that are used to heat a forced air stream, with the combustion products being released directly into the heated air.

5.7.2 Heater air supply

The air supply for a direct-fired air heater shall be taken directly from the outside of the building and comply with the requirements of Clause 2.15.2.

NOTE: Recirculated inside air may be added after the outside air has passed through the combustion zone of the heater.

5.7.3 Air flow sensing device

A direct-fired air heater shall be fitted with an air flow sensing device in accordance with Clause 2.17.2 which shall operate if the heater air supply falls to a level that would produce emissions in excess of those stated in Clause 5.7.7.1 at the appliance nominal gas consumption.

5.7.4 Pre-purge

A pre-purge shall be carried out in accordance with Clause 2.19.2.2.

NOTE: For the purposes of this Clause the purge volume includes the air heater, inlet ductwork and outlet ductwork up to the first permanently open outlet.

5.7.5 Temperature limit device

An air temperature limit device shall be fitted, in accordance with Clause 3.4.2.3, to shut off the gas supply before the temperature of the air at the heater outlet reaches 80°C.

5.7.6 Start gas rate

The start gas rate for a direct-fired air heater shall not exceed 10% of the maximum main burner gas rate.

5.7.7 Combustion

5.7.7.1 Limits for combustion products

A direct-fired air heater shall not produce carbon dioxide, carbon monoxide, aldehydes or nitrogen dioxide in excess of the following values, with the heater handling the manufacturer's rated air throughput at nominal gas consumption and at the manufacturer's minimum gas consumption—

- | | | |
|-----|-----------------|------------|
| (a) | CO ₂ | 3000 ppm; |
| (b) | CO | 10 ppm; |
| (c) | Formaldehyde | 1 ppm; and |
| (d) | NO ₂ | 0.5 ppm. |

NOTES:

- 1 The ratio of CO to CO₂ should not exceed 0.003.
- 2 In some areas the ambient level of CO may cause the outlet level of CO from the heater to be higher, however the level of CO in the heated air stream should not exceed 50 ppm.

5.7.7.2 *Samples of heated air to be taken*

To ensure the requirements of Clause 5.7.7.1 are met samples of the heated discharge air shall be taken from the discharge duct work, before the first discharge outlet, and far enough downstream to ensure that combustion products are uniformly mixed with the heated air.

5.7.7.3 *Limitation on air temperature*

The heated air temperature at the point of discharge shall not exceed 80°C during combustion testing.

5.7.7.4 *Combustion at minimum air flow*

The direct-fired air heater shall comply with the combustion requirements of Clause 5.7.7.1 with the heater delivering all air flows down to the point at which the air flow limit device is tripped, at the nominal gas consumption.

5.7.8 **Markings****5.7.8.1** *Marking plate to be fitted*

The marking plate(s) shall include the following information in addition to that required by Clause 4.1.1:

- (a) The wording 'DIRECT-FIRED AIR HEATER'.
- (b) The air flow proving device trip setting, in Pascals.
- (c) The setting of the temperature limit device in °C.
- (d) The rpm of the heater fan, the related air flow in litres per second and the external static pressure in Pascals.
- (e) A statement which includes the following words:

'This heater shall be tested annually to show that the concentration of the following gases at the heater outlet does not exceed the following values:

Carbon monoxide	(CO)	10 ppm
Carbon dioxide	(CO ₂)	0.3% v/v (3000 ppm).'

5.7.8.2 *Restriction on installation*

Direct-fired air heaters shall have a permanent label attached in a prominent position that includes the following wording, in letters of at least 8 mm height:

'THIS HEATER SHALL NOT BE INSTALLED IN DOMESTIC OR RESIDENTIAL PREMISES. FOR ALL OTHER APPLICATIONS THE APPROVAL OF THE GAS TECHNICAL REGULATOR MUST BE OBTAINED. THE INSTALLER MUST ENSURE THAT THE WHOLE INSTALLATION IS INSPECTED BY THE GAS TECHNICAL REGULATOR.'

5.8 **STATIONARY GAS ENGINES AND TURBINES****5.8.1** **General**

This Clause applies to stationary gas engines and turbines that shall be designed and/or installed in such a manner that a combustible mixture igniting within them shall not directly cause injury to personnel or damage to other equipment.

The gas supply to engines operating on LP Gas in the liquid phase shall be installed in accordance with AS/NZS 1596 and, where applicable, AS/NZS 1425.

5.8.2 Requirement for safety shut off valve system

5.8.2.1 Safety shut off system to be fitted

A safety shut off system complying with the following shall be fitted:

- (a) Where the gas consumption of the gas engine or turbine is less than 500 MJ/h and the engine or turbine is located outdoors the safety shut off system shall comprise at least one safety shut off valve complying with Clause 5.8.2.2.
- (b) Where the gas consumption of the gas engine or turbine is not less than 500 MJ/h the safety shut off system shall comply with Clause 2.14.3.

NOTE: This Clause does not apply to manual start engines used for recreational or domestic purposes outdoors.

5.8.2.2 Requirements for safety shut off valves and vent valves

Safety shut off valves of Class 1, 2 or 3 and vent valves used on safety shut off systems for gas engines or turbines shall comply with the requirements of AS 4629 and be certified.

5.8.2.3 Safety shut off system to shut off gas supply

Safety shutdown shall occur when—

- (a) the gas engine or turbine stops; or
- (b) the gas engine or turbine fails to ignite the gas; or
- (c) the inlet gas pressure is reduced to 80% of the normal operating pressure to the appliance or 800 Pa whichever is the higher.

5.8.3 Turbine purging

Prior to any start-up a turbine shall be purged in accordance with Clause 2.19.

5.8.4 Flexible connection to be installed in gas supply line

A flexible connection complying with the requirements of AS/NZS 1869 shall be installed downstream of the safety shut off valve(s) controlling the gas supply to a gas engine or turbine.

The gas supply to engines operating on LP Gas in the liquid phase shall be installed in accordance with AS/NZS 1596 and where applicable AS/NZS 1425.

5.8.5 Exhaust system to be fitted

A gas engine or turbine shall be fitted with an exhaust system capable of preventing any hazard to personnel resulting from the ignition of unburnt gas.

5.8.6 Flexible metallic connection to be fitted to exhaust line

A suitable metallic flexible connection shall be provided in an exhaust system of a gas engine or turbine to minimize the possibility of fracture due to vibration or expansion and contraction.

5.8.7 Requirements of an exhaust system

The exhaust system of a gas engine or a turbine shall—

- (a) be as short as possible; and
- (b) not be manifolded together or connected to the flue of another appliance.

5.8.8 Exhaust terminal location

The exhaust system shall discharge combustion products to atmosphere in accordance with the requirements for flues in AS 5601.

5.8.9 Ventilation

Where an engine or turbine is installed in a building or compartment the ventilation must be in accordance with AS 5601.

NOTE: Additional ventilation may be necessary to maintain an acceptable ambient temperature.

5.9 INCINERATORS AND CREMATORS

5.9.1 General

Burners for incinerators and cremators shall be provided with safety systems that shall incorporate the functions and equipment set out in Clauses 5.9.2 to 5.9.5.

NOTE: Requirements for the prevention and relief of explosions due to such process hazards as combustible gases, vapours or dusts are given in AS 1375.

5.9.2 Primary burner interlock

Where a primary burner and a secondary burner are fitted, the primary burner shall be interlocked to prevent its ignition and operation unless the secondary burner is operating or a temperature in excess of 750°C has been reached in the secondary combustion chamber.

5.9.3 Combustion air

Combustion air to a burner shall be supplied by mechanical means unless:

- (a) The combustion air for a secondary burner, and for any other burner not interlocked with a secondary burner, is supplied by other than mechanical means provided—
 - (i) the flow of gases between the burner and the stack terminal incorporates no downward flow section; and
 - (ii) the connecting openings between the burner and the stack terminal do not affect the flow so as to cause unsatisfactory combustion.
- (b) The combustion air for a primary burner interlocked with a secondary burner is supplied by means of a high pressure inspirator which is capable of supplying all the air, as primary air, that is required for the combustion of the gas.

5.9.4 Pre-purge

Where a mechanical means of supplying combustion air is required, the safety system shall incorporate a pre-purge period to ensure that either—

- (a) where only one chamber is fitted with a burner, a volume of air equal to five times the effective volume of the chamber into which the burner is firing, is purged to atmosphere before ignition is attempted; or
- (b) where more than one chamber is fitted with a burner each chamber shall be purged sequentially, commencing with the primary chamber, with an air volume equal to five times the effective volume of the chamber into which each burner is firing, before ignition is attempted in any chamber.

5.9.5 Flues

5.9.5.1 Flues not to be interconnected

The flue shall not be interconnected with the flue from any other type of appliance.

NOTE: Where two or more incinerators or cremators are connected to a common flue, mechanical assistance may be required to ensure that all flue gases discharge only at the flue terminal.

5.9.5.2 *Limiting updraught*

Provision shall be made so that updraught in the combustion chamber does not exceed the design limit.

5.10 OVENS—DIRECT-FIRED

5.10.1 General

This Clause does not cover all the requirements for special atmosphere ovens nor does it provide for the safety of the processes carried out.

NOTE: Some of the requirements for the prevention and relief of explosions due to such process hazards as combustible gases, vapours or dusts are given in AS 1375.

5.10.2 Purging

A direct-fired oven, including recirculation ducts, shall be purged in accordance with Clause 2.19 before a source of ignition is introduced into or energized within the appliance.

5.10.3 Provision of air

All primary and secondary air for combustion shall be supplied direct to the burner(s) from outside the oven.

5.10.4 Explosion relief

Explosion relief shall be fitted where required by AS 1375 except where sufficient dilution air is provided in accordance with AS/NZS 4114.1 and AS/NZS 4114.2.

5.10.5 Temperature limit device

A temperature limit device, interlocked with a safety shut off valve to cause lockout of the gas supply in the event of excess temperature, shall be fitted unless the temperature reached with all burners operating continuously at maximum rate exceeds neither—

- (a) the ignition temperature of any materials processed; or
- (b) a temperature that is hazardous to adjacent personnel, the oven itself or materials surrounding the oven.

5.10.6 Access for cleaning

Ducts and flues within the oven shall be provided with access for cleaning.

5.11 SMOKE OVENS—DIRECT-FIRED

5.11.1 Lighting torch

Where manual ignition is required and a pilot burner is not fitted, then a lighting torch shall be installed to light the burners.

5.11.2 Combustion air

5.11.2.1 *Combustion air to be provided from outside of oven*

All primary and secondary air for combustion shall be supplied direct to the burner(s) from outside the oven.

5.11.2.2 *Restrictions on the use of ducting*

Where ducting is used to provide combustion air for an atmospheric burner, the duct shall have an unobstructed cross-sectional area throughout its total length of not less than 300 mm² per MJ/h of gas consumption.

5.11.2.3 *Smoke not to interfere with combustion*

The admission or generation of smoke within the oven shall not cause unsatisfactory combustion.

5.11.3 **Explosion relief requirements**

Explosion relief with a total area of not less than 0.2 m²/m³ of the volume of the appliance shall be provided.

5.11.4 **Loading doors**

Loading doors shall not be used for explosion relief.

5.11.5 **Sawdust trays**

Where sawdust trays are located above the burner they shall—

- (a) be located so as not to obstruct the free escape of flue gas; and
- (b) provide adequate clearance from the burner to avoid flame impingement in the event of a gas rich flame.

NOTE: See Clauses 2.22.5 and 2.23.5 for the protection of burners.

5.11.6 **Flue**

5.11.6.1 *Minimum requirements for natural draught flue*

The cross-sectional area of a natural draught flue shall be at least equivalent to 250 mm² per MJ/h of gas consumption, but shall not in any case be less than 8100 mm² (100 mm diameter).

5.11.6.2 *Flue damper*

A damper, where fitted in a natural draught flue, shall not restrict more than one-third of the total cross-sectional area of the flue.

5.12 **WATER HEATERS**

5.12.1 **General**

This Clause applies to water heaters including instantaneous heaters, circulators and storage water heaters but excluding open tanks in which the water is heated at or near atmospheric pressure.

5.12.2 **Thermostat**

A thermostat shall be fitted on all water heaters other than those of the instantaneous type.

5.12.3 **Over-temperature control**

5.12.3.1 *Over-temperature cut-out device to be fitted*

An over-temperature cut-out device shall be fitted to—

- (a) all water heaters having a gas consumption in excess of 200 MJ/h (55 kW); and
- (b) all unvented water heaters containing more than 1 L of water.

5.12.3.2 *Over-temperature cut-out to initiate lockout*

The over-temperature cut-out device shall be interlocked with the gas supply to cause lockout before the water temperature exceeds 99°C.

5.12.4 Unvented water heaters

5.12.4.1 Relief valve to be fitted

Unvented water heaters containing more than 1 L of water shall be fitted with one or more certified relief valves, with a pressure setting not exceeding the maximum working pressure of the water heater, and which are either—

- (a) a combination temperature and pressure relief valve complying with AS 1357.1 and AS 1357.2 and having a rating in kilowatts of not less than $0.21 \times$ gas consumption (MJ/h); or
- (b) a pressure relief valve complying with AS 1271 and having a total steam discharge capacity, in kg/h, of not less than $0.34 \times$ gas consumption (MJ/h).

NOTE: A rating in kilowatts of $0.21 \times$ gas consumption is the equivalent in energy of a steam rating in kg/h of $0.34 \times$ gas consumption (MJ/h).

5.12.4.2 Location of relief valves

The relief valves required by Clause 5.12.4.1 shall be located within 150 mm of the top of the water container or the top 20% of the water capacity whichever is the higher.

NOTE: In the case of instantaneous water heaters, fitting the valves in the plumbing immediately adjacent to the outlet will be deemed to comply with the requirement.

5.12.4.3 Heaters containing 1L of water or less

Unvented water heaters containing 1 L of water or less shall be fitted with a relief device that will release excess pressure in the waterways to prevent damage to the heater.

5.12.5 Provision for draining

All water heaters and attached water vessels shall be provided with a means to effectively drain the water in the heater without causing damage to the building or contents.

NOTE: In the case of instantaneous water heaters, a plug or cap on the drain connection will be deemed to comply with the requirement.

5.13 MULTI-FUEL FIRING SYSTEMS

5.13.1 Alternative multi-fuel systems

5.13.1.1 Isolation of alternative fuel supply

Multi-fuel alternative burner systems shall be arranged so that the safety shut off valve(s) for the fuel not being used are automatically closed if the burner for that fuel is—

- (a) not in the firing position; or
- (b) is not intended to be fired.

5.13.1.2 Alternative fuel system to be interlocked

Each multi-fuel alternative burner firing system shall be provided with an interlock system to ensure that—

- (a) more than one fuel cannot be supplied simultaneously;
- (b) the shutdown procedure for one fuel is completed before the start-up procedure, including pre-purge, for the other fuel is initiated;
- (c) all circuits from one fuel are disconnected before switching to an alternative fuel; and
- (d) the circuitry is arranged so that a pre-purge is carried out, except in multiple burner installations where other burners are firing.

5.13.1.3 *Fuel lines to be sealed on disconnection*

Where part of the fuel firing equipment is disconnected while the alternative fuel is in use, provision shall be made for:

- (a) sealing off disconnected fuel lines; and
- (b) a procedure to be included in the operators' instructions detailing the correct method of changing fuels.

NOTE: The disconnection and sealing off of fuel lines should not be carried out until after the manual isolating valve for the fuel has been shut.

5.13.2 Multi-fuel simultaneous firing systems

5.13.2.1 *Maximum operating input*

Multi-fuel simultaneous burner systems shall be arranged so that the maximum operating input cannot exceed the maximum rated hourly consumption of the burner.

5.13.2.2 *Combustion air requirement*

In a multi-fuel simultaneous burner system, when both fuels are being admitted, the combustion air supply shall be adequate for the total quantity of fuel being admitted.

APPENDIX A
STANDARD INFORMATION AND TECHNICAL DATA
(Informative)

To be supplied to the technical regulator for each appliance in accordance with the procedure set out in Appendix B.

- 1 Name and address of appliance manufacturer.
- 2 Name and address of the authorized installer or conversion contractor.
- 3 Name and address of commissioning person.
- 4 Name and address of organization where appliance is or is to be installed.
- 5 Customer contact and telephone number.
- 6 Number of burners and type.
- 7 Nominal gas consumption for total appliance and for each main burner.
- 8 Gas consumption at ignition for each burner.
- 9 Air flow rate at ignition for each burner.
- 10 Volume of each combustion chamber.
- 11 Total volume swept by the combustion products from the burner(s) to each flue connection.
- 12 Air flow rate during purge periods.
- 13 Details and method of operation of any combustion air or flue dampers.
- 14 Details of any explosion reliefs including location, cross-sectional area and weight together with calculations (refer AS 1375 Appendix E).
- 15 Appliance marking plate details (refer Clause 4.1 for requirements).
- 16 Schematic drawing of the valve train specifying all valve train components (i.e. their brand, model number, size and rated working pressure) and the proposed setting of all adjustable devices (refer Figure A1 for a typical example).
- 17 Schematic electrical wiring diagram showing the safety and control circuits including details of the brand, model number and method of operation of each major component and the proposed setting of any adjustable device (refer Figure A2 for a typical example).
- 18 Purge time calculations.
- 19 Calculations of start gas rate conditions (refer Clause 3.2.3).
- 20 Air dilution rate calculations for processes involving solvents or dusts (refer AS 1375 Appendix F).
- 21 Ventilation provided or to be provided in the area where the appliance is or is to be installed (refer AS 5601—2004 Clause 5.4.1).
- 22 Method of flueing and location and type of flue material.
- 23 Operating instructions.

NOTE: Units of measurement should comply with the SI system.

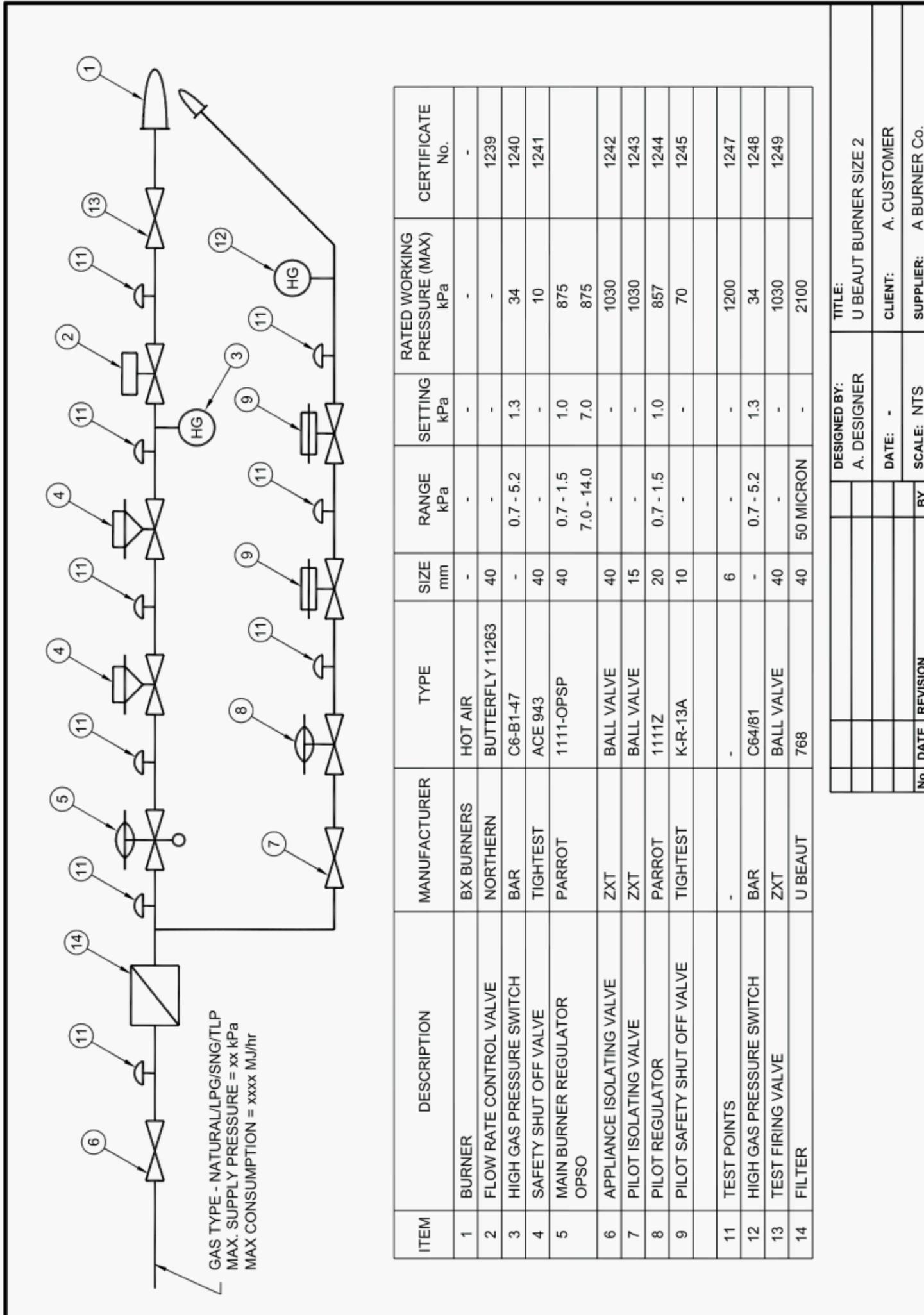


FIGURE A1 EXAMPLE OF A TYPICAL VALVE TRAIN SCHEMATIC

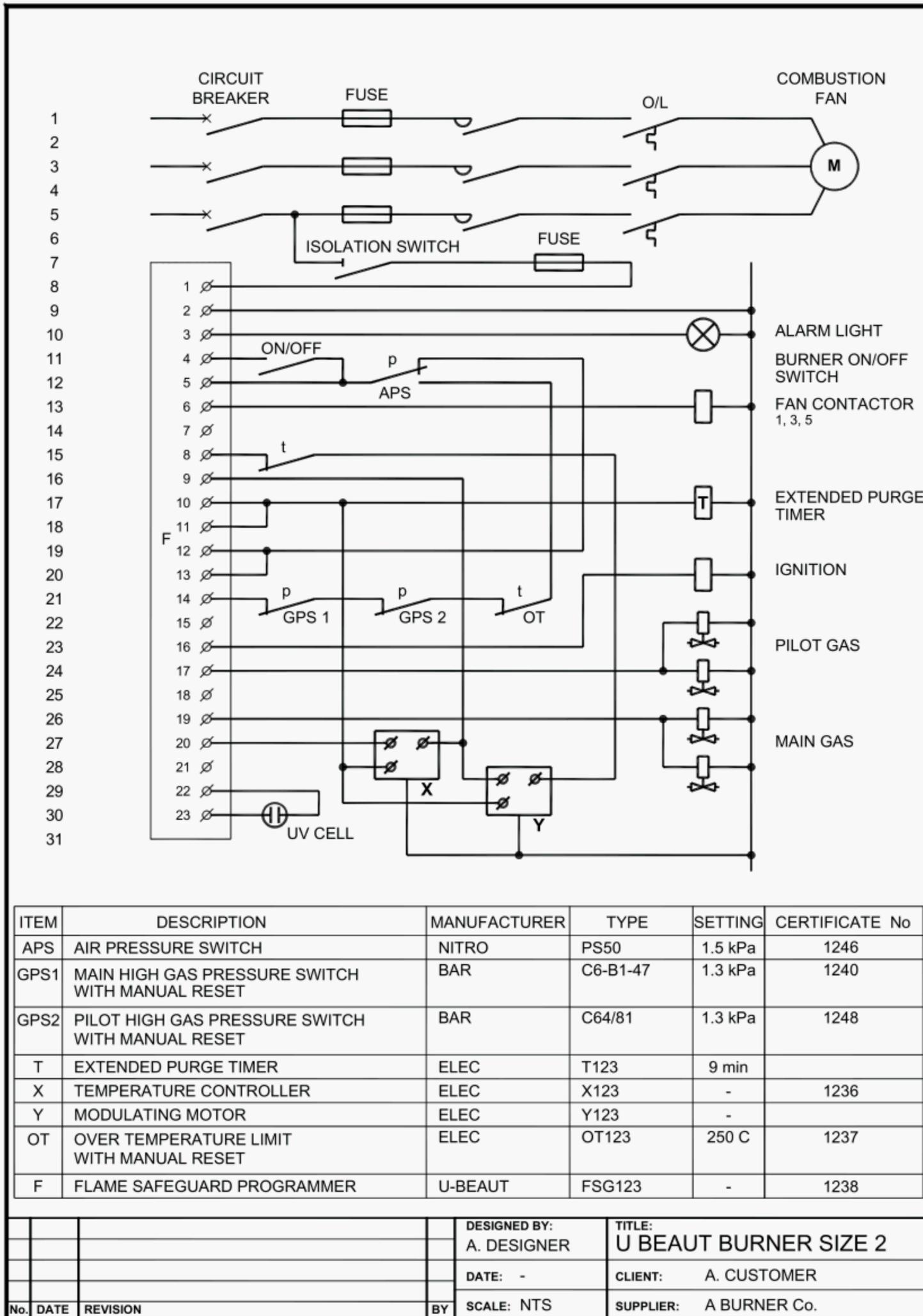


FIGURE A2 EXAMPLE OF A TYPICAL ELECTRICAL SCHEMATIC DIAGRAM

APPENDIX B
PROCEDURES FOR THE APPROVAL OF INDUSTRIAL AND COMMERCIAL
APPLIANCES
(Informative)

The following procedure is to be adopted by all persons wishing to install or commission appliances covered by this Standard.

Whilst the technical regulator may inspect and test the appliance for compliance with the requirements of this Standard, it remains the responsibility of the person commissioning the appliance to ensure—

- (a) compliance with these requirements;
- (b) adequate instruction of operating personnel; and
- (c) the safety of the installed appliance.

The technical regulator will not accept any responsibility for the failure of the technical regulator to detect breaches of the requirements of this Standard or for any inadequacies of the Standard requirements.

- 1 The details set out in Appendix A are to be submitted to the technical regulator for approval at least 28 d before the appliance is due to be commissioned, together with any relevant fee that may be required by the technical regulator for inspection and testing.
- 2 The technical regulator will examine the details submitted and give its comments or preliminary approval within 14 d.
- 3 No appliance is to have gas turned on until preliminary approval of the technical regulator has been given.
- 4 Upon receipt of preliminary approval, the appliance may be commissioned by a licensed/registered commissioning person.
- 5 At least 7 d notice is to be given to the technical regulator to inspect and test the commissioned appliance.
- 6 The technical regulator may carry out an on-site inspection and test of the installed appliance as soon as possible after the receipt of a request to test and the completion of commissioning.
- 7 When satisfied that the appliance meets these requirements, the technical regulator may issue a Certificate of Compliance (see Figure B1) upon request and may attach an approval label to the appliance.
- 8 No appliance may be handed over to the consumer for operation until the requirements of the technical regulator have been met.

CERTIFICATE OF COMPLIANCE FOR GAS EQUIPMENT

REFERENCE No:

LOCATION NAME:

ADDRESS:

APPLIANCE DESCRIPTION:

SERIAL NUMBER:

APPLIANCE INSTALLER:

COMMISSIONING PERSON:

AS 3814 - INDUSTRIAL AND COMMERCIAL GAS-FIRED APPLIANCES

The above appliance has been inspected and tested for compliance with AS 3814.

The appliance was found to comply with the requirements current at the date of inspection.

If this appliance is modified or relocated, it must be upgraded to meet the requirements of AS 3814 current at the time of modification or relocation and be re-submitted to the Gas Technical Regulator for approval.

Whilst the Gas Technical Regulator has tested the appliance for compliance with the requirements of the Standard, the Gas Technical Regulator cannot accept responsibility for any failure to detect breaches of the requirements or for any inadequacies of the requirements.

GAS TECHNICAL REGULATOR:

.....

INSPECTING OFFICER: DATE: .. / .. / ..

DEPARTMENT:

ESSENTIAL MAINTENANCE

This appliance and its safety equipment must be maintained in a state of proper repair.
Failure to do so may render the appliance unsafe and liable to disconnection from the gas supply.

FIGURE B1 EXAMPLE OF A TYPICAL CERTIFICATE OF COMPLIANCE

ABC GAS COMPANY	
THIS APPLIANCE COMPLIES WITH THE CURRENT REQUIREMENTS OF AS 3814 - INDUSTRIAL AND COMMERCIAL GAS-FIRED APPLIANCES	
INSPECTING OFFICER:	
DEPARTMENT:	
DATE:	REF. No.
<p>If this appliance is modified or relocated, it must be upgraded to meet the requirements of AS 3814 current at the time of modification or relocation and be submitted to the Gas Technical Regulator for approval.</p> <p>Whilst the Gas Technical Regulator has tested the appliance for compliance with the requirements of the Standard, the Gas Technical Regulator cannot accept responsibility for any failure to detect breaches of the requirements or for any inadequacies of the requirements.</p>	
ESSENTIAL MAINTENANCE	
<p>This appliance and its safety equipment must be maintained in a state of proper repair. Failure to do so may render the appliance unsafe and liable to disconnection from the gas supply.</p>	

FIGURE B2 EXAMPLE OF A TYPICAL APPROVAL LABEL

APPENDIX C
LIST OF REFERENCED DOCUMENTS
(Normative)

AS	
1271	Safety valves, other valves, liquid level gauges, and other fittings for boilers and unfired pressure vessels
1357	Valves primarily for use in heated water systems
1357.1	Part 1: Protection valves
1357	Valves primarily for use in warm and hot water systems
1357.2	Part 2: Control valves
1375	Industrial fuel-fired appliances (known as the SAA Industrial Fuel-fired Appliances Code)
2593	Boilers—Safety management and supervision systems
4617	Manual shut off gas valves
4618	Gas appliance regulators
4620	Thermoelectric flame safeguards
4624	Combination controls for gas
4625	Electronic flame safeguards and flame detectors
4629	Automatic shut off valves and vent valves
4630	Leakage detection systems
5601	Gas installations
61508	Functional safety of electrical/electronic/programmable electronic safety-related systems (set)
AS/NZS	
1425	LP Gas for fuel systems for vehicle engines
1596	The storage and handling of LP Gas
1869	Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas
3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
4114	Spray painting booths, designated spray painting areas and paint mixing rooms
4114.1	Part 1: Design, construction and testing
4114.2	Part 2: Installation and maintenance

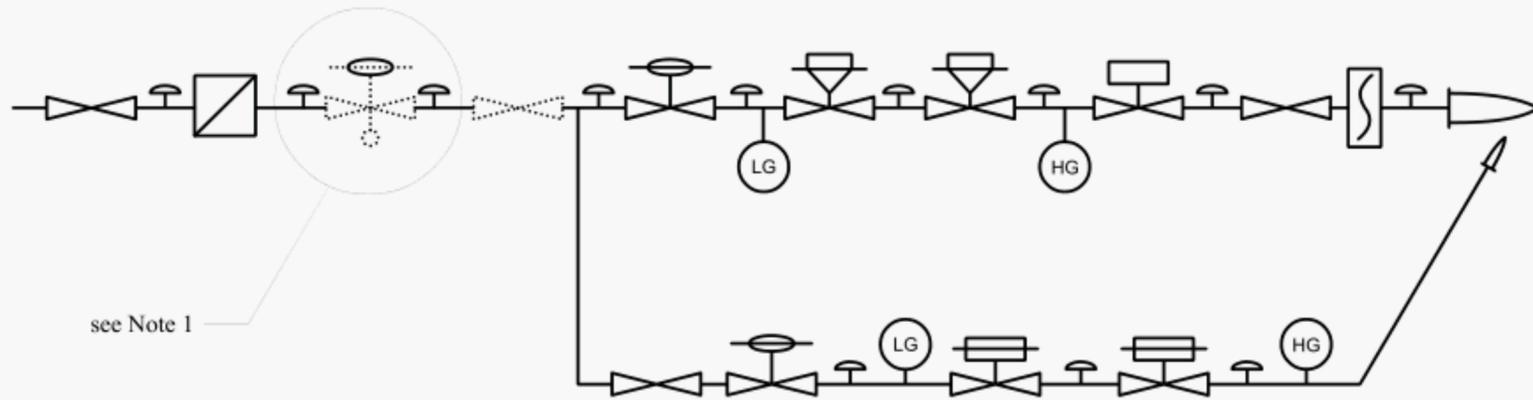
APPENDIX D
TYPICAL VALVE TRAIN ARRANGEMENTS
(Informative)

Any gas valve train must comply with the requirements of Clause 2.8. The examples shown here are a limited selection of arrangements that comply with the requirements of this Standard. It is not to be construed that these are the only arrangements possible, or that they will comply or be suitable in every case.

The diagrams of typical valve train arrangements show a double block safety shut off valve system on both main and start gas supplies. The number and selection of safety shut off valves must be in accordance with Clause 2.14.

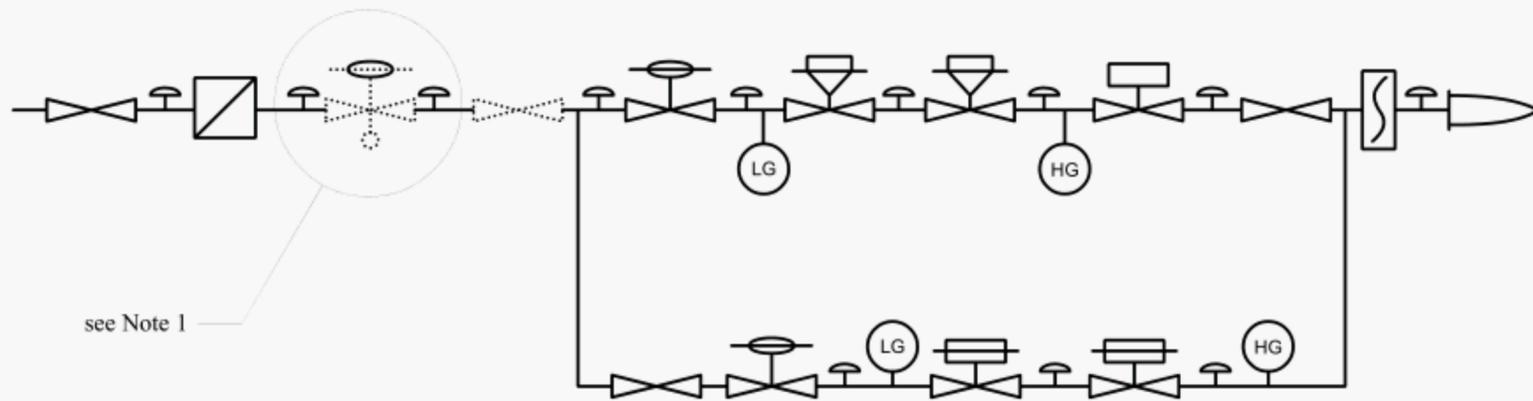
	Manual gas valve	A symbol shown in dotted lines means the item is optional
	Filter	
	Pressure test point	
	Pressure regulator	
	Pressure regulator with over-pressure protection	
	Over-pressure slam-shut valve	
	Slow-opening fast-closing valve	Automatic safety shut off valves
	Slow-opening fast-closing two stage valve	
	Fast-opening fast-closing valve	
	Fast-opening fast-closing two stage valve	
	Manual reset valve	
	Vent valve	
	Position indicator switch on valve	
	Proof of closure switch on valve	
	Low gas pressure detector	
	High gas pressure detector	
	Flow rate control valve	
	Flow limiting valve	
	Burner	
	Thermoelectric valve	
	Three-way valve	

FIGURE D1 LIST OF COMMONLY USED SYMBOLS



see Note 1

(a) Burner with separate pilot



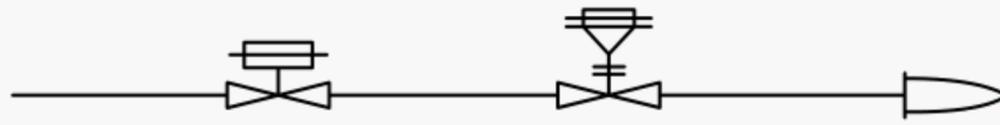
see Note 1

(b) Burner with direct spark ignition

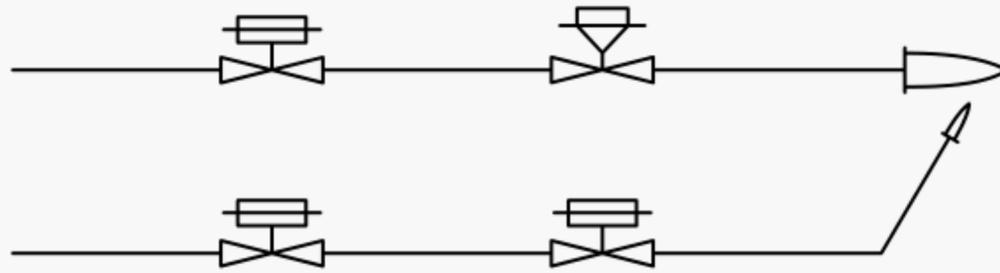
NOTES:

- 1 An over-pressure protection device is required if downstream components are not rated at the gas inlet pressure.
- 2 High gas pressure detectors should preferably be located downstream of safety shut off valves to prevent nuisance shutdowns. Such shutdowns will occur when either lock-up or positive shock pressure of the regulator is above the detector setting, or weep past the regulator seat occurs.

FIGURE D2 TYPICAL VALVE TRAIN INCORPORATING DOUBLE-BLOCK SAFETY SHUT OFF VALVE ARRANGEMENT



(a) Burners up to 1 GJ/h (275 kW) employing staged valves – Clause 2.14.3.6



(b) Burners over 1 GJ/h (275 kW) ignited by a separate pilot – Clause 2.14.5

FIGURE D3 SLOW OPENING SAFETY SHUT OFF VALVES

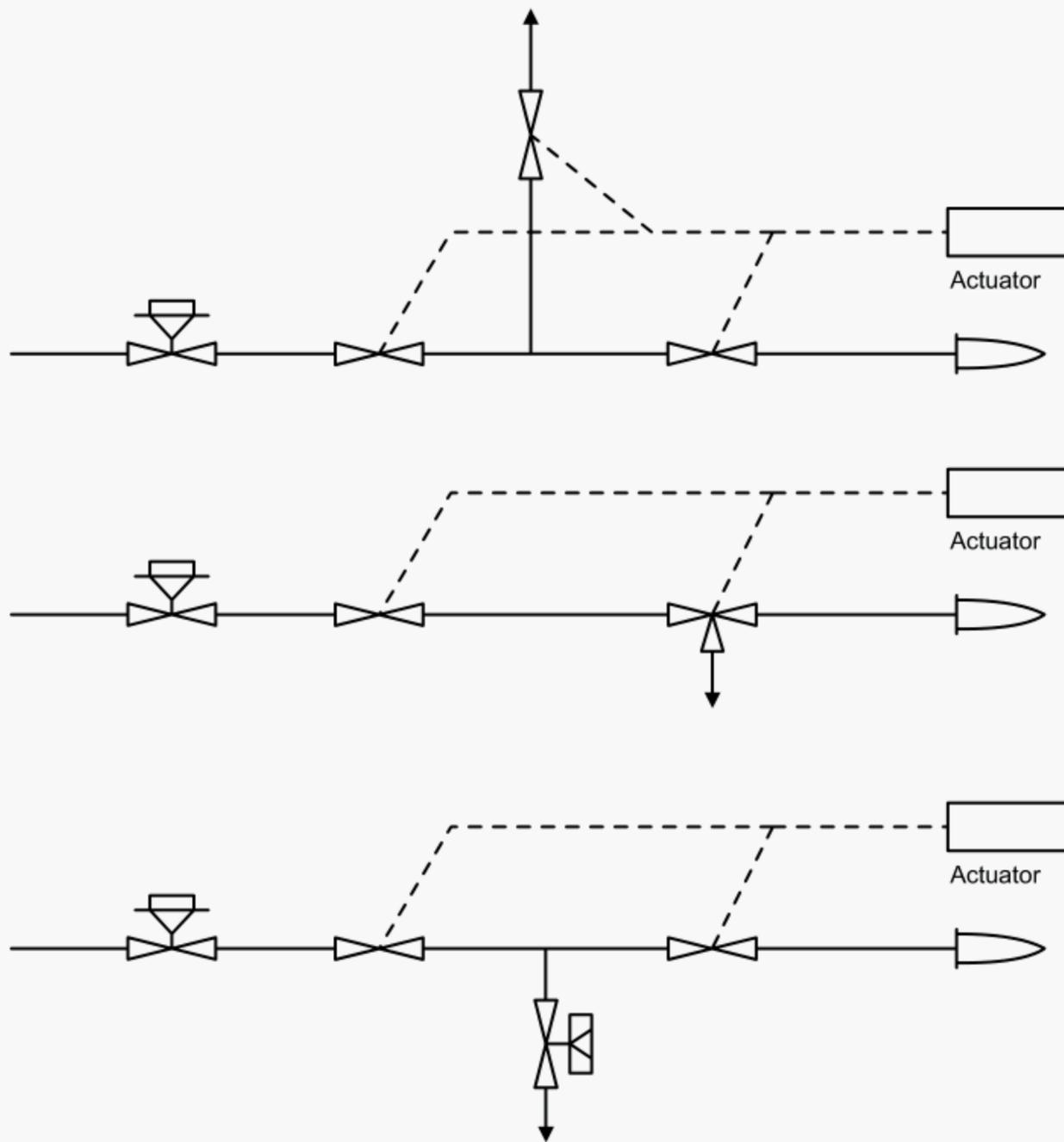


FIGURE D4 RIGIDLY COUPLED VALVES (CLAUSE 2.14.12.3)

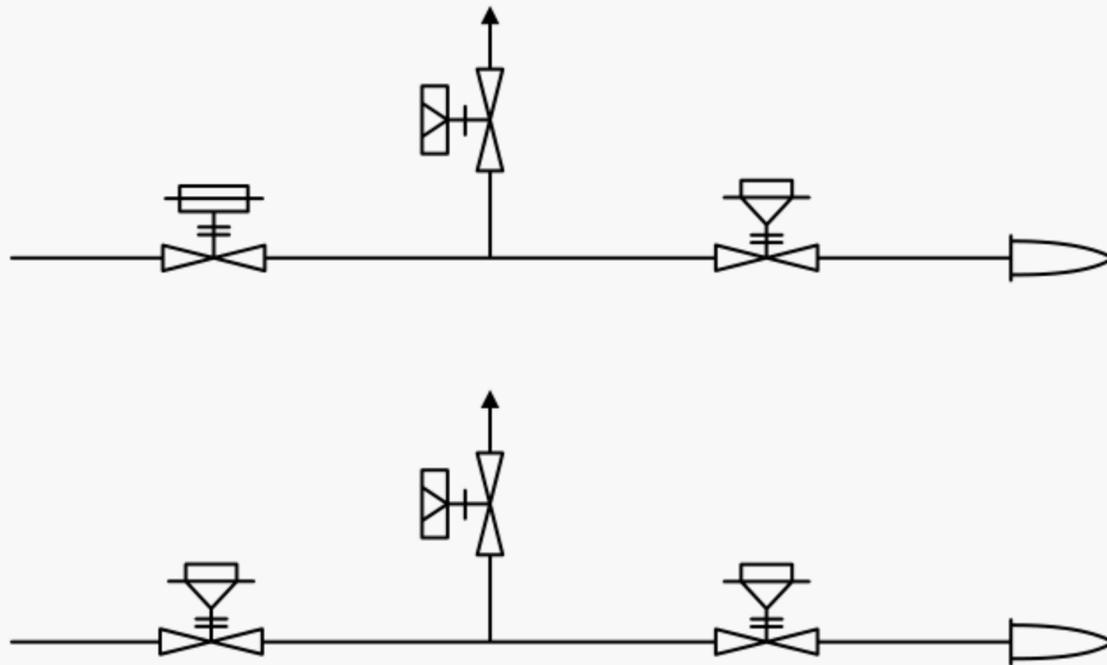


FIGURE D5 POSITION-PROVING SAFETY SHUT OFF SYSTEMS (CLAUSE 2.14.9.1)

APPENDIX E

TYPICAL OPERATING SEQUENCE FOR AN AUTOMATIC FORCED OR INDUCED DRAUGHT BURNER WITH INTERRUPTED PILOT

(Informative)

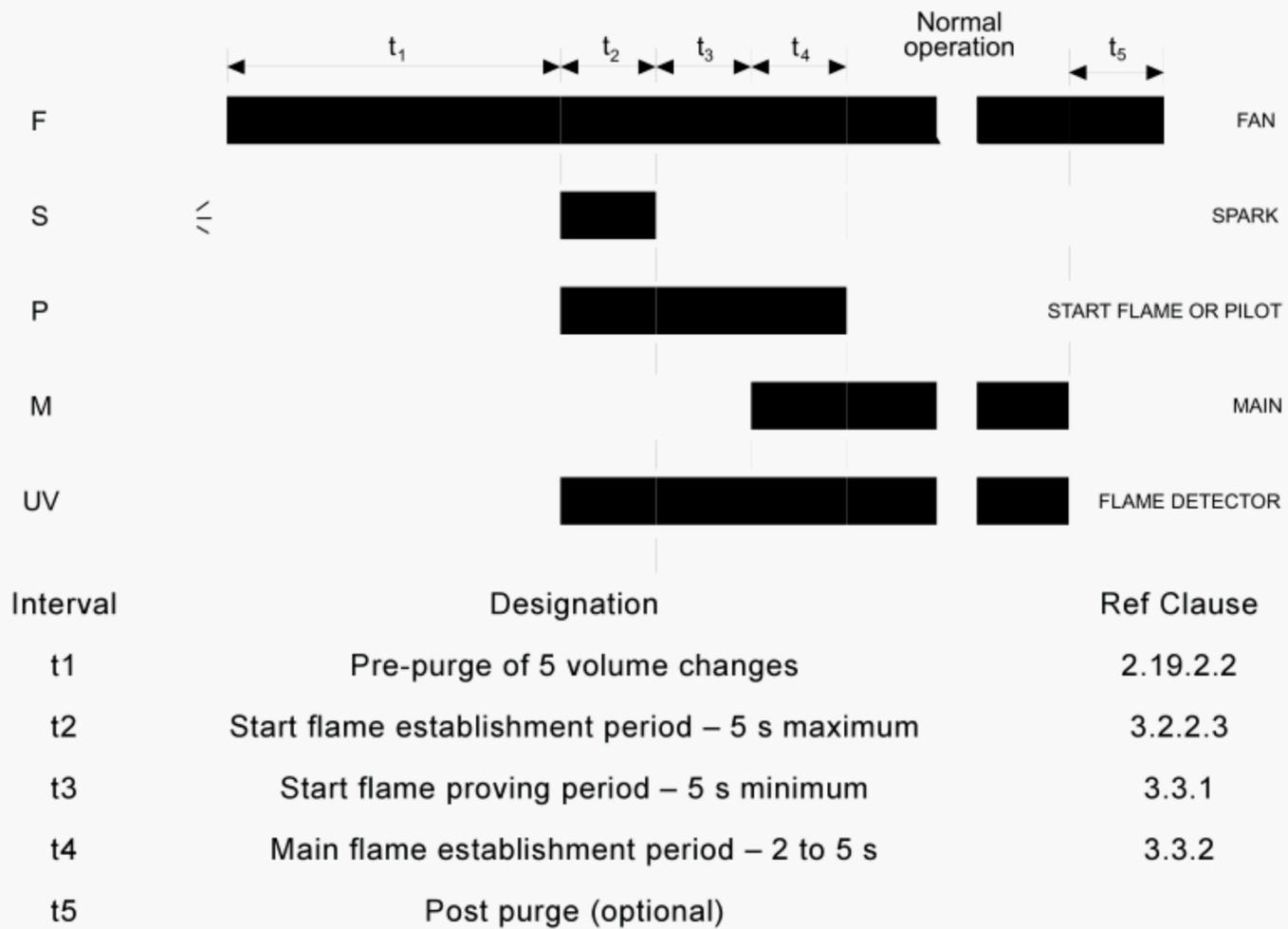


FIGURE E1 TYPICAL OPERATING SEQUENCE DIAGRAM

APPENDIX F
A TYPICAL COMMISSIONING PROCEDURE
(Informative)

F1 SCOPE

This Appendix describes a typical commissioning procedure, and is intended as a model on which the commissioning instructions for an appliance can be based. It is written about a gas-fired appliance that is automatic in operation as a matter of convenience, but it is expected that it can be adapted for applications using manual control.

F2 STAGE 1 PRELIMINARY INSPECTION

- (a) Check that all necessary preliminary approvals have been obtained.
- (b) Burner—check that the capacity matches the appliance specification.
- (c) Burner, valve train and components—check compliance with the applicable requirements.
- (d) Obtain the operating and commissioning manual, including a burner and appliance wiring diagram.
- (e) Gas supply:
 - (i) Check the gas availability and condition at the appliance inlet, e.g. gas type, pressure, and temperature.
 - (ii) Check any gas over-pressure protection against specification.
 - (iii) Check that any interlocks for multiple fuel firing are as specified.
- (f) Interlocks:
 - (i) Check appliance safety devices—over-temperature cut-out device, vents, relief devices, etc.
 - (ii) Check for interlocks on multiple burner installations.
 - (iii) Conduct a visual inspection and check compliance with any applicable requirements.
- (g) Check availability and correct voltage, phase, etc., of the electricity supply.
- (h) Ventilation:
 - (i) check the plantroom ventilation for compliance with any applicable requirements, size and location of openings; or
 - (ii) if mechanical ventilation is provided, check the operation of fans and their interlocks with ventilation openings.
- (i) Carry out a general safety inspection of plantroom area.
- (j) Check that the flue complies with applicable requirements.

F3 STAGE 2 ACTIVATION—RUN WITHOUT FUEL

- (a) Check that all gases have been isolated.
- (b) Ensure that burner isolating valves are closed, i.e. start and main safety shut off valves.
- (c) Check all valves, joints and components for gas leakage.
- (d) Set control instruments (regulators, air pressure switch, etc) to a level at which they will not cause the burner to lockout.
- (e) Switch on power supply.
- (f) Check the operation of all fan motors, including the direction of rotation.
- (g) Prove that all valves operate in the correct sequence, check and set any valve-proving provisions.
- (h) Check the sequence of the burner management system up to lockout, with no start gas present.
- (i) Check that the purge and/or combustion air pressure switch contacts change over from the no-flow condition to the start-up flow condition, and that the proving provisions for both conditions function correctly.
- (j) Check the purge time, and that the purge is monitored during the entire purge period.

F4 STAGE 3 ACTIVATION—RUN WITH FUEL

- (a) Check that the gas supply, burner, appliance, flue, plantroom and process are ready for a safe run on gas.
- (b) Open the appliance manual isolating valve.
- (c) Ensure the isolation of main gas to the burner by closing the test firing valve or by removing the test firing link.
- (d) Ensure that air flow for the start flame is not excessive.
- (e) Admit gas to the burner system inlet.
- (f) Switch burner on, establish start flame.
- (g) Check start rate.
- (h) Prove the operation of the flame safeguard system for start flame.
- (i) Check for reliable ignition of start flame.
- (j) After the establishment of start flame, introduce main gas and establish main flame.
- (k) Check the gas flow rate with the appliance specification.
- (l) Re-check the start rate.
- (m) If high/low firing, check the low fire rate and air setting, and check the flame stability during transition.

F5 STAGE 4 OPERATION

- (a) Carry out combustion checks over the operating range of the burners to ensure that combustion is appropriate for the appliance and complies with the requirements of the technical regulator.
- (b) Check and adjust any air pressure switch.
- (c) Check and set all safety and operating controls.

- (d) Check the operation of pressure relief devices.
- (e) Check the operation of all interlocks (not forgetting any plantroom ventilation interlocks).
- (f) Check that all covers such as regulator caps, pressure test point screws, hatches on controls, etc., have been replaced.
- (g) Secure all locking devices.
- (h) Conduct any required performance verification or efficiency tests.

F6 STAGE 5 COMPLETION

- (a) Ensure that the appropriate operative, supervisory or maintenance staff, or the consumer, receive the relevant instructions on the following:
 - (i) Burner electrical schematic drawings.
 - (ii) Burner component details.
 - (iii) Operating sequence.
 - (iv) Adjustments and settings.
 - (v) Fault finding.
 - (vi) Maintenance.
- (b) Complete the commissioning data sheet.
- (c) Record and re-submit any variations to the appliance if these constitute a departure from the original specification.
- (d) Record the gas supply details.
- (e) Check that any necessary post-commissioning approvals have been completed.
- (f) Check that any operating instructions required are permanently and prominently displayed near the appliance operating station.
- (g) Hand over to the consumer; commissioning completed.

APPENDIX G
FIELD CHECK LIST
(Informative)

This checklist should only be used after the full requirements of the Standard have been consulted and understood. The checklist is not totally comprehensive and is to be used only as an aid to thorough field testing of gas appliances.

The installation of gas appliances is covered by AS 5601. Both AS 5601 and this Standard should be consulted when assessing any gas appliance installation to ensure that, not only the appliance is safe, but its installation is safe as well.

JOB IDENTIFICATION REFERENCE No.....

CONSUMER.....

CONTACT.....

ADDRESS.....

.....

..... POSTCODE.....

GAS TYPE..... SUPPLY PRESSURE.....kPa

CONTRACTOR.....

ADDRESS.....

.....

..... POSTCODE.....

COMMISSIONING PERSON.....

Markings and instructions

Data plate (Section 4)

- 1 Manufacturer’s name
 - 2 Model identification
 - 3 Nominal gas consumption
 - 4 Gas type
 - 5 Maximum & minimum gas supply pressure
 - 6 Purge times
 - 7 Gas pressure at burner head for nominal gas consumption
 - 8 Combustion chamber volume
 - 9 Total volume swept by the combustion products in passing from the burner to the flue connection
 - 10 Serial number
 - 11 Date of manufacture
 - 12 Dilution air volume m³/min at 20°C (where applicable)
- | | | |
|-----------------------------------|-----------------|--|
| Design solvent (where applicable) | Type | |
| | Quantity (1/hr) | |
- 13 Any other markings required by the technical regulator
- Other markings correct (Clause 4.1)
- Instructions, available and sufficient (Clause 4.2)

Appliance design and construction

Design, construction & components conform to submission

- Sound construction (Clause 2.1.5)
 - Materials suitable (Clause 2.7)
 - Surface and component temperatures (Clause 2.4)
 - Any special hazards, eg solvents, dust (Clause 2.1.1)
- Special appliance requirements
- High input appliances (Clause 5.2)
 - Air-gas mixing machines (Clause 5.3)
 - Atmosphere generators (Clause 5.4)
 - Process after-burners (Clause 5.5)
 - Steam and hot water boilers (Clause 5.6)
 - Direct fired air heaters (Clause 5.7)

• Gas engines and turbines	(Clause 5.8)	.....
• Incinerators and cremators	(Clause 5.9)	.....
• Ovens — direct-fired	(Clause 5.10)	.....
• Smoke ovens — direct-fired	(Clause 5.11)	.....
• Water heaters	(Clause 5.12)	.....
Gas valve trains			
• Pipework	(Clause 2.8)	.....
• Pressure rating	(Clause 2.8.3)	.....
• Appliance isolating valve	(Clause 2.8.7)	.....
• Gas tight	(Clause 2.8.1)	.....
• Gas pressure regulation	(Clause 2.9)	.....	Set:
• Over-pressure protection	(Clause 2.10)	.....	Set:
• Pressure test points	(Clause 2.12)	.....
• Safety shut off systems	(Clause 2.14)	.....
Operation	(Clause 2.14.2)	.....
Position-proving system	(Clause 2.14.9)	.....
POC switch operation	(Clause 2.14.9.1)	.....
Leakage detection	(Clause 2.14.10)	.....
• Other		.....
Air controls			
• General	(Clause 2.15)	.....
• Air flow detector(s)	(Clause 2.17.2)	.....	Set: Trip:
• Air gas ratio control	(Clause 2.15.1)	.....
• Dampers	(Clause 2.18)	.....
• Appliance pre-purging	(Clause 2.19)	.....	Set: Trip:
		.....	Time:
Process controls	(Clause 2.20)	.....	Set: Trip:
Pilot burners			
• Stable	(Clause 2.22.1)	.....
• Ignition of main burner	(Clause 2.22.1)	.....
• Support and location	(Clause 2.1.7)	.....
Ignition systems	(Clause 2.21)	.....
Control circuits	(Clause 2.26)	.....
• Required	(Clause 2.24.2)	.....
• Reaction time	(Clause 2.24.5)	.....
• Self check/flame simulation	(Clause 2.24.7)	.....

Multi-fuel firing systems

- Alternative (Clause 5.13.1) _____
- Simultaneous (Clause 5.13.2) _____

Appliance operation

General _____

- Smooth ignition (Clause 2.23) _____

Ignition

- Starting sequence interlocks (Clause 3.2.1) _____
- Ignition sequence (Clause 3.2.2) _____
- Start gas rate (Clause 3.2.3) _____ %CO₂

Main burners (Clause 3.3) _____

Interlocks (Clause 3.4) _____

- Correctly installed & operating (Clause 3.4.1) **Set:** _____
- Limit devices (Clause 3.4.2) _____

Correctly installed

Trip and lockout **Set:** _____

Operation sequences (Clause 3.5) _____

- Self check (Clause 2.24.3) _____
- Start interlocks (Clause 3.2.1) _____
- Pre-purge (Clause 2.19) _____
- Spark/ignition (Clause 3.2.2.1) _____
- Start flame establish. period (Clause 3.2.2.3) _____
- Main flame establish. period (Clause 3.3.2) _____
- Lockout of burner(s) (Clause 3.5.4) _____

Combustion conditions (Clause 3.6) _____

- Ignition smooth & reliable _____
- Complete within combustion chamber _____
- Combustion stable _____

Combustion analysis

LOW MID HIGH DFAH

Carbon dioxide _____

Carbon monoxide _____

Oxygen _____

Low start fire carbon dioxide

Airflow measurements

Purge air flow

Required: _____ Actual: _____

Purge time

Required: _____ Actual: _____

Commissioning

Systematic and correct

Special appliance requirements

High input appliances

- Multiple main burner ignition

- Burner control

- Flame safeguards

Continuous checking required?

Multiple burner supervision

Extra flame safeguard

Intermittent/permanent pilots

Air-gas mixing machines and mixing blowers

- Strength sufficient

- Material satisfactory

- Air-gas ratio fixing

- Safety shut off system and operation

- Pipework and fittings strength sufficient

- Mixing blower outlet not exceeding 1 m

- Blow out discs and non-return valve

- Flame arrestors correct & correctly installed

Atmosphere generators and special atmospheres

- Water cooling system

Set: _____

- Flow indicators

- Venting of special atmospheres

- Generator start-up

- Automatic atmosphere relief device

Set: _____

- Disposal of special atmospheres

- Vent lines

- Special atmosphere (combustible)

Safe discharge

Reliable ignition

Flame arrestor

Flame arrestor operation

- Piping for special atmosphere

- Storage of special atmospheres
- Compressed special atmosphere

Exothermic atmosphere generators

- Flame safeguard
- Low temperature limit
- Pressure detectors

	Set:	Trip:
High:	Set:	Lockout:
Low:	Set:	Lockout:

- Manual ignition
- Purging
- Air-gas ratio control

Time:	Rate:
-------	-------

Endothermic atmospheric generators

- Safety shut off valves
- Air shut off device
- Pressure detectors

		Trip:
		Trip:
High gas:	Set:	Trip:
Low gas:	Set:	Trip:
High air:	Set:	Trip:

Process after-burners

- Interlocking
- Flame failure
- Excessive process products limit
- Combustion air supply
- Shutdown
- Air in process exhaust gas
- Pre-purge

Set:	Trip:	
Time:	Rate:	Omission:

Steam and hot water boilers

- Registered
- Emergency valve

Number:
Type:

Direct-fired air heaters

- Air supply directly from outside
- Air flow detector
- High temperature limit
- Start gas rate (10% max)
- Combustion
- Aldehydes odour:
- Correct test conditions:
- Additional markings as required

No flow:	Set:	Trip:
Trip:	Set:	(80°C max)
Rate:		
CO ₂ :	%	CO: ppm

Stationary gas engines and turbines

- Safety shut off system
- Turbine shut off system
- Flexible connection
- Exhaust system strength
- Blow disc interlock
- No manifolding of exhaust systems
- External terminal location

Trip: _____

Trip: _____

Incinerators and cremators

- Safety shut off system
- Visual flame loss indicator
- Primary burner interlock
- Combustion air
- Pre-purge
- Flue not interconnected

Trip: _____

Set: Trip: _____

Set: Trip: _____

Time: Rate: _____

Ovens direct-fired

- Pre-purge
- Provision of air
- Explosion relief
- High temperature limit
- Access for cleaning

Time: Rate: _____

Set: Trip: _____

Smoke ovens — direct-fired

- Lighting torch
- Combustion air supply
- Explosion relief
- Shielding of burners
- Sawdust tray location
- Flue cross-sectional area
- Flue damper restriction

Area: _____

Water heaters

- Thermostat fitted
- High temperature limit (99°C max)
- Unvented heater relief valve(s)
- Draining

Trip: Set: _____

Total rating: _____

APPENDIX H
FLAME SAFEGUARD SELECTION
(Informative)

The following information on flame safeguard classification has been provided to assist users in the selection of a unit appropriate for the application.

The basic flame safeguard is a Class 3D that changes over one or more sets of contacts whenever a flame is detected. It is primarily intended for use in manual systems or as an addition to a programming unit to supervise an additional flame. Any safe start checks required by Appliance Standards or any programming functions are provided by external circuitry.

The majority of flame safeguard applications will require a Class 2 unit:

- | | |
|----------|---|
| Class 2A | These units provide timings which are acceptable for most applications. However, units should still be checked for any other features required for a particular application and for any duty limits recommended by the manufacturer. |
| Class 2B | Class 2B units are generally suitable for natural draught burners on small appliances where the longer flame establishment periods and limited flame proving periods may be permitted by the gas appliance Standards. |
| Class 2C | These units are provided with a reignition attempt after flame failure. Sub-type (a) has timings similar to Class 2A units and sub-type (b) has timings similar to Class 2B units. Class 2C units should only be used under the strict guidelines laid down in relevant gas appliance Standards. |
| Class 2D | These units are similar to the basic Class 3D units except that a safe start check is included. |
| Class 1 | Class 1 units are similar to their Class 2 counterparts except that they automatically check the correct operation of the unit at regular intervals whilst in use, thus providing additional safety against fault conditions. This feature is particularly relevant where appliances operate for extended periods without shutdown. |

APPENDIX I

PRO-FORMA LETTER TO THE GAS TECHNICAL REGULATOR FROM A CONTRACTOR /COMPANY CERTIFYING THE TESTS CONDUCTED ON THE PES

(Informative)

CONTRACTOR/COMPANY (letterhead)

To:(ABC Gas Company)

We certify that the Type B appliance described in the accompanying submission for:

.....

job has had its Programmable Electronic System (PES) exhaustively tested by simulation and field testing under all known possible combinations to try to detect any possible systematic software and systematic/random hardware faults. To the best of our assessment the PES is error-free and functions according to the logic on the attached flow sheet.

Yours faithfully

..... (Signature)

..... (Print name)

Date:

FIGURE I1 EXAMPLE OF PRO-FORMA LETTER—PES

NOTES

NOTES

NOTES

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body. For further information on Standards Australia visit us at

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