

Australian Standard[®]

LP Gas mobile industrial direct fired air heaters



This Australian Standard® was prepared by Committee AG-001, Gas Appliances. It was approved on behalf of the Council of Standards Australia on 12 January 2011. This Standard was published on 26 May 2011.

The following are represented on Committee AG-001:

- Appliance and Component Testing
 - Australian Gas Association
 - Australian Greenhouse Office, Department of the Environment and Water Resources
 - Consumers' Federation of Australia
 - Energy Networks Association
 - Gas Appliance Manufacturers Association of Australia
 - Gas Technical Regulators Committee
 - LPG Australia
-

This Standard was issued in draft form for comment as DR AS 5262.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

Keeping Standards up-to-date

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting **www.standards.org.au**

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at **mail@standards.org.au**, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard[®]

LP Gas mobile industrial direct fired air heaters

Originated as AG 404—1988.
Revised and redesignated as AS 5262—2011.

COPYRIGHT

© Standards Australia Limited

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968.

Published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 978 0 7337 9856 6

PREFACE

This Standard was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee AG-001, Gas Appliances, to supersede AG 404—1988, *Approval requirements for LPG mobile industrial direct fired air heaters*.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide manufacturers, designers, regulatory authorities, testing laboratories and similar organizations with uniform minimum requirements for the safety, performance and use of LP Gas mobile industrial direct fired air heaters.

AS/NZS 5601.1, *Gas installations, Part 1: General installation*, provides essential requirements and basic standards for gas installations.

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

Minimal changes have been made to AG 404—1998 in this revision in anticipation of the re-structuring and updating of all gas appliance standards.

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.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 REFERENCED DOCUMENTS	5
1.3 DEFINITIONS	5
SECTION 2 DESIGN AND CONSTRUCTION	
2.1 GENERAL	13
2.2 MATERIALS AND STANDARDS	15
2.3 ELECTRICAL SYSTEMS	16
2.4 INSTALLATION REQUIREMENTS	16
2.5 MAINTENANCE REQUIREMENTS	16
2.6 PRESSURE REGULATORS	18
2.7 GAS CONTROLS AND FLAME SAFEGUARDS	18
2.8 COMBUSTION AIR SUPPLY AND CONTROLS	19
2.9 IGNITION, PILOTS AND MAIN BURNERS	20
2.10 MARKINGS	21
2.11 INSTRUCTIONS	22
SECTION 3 PRELIMINARY TESTS	
3.1 GENERAL REQUIREMENTS	24
3.2 PREPARATION FOR TESTING	24
3.3 GAS LEAKAGE	25
3.4 GAS CONSUMPTION—TOLERANCE ON DETERMINED GAS CONSUMPTION	25
3.5 LOW GAS PRESSURE DETECTORS	25
3.6 IGNITION AND SAFETY SHUT-OFF SYSTEMS	26
SECTION 4 COMBUSTION TESTS	
4.1 INTRODUCTION	28
4.2 SATISFACTORY COMBUSTION	28
4.3 TESTING AT MANUFACTURER'S RATED AIR THROUGHPUT	28
4.4 TESTING AT AIR FLOW JUST IN EXCESS OF SETTING ON AIR FLOW DEVICE	28
4.5 COMBUSTION PRODUCTS LIMITS	29
SECTION 5 PERFORMANCE TESTS	
5.1 AIR DISCHARGE TEMPERATURE	30
5.2 COMBUSTION AIR SUPPLY	30
5.3 INTERLOCK SYSTEMS	30
5.4 SHUT-DOWN	31
5.5 TEMPERATURE HAZARDS	31
5.6 HEAT RESISTANCE	32
5.7 SPECIFICATIONS	32

APPENDICES

A	FIGURES A1 TO A3	33
B	METHODS OF TEST.....	36
C	MAINTENANCE SCHEDULE AND SERVICING INSTRUCTIONS.....	56
D	DETERMINATION OF FORMALDEHYDE CONCENTRATION IN DISCHARGE PRODUCTS	61
E	AIR DISCHARGE SAMPLING AND TEMPERATURE MEASUREMENT	63
F	APPLIANCE TEST REPORT	66

STANDARDS AUSTRALIA

Australian Standard**LP Gas mobile industrial direct fired air heaters**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for new mobile industrial direct fired air heaters, constructed entirely from new materials and components and intended for use with liquefied petroleum gas (LP Gas) with gas consumption greater than 50 MJ/h and not exceeding 500 MJ/h.

NOTE: For direct fired air heaters up to and including 50 MJ/h, refer to AS 4553.

Figures for this Standard are set out in Appendix A. Methods of test are set out in Appendix B.

1.2 REFERENCED DOCUMENTS

The documents referred to in this Standard are as follows:

AS

- 1319 Safety signs for the occupational environment
- 1881 Zinc alloys—Casting ingots and castings—Quality requirements
- 4553 Gas space heating appliance
- 4617 Manual shut-off gas valves
- 4625 Electronic flame safeguards and flame detectors
- 4646 Gas appliance standards—Definitions and calculations

AS/NZS

- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3100 Approval and test specification—General requirements for electrical equipment
- 5601 Gas installations
- 5601.1 Part 1: General installations
- 60335 Household and similar electrical appliances—Safety
- 60335.1 Part 1: General requirements (IEC 60335-1 Ed.4.2, MOD)

ISO

- 6976 Natural gas—Calculation of calorific values, density, relative density and Wobbe index from composition

EN

- 298 Automatic gas burner control systems for gas burners and gas burning appliances with or without fans

1.3 DEFINITIONS

For the purpose of this Standard the definitions below apply.

1.3.1 Appliance regulator

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

1.3.2 Approved

Acceptable to, and meeting the prescribed standards of, the authority having jurisdiction.

1.3.3 Authority

Means the authority having jurisdiction or such authority as delegated.

1.3.4 Authority having jurisdiction

The authority having statutory (legal) control.

1.3.5 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.

1.3.6 Automatic ignition

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

1.3.7 Automatic operation

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

1.3.8 Calibration

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

1.3.9 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.

1.3.10 Combination gas control

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

1.3.11 Combustible construction

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

1.3.12 Combustion products

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

1.3.13 Cut-off

The function of isolating the upstream pressure from the downstream side of a valve or regulator.

1.3.14 Determined gas consumption

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

NOTE: The derivation of the formula used for calculating the determined gas consumption is given in AS 4646.

1.3.15 Direct gas-fired air heater

A heater in that all the combustion products are released into the air stream being heated.

1.3.16 Direct ignition device

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

1.3.17 Fitting

A component used to join pipes, or to change direction or diameter of a pipe, or to provide a branch, or to terminate a pipe.

1.3.18 Flame abnormality

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

1.3.19 Flame detector

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

1.3.20 Flame establishment period

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

1.3.21 Flame failure response time

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

1.3.22 Flame proving period

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

1.3.23 Flame safeguard

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

1.3.24 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.

1.3.25 Flue gases

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

1.3.26 Forced draught burner

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

1.3.27 Gas

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

- (a) *Natural gas (NG)* A hydrocarbon gas, consisting mainly of methane.
- (b) *Simulated natural gas (SNG)* A gas comprising a mixture of LP Gas and air, in the approximate proportions of 55% gas and 45% air for commercial propane.
- (c) *Town gas (TG)* A gas manufactured from coal or petroleum feed stocks.
- (d) *Tempered liquefied petroleum gas (TLP)* A gas comprising a mixture of LP Gas and air, in the approximate proportions of 27% gas and 73% air for commercial propane.

- (e) *Liquefied petroleum gas (LP Gas)* A gas composed predominantly of any of the following hydrocarbons, or any combination of them in the vapour phase:
- (i) Propane.
 - (ii) Propene (propylene).
 - (iii) Butane.
 - (iv) Butene (butylene).
- (f) Universal LP Gas

Any mixture of propane and butane. The term 'Universal LP Gas' is used to describe a category of certification or class appliance rather than a gas type. Certification options for LP Gas appliances are propane, butane or Universal LP Gas.

1.3.28 Heating value, gross (at constant pressure)

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

NOTE: Calculation of heating value is based upon ISO 6976 as given in AS 4646.

1.3.29 Hose assembly

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

1.3.30 Interlock

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

1.3.31 Intermittent pilot

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

1.3.32 Interrupted pilot

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

1.3.33 Limit device

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

1.3.34 Lockout

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

1.3.35 Lock-up pressure

The outlet pressure of a pressure regulator which causes the regulator to shut off completely.

1.3.36 Low gas pressure detector

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

1.3.37 LP Gas

See under Gas.

1.3.38 Manual ignition

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

1.3.39 Mobile appliance

An appliance with one or more wheels designed to be easily moved from place to place by one person.

1.3.40 Nominal gas consumption

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

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

1.3.41 Nominal outlet pressure

The outlet pressure or outlet pressure range of a regulator, as specified by the manufacturer.

1.3.42 Nominal test point pressure

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

1.3.43 Permanent pilot

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

1.3.44 Piezo electric ignition

A form of ignition with which a high voltage spark is produced as the result of pressure or impact upon specially treated ceramic material.

1.3.45 Pilot

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

1.3.46 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. that 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; and
 - (e) other computer based devices.
- 4 A PES can include a microprocessor-based temperature, pressure, air/fuel ratio, or level controller or monitor.

1.3.47 Programming flame safeguard

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

1.3.48 Rated working pressure

The maximum allowable inlet pressure specified by the manufacturer.

1.3.49 Regulator

A device which automatically regulates the outlet pressure or the outlet volume of gas passing through it to a pre-determined value. Regulators may be adjustable (usually spring-loaded) or non-adjustable (usually weight-loaded).

1.3.50 Relative density

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

NOTE: Calculation of relative density is based upon ISO 6976, as given in AS 4646.

1.3.51 Safety shut-down

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

1.3.52 Safety shut-off system

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

1.3.53 Safety shut-off valve

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

1.3.54 Set pressure

The mean pressure at which the device will trip at a specific adjustment.

1.3.55 Specific gravity

See relative density.

1.3.56 Stoichiometric combustion

Combustion of a fuel–air mixture in exact weight proportion so that the theoretical products of combustion are only carbon dioxide, water vapour and the nitrogen in the combustion air and no excess oxygen or incomplete combustion products.

1.3.57 Temperature limit device

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

1.3.58 Temperature sensing element

The part of a thermostat that is placed in the controlled medium and which responds to changes in the applied temperature.

1.3.59 Thermostat

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

1.3.60 Thermostat bypass

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

1.3.61 Thermostat valve

The valve that is operated directly or indirectly by the temperature sensing element.

1.3.62 Valve

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

1.3.63 Valve train

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

1.3.64 Vent limiter

A means of limiting the flow of air, or gas in the case of a diaphragm leakage, from the chamber on the atmospheric side of the diaphragm. This may be either a limiting orifice or a limiting device.

1.3.65 Wobbe index

The Wobbe index of a gas is as shown in Table 1.1.

TABLE 1.1
TEST GAS TABLE

Composition, %								Characteristics*			
Test gas	Application	Hydrogen	Methane	Propane	Propylene	Butane	Nitrogen	Air	Heating value MJ/m ³	Relative density	Wobbe index MJ/m ³
X	LP Gas	—	—	100	—	—	—	—	95.8	1.553	76.9
Y		—	—	—	—	100	—	—	125.7	2.078	87.2
Z		—	—	—	100	—	—	—	88.5	1.476	72.9

* The reference conditions for the characteristics are 15°C, 101.325 kPa, dry. The test gases shall be of a composition and of combustion characteristics as shown in the table. Where base gases of the required combustion or purity are not available, suitably blended gases of the same Wobbe index and other combustion characteristics may be used. In case of dispute, strictly those gases shown in Table 1.1 shall be used.

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

SECTION 2 DESIGN AND CONSTRUCTION

2.1 GENERAL

2.1.1 Preliminary specification

Testing shall not commence until the manufacturer's written description of the appliance and instructions for installation and operation, sufficient for testing, have been received and studied. The appliance shall not be dismantled for specification study until testing has been completed.

2.1.2 Physical inspection

Before any physical performance testing as set out in Sections 3, 4 and 5 takes place, the industrial air heater must satisfy the design and construction and other requirements as set out in this Section to ensure that it does not possess any obvious features which would prevent its approval. If the industrial air heater is not considered satisfactory, no time shall be spent in testing until the manufacturer has made the necessary adjustments.

2.1.3 Certification of safety components

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

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

2.1.4 Programmable electronic systems

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

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

2.1.5 Manual shut-off gas valves

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

2.1.6 Compliance of electrical components

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

2.1.7 Fuel storage container

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

2.1.8 Sharp projections or edges

All parts with which the operator's hand 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 Safety, substantiality and durability

The construction of the gas firing equipment shall be such that all parts are well fitted and are not warped, bent, broken or otherwise damaged, and shall be in accordance with reasonable concepts of safety, substantiality and durability.

2.1.10 Displacement of parts

Every part of the equipment shall be secure against accidental displacement and shall be constructed to maintain a fixed relationship between essential parts under normal and reasonable conditions of handling and usage so as to assure continued compliance with these requirements.

2.1.11 Means of support

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

2.1.12 Enclosures for gas trains

Enclosures for gas trains shall be adequately ventilated at high and low level.

2.1.13 Burner valve train

Each burner or group of burners shall be supplied with a valve train consisting of at least the following components:

- (a) Gas pressure regulator.
- (b) A safety shut-off valve system complying with Clause 2.7.9.
- (c) Manual shut-off valve or a means provided on the appliance to manually shut off both safety shut-off valves.

2.1.14 Valve train components

All valve train components shall be capable of withstanding 1.5 times the maximum operating pressure of the appliance.

2.1.15 Manual shut-off valve

Where a manual shut-off valve is fitted to comply with Clause 2.1.13, Item (c), it shall be a quarter turn valve.

2.1.16 Pipework

Pipework shall comply with AS/NZS 5601.1 where relevant to expansion, flexibility, materials, joints and jointing compounds.

2.1.17 Support for manual shut-off valve

Gas supply piping, tubing and fittings shall be adequately supported.

2.1.18 Construction of joints

Joints shall be securely bolted, screwed, brazed or of equivalent construction and shall be gas tight.

2.1.19 Adjustable devices

Any adjustable device that affects the safety of the appliance shall be so designed that—

- (a) it may be readily and conveniently reset as required;
- (b) it is, if important to the safety of the equipment, protected against unauthorized interference;
- (c) it is not upset by temperature changes;
- (d) it is not susceptible to sticking or seizing under normal conditions of use; and
- (e) it incorporates locking or holding arrangements, which are sufficiently positive to prevent subsequent movement through accident, vibration, or expansion; the tightening of any such locking device shall not significantly alter any setting.

2.1.20 Limit devices

Any limit device shall be locked or sealed unless, when adjusted to its maximum setting and minimum differential, it functions to shut off the gas supply before an unsafe condition is reached.

2.1.21 Provision of positive locking devices

Any manual adjustments affecting the combustion conditions shall be provided with positive locking devices.

2.1.22 Prevention of manual contact with fan impeller

Each appliance air inlet shall be guarded or screened to prevent manual contact with the fan impeller.

2.1.23 Gas pressure test point

The following requirements apply:

- (a) A gas pressure test point or gauge shall be provided downstream of the regulator and upstream of the safety shut-off valve and at the inlet to burners.
- (b) Pressure test points shall be plugged or capped. Where the normal working pressure exceeds 7 kPa, a manual shut-off valve shall be fitted unless a self-sealing fitting is used.
- (c) Means shall be provided to test the gas tightness of each valve of the safety shut-off valve system.

2.2 MATERIALS AND STANDARDS

2.2.1 General

Materials used in the construction shall be suitable for the conditions of use.

2.2.2 Materials in contact with gas

Materials in contact with gas shall be suitable for use with liquefied petroleum gases.

2.2.3 Strength, durability and suitability of materials

The strength, durability and suitability of materials used for the construction of gas firing equipment shall ensure their safe operation and should render them reasonably durable in normal service.

2.2.4 Zinc based alloys—general

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

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

- (a) the alloy shall comply with AS 1881, Type ZN AL 4; and
- (b) the temperature shall not exceed 80°C.

2.2.5 Zinc based alloys—exposure to water vapour

Zinc based alloys shall not swell, crumble or develop cracks when exposed to saturated water vapour at 97°C for 10 days.

2.2.6 Materials subject to heat or corrosion

Materials subject to heat or corrosion shall be sufficiently resistant to such heat or corrosion to ensure acceptable equipment life.

2.2.7 Fittings

Olive type fittings shall not be used on gas fitting lines. Other fittings shall conform to an acceptable standard and mating surfaces shall be compatible.

2.3 ELECTRICAL SYSTEMS

2.3.1 Accessibility to electrical components

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

2.3.2 Connection of electrical components

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

2.3.3 Protection of low voltage electrical components and wiring

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

2.3.4 Outdoor installation

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

2.3.5 Motor bearing suitability

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

Normal operation shall mean operating at nominal gas consumption with the fan operating at all speeds.

2.3.6 Control circuit design

Control circuits shall be so designed that the failure of a single component cannot cause a hazardous condition.

2.3.7 Failure of component

Where the failure of a component allows the unit to remain in operation, any further component failures shall not cause a hazardous condition.

2.4 INSTALLATION REQUIREMENTS

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

2.5 MAINTENANCE REQUIREMENTS

2.5.1 Special tools

Special tools beyond those normally carried by a service fitter shall not be required for adjusting or replacing any component or integral part except those of electrical components or assemblies.

2.5.2 Dismantling and replacement by the operator

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

2.5.3 Insertion and removal of screw-in jets

Screw-in jets such as gas injectors and burner jets shall be made so that they can be inserted and removed without damage.

2.5.4 Assembly and attachment of handles, dials and pointers

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

2.5.5 Accessibility for adjustment

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

- (a) Aeration controls. (It is acceptable for the adjustment to be finalized with the burner removed, provided the setting will not be disturbed during removal.)
- (b) Pilots.
- (c) Regular adjustments.
- (d) Ignition devices.
- (e) Safety devices.

2.5.6 Accessibility for replacement

The following components shall be accessible for normal servicing in position and shall be replaceable during normal servicing:

- (a) Regulator diaphragms and valves (body exempt).
- (b) Gas valve plugs.
- (c) Injector nipples.
- (d) Filters.
- (e) Pilot head assemblies, pilot jets.
- (f) Burners.
- (g) Ignition devices.
- (h) Automatic control equipment.
- (i) Flame safeguards.
- (j) Fans, electric motors and drives.

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

2.5.7 Accessibility of pilot flame detector

Means shall be provided for accessibility of the pilot flame detector.

2.5.8 Inaccessible nuts or bolts

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

2.6 PRESSURE REGULATORS

2.6.1 Provision of a pressure regulator

A main burner gas pressure regulator shall be supplied.

2.6.2 Type of pressure regulator

Gas pressure regulators shall be of the lock-up type.

2.6.3 Provision of a separate pressure regulator

Where the start-gas rate is not the full burner input a separate regulator shall be fitted to control the start gas on an appliance unless the start gas valve train is connected downstream of the main gas pressure regulator.

2.6.4 Provision of a vent limiting device

Gas pressure regulators shall be fitted with a vent limiting device that does not adversely affect the operation of the regulator.

2.6.5 Positioning of pressure regulators

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

2.6.6 Adjustments on pressure regulators

Gas pressure regulators intended to be adjusted during normal operation shall not be capable of adjustment beyond the intended operating range.

Other gas pressure regulators shall be of a type or design not readily interfered with by unauthorized persons.

2.7 GAS CONTROLS AND FLAME SAFEGUARDS

2.7.1 Accessibility of controls and working parts

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

2.7.2 Accidental change of settings of valves, dials and pointers

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

2.7.3 Markings for controls, dials and gauges

Controls, dials and gauges shall be identified with clear and permanent markings and shall be marked with an appropriate scale.

2.7.4 Indication of functions on manual gas valves

Manual gas valves serving more than one function shall have the position of each function including any special lighting position, clearly indicated.

2.7.5 Type of manual shut-off valves

Manual shut-off valves shall be of the quick acting type. They shall be of a type that clearly indicates the open and closed positions and shall be provided with rigid stops secured to the valve to limit the extremes of travel to the fully open and fully closed positions.

2.7.6 Use of limit devices

Limit devices shall not be used as operating controls.

2.7.7 Provision of flame safeguard

All heaters shall include a flame safeguard system incorporating an approved flame safeguard connected in such a manner as to cause lockout of that burner, in the event of flame failure at the point of supervision.

2.7.8 Supervision of pilots

Pilots shall be supervised by an approved flame safeguard system.

2.7.9 Main burner shut-off valves

All gas to the main burners shall pass through at least two safety shut-off valves in series that may or may not be in a single control body. At least one of the valves shall be a Class 1 safety shut-off valve.

2.7.10 Fitting of double block safety shut-off valve

Burners employing ignition of the main burner at low rate may be fitted with one double block safety shut-off valve system to cover both main and start gas rates provided that the downstream safety shut-off valve is a two-stage valve employing an independently energized or actuated second-stage such that energizing the second stage alone does not open the valve and incorporating proof that the second stage is not operated before and during the start gas establishment period.

2.7.11 Fitting of Class 1 valves

Where a separate start gas line is provided it shall be fitted with one Class 1 valve unless the start gas rate exceeds 10% of the main burner gas rate, in which case two Class 1 valves in series are required.

2.7.12 Start gas supply

A start gas supply may be taken from between the two main gas safety shut-off valves provided the downstream safety shut-off valve is fitted with a closed position indicator switch (CPI).

2.7.13 Fitting of safety shut-off system

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

2.7.14 No bypassing of safety shut-off valve system

A safety shut-off valve system shall not be bypassed.

2.7.15 Protection of required safety controls

No means shall be provided with a limit device for the purpose of permitting any safety control to be rendered ineffective or allowing firing of the appliance without the protection of each of the required safety controls.

2.8 COMBUSTION AIR SUPPLY AND CONTROLS

2.8.1 Combustion air supply equipment

The air supply equipment shall be correctly sized and arranged to ensure a non-pulsating air flow adequate for all operating conditions specified by the manufacturer.

2.8.2 Combustion air flow proving interlock

The air flow proving device shall be interlocked to cause lockout or prevent an ignition attempt unless the device is in the 'no flow' condition prior to the start-up of the air supply fan.

2.9 IGNITION, PILOTS AND MAIN BURNERS

2.9.1 Provision of manual shut-off valve for pilot burner

A manual shut-off valve shall be provided for turning off the gas supply to a pilot burner independently of the main burner.

2.9.2 Provision of manual shut-off valve for main burner

A manual shut-off valve shall be provided to isolate the main burner whilst commissioning a pilot burner or low fire start system unless an alternative approved permanent isolation facility is provided.

2.9.3 Viewing of burner flames

It shall be possible for maintenance or adjusting personnel to view a flame, either by direct sight or by means of a remote viewing device equivalent to direct sight. The removal of a panel or part to facilitate viewing is permissible provided that there is no hazard involved.

2.9.4 Ensuring burner or pilot is alight

It shall be possible for an operator to ensure visually, safely and at any time that the burner or pilot is alight. Reflected glare or indicator lamps would be considered adequate for this purpose.

2.9.5 Support of pilots, igniters and flame sensing devices

All pilot burners, fixed igniters and flame detectors shall be supported in such a manner that their position relative to each other and to the flame of the main burner or burners will remain fixed.

2.9.6 Securing of burners

Burners shall be secured so that they will not twist, slide or drop out of position in normal use.

2.9.7 Support of limit devices

Limit devices shall be supported in such a manner that each will remain fixed in its proper position. It shall be possible to determine readily by observation or tests whether or not each limit device is in its proper location.

2.9.8 Protection of ports and injectors

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

2.9.9 Design and location of means for ignition

The means for ignition shall be so designed and located as to prevent the collection of carbon and other material, and the dislocation, distortion and burning of parts as the result of normal conditions of vibration, heating, etc.

2.9.10 Location of pilot burners

All pilot burners shall be located so as to ensure proper ignition of all burners, be readily accessible for service and maintenance and so fixed that they must be readily returned to the original position after removal for servicing.

2.9.11 Aeration adjustment for Universal LP Gas appliances

For Universal LP Gas appliances, primary burner aeration shall be non-adjustable.

2.10 MARKINGS

2.10.1 Provision of marking plate(s)

The heater shall have a clear and permanent marking plate(s) readily accessible and easy to read.

2.10.2 Information on marking plate(s)

Such marking plate(s) shall be labelled 'MOBILE INDUSTRIAL DIRECT GAS-FIRED AIR HEATER' and shall include the following information:

- (a) Manufacturer's name.
- (b) Model identification.
- (c) Month and year of manufacture or serial number where this is documented to show month and year of manufacture.
- (d) LP Gas type.
- (e) Rated gas consumption.
- (f) Maximum and minimum gas supply pressure.
- (g) Gas pressure at burner for rated maximum gas consumption.
- (h) Markings as required by the electricity supply authority.
- (i) Approval certificate number.
- (j) Air flow proving device setting.
- (k) Setting of temperature limit device.
- (l) Speed of heater fan (in r/min) and related air flow in litres per second (L/s).
- (m) Clearance from combustible materials.

2.10.3 Provision of wiring diagram

Each heater shall be accompanied by a wiring diagram.

2.10.4 Provision of label relating to use

The heater shall have a permanent label attached in a prominent position with a notice in letters at least 8 mm high reading—

THIS HEATER IS APPROVED FOR INDUSTRIAL USE ONLY.

2.10.5 Provision of label relating to ventilation

The heater shall be clearly labelled on each side in letters 30 mm high—

USE ONLY IN A WELL VENTILATED SPACE

followed by in letters 20 mm high—

MINIMUM VOLUME V CUBIC METRES

where V is calculated as 5 times the rated gas consumption in MJ/h.

The lettering shall have a clear space of 20 mm between lines and 20 mm all round. Lettering shall conform to AS 1319.

2.10.6 Provision of warning label

The appropriate warning label as shown in Figure A1 in Appendix A. The label shall be located on the outside of the appliance in a position where it can be easily read by the operator when the appliance is in the installed position.

2.10.7 Gas valve 'OFF' position

The means of isolating the gas supply ('OFF' position) shall be clearly identified and visible to the user.

2.11 INSTRUCTIONS

2.11.1 General

The appliance should be used in accordance with the manufacturer's operating instructions, local gas fitting regulations, municipal building codes, AS/NZS 5601.1, and any other relevant statutory regulations.

2.11.2 Provision of operating instructions

The operating instructions should clearly show, using both written and diagrammatic detail, the use of the appliance under all intended conditions to comply with all statutory requirements, and to obtain satisfactory operating conditions.

Clear and concise operating instructions shall be fixed to the heater in a prominent position and shall cover each of the following points:

- (a) Recommended location of the appliance; clearance from fixings, walls, floors, or other combustible materials.
- (b) Details of any special conditions that may be required in use.
 - (i) Gas inlet connection; provide details of—
 - (ii) size and type of gas inlet connection;
- (c) Location of and/or alternative locations of gas inlet connections;
NOTE: Refer to AS/NZS 5601.1 for pipe sizing details.
- (d) Details of required ventilation.
- (e) Instructions of the procedure to be adopted if the appliance cannot be adjusted to perform correctly.
- (f) Start-up;
- (g) Normal operation;
- (h) Normal shut-down; and
- (i) Emergency shut-down.

2.11.3 Content of operating and servicing instructions

Each heater shall be supplied with operating and servicing instructions which shall include a Warning Note to read—

WARNING: THIS HEATER IS APPROVED FOR INDUSTRIAL USE ONLY.

Model number and type of appliance shall be clearly shown and shall include:

- (a) Model or type of heater.
- (b) Gas or gases for which the heater is intended and data such as gas consumptions, pressures, etc.
- (c) Reference to the appliance data plate and location on appliance of data plate.
- (d) Instructions with regard to the removal of any transit protection.
- (e) Special conditions which must be avoided, e.g. marine environment, and any conditions necessary to ensure optimum performance.
- (f) The requirements of the relevant authorities.

- (g) Details of any assembly work required.
- (h) Details of the necessary testing and instructions for minor adjustments.
- (i) Wiring diagram of electrical connections to the unit.
- (j) The frequency of servicing and the scope of the service program recommended by the manufacturer.
- (k) Identification of any special tools or equipment that are necessary for any servicing procedure.
- (l) The procedure for removing or gaining access to parts or components to be serviced, together with the recommended service work and associated procedures.
- (m) Instructions that, if the heater cannot be adjusted to perform correctly, the manufacturer and/or an approved service agent should be contacted.
- (n) Instructions with sufficient diagrams to indicate all measurements of the appliance and location by measurement of connecting points, e.g. gas, electricity.

2.11.4 Dimensions

All details should be shown in metric terms, all relevant data shall be included. 6