AS/NZS 5601.2:2020
(Incorporating Amendments up to and including No. 2)

Australian/New Zealand Standard™

Gas installations

Part 2: LP Gas installations in caravans and boats for non-propulsive purposes

This Joint Australian/New Zealand Standard™ was prepared by Joint Technical Committee AG-006, Gas Installation. It was approved on behalf of the Council of Standards Australia on 18 September 2020 and by the New Zealand Standards Approval Board on 22 September 2020.

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Australian Building Codes Board
Australian Gas Association
Australian Industry Group
Building and Energy, WA
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Australian/New Zealand Standard™

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Part 2: LP Gas installations in caravans and boats for non-propulsive purposes

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Reissued incorporating Amendment No 2 (September 2024).

Preface

This Standard was prepared by the Standards Australia/Standards New Zealand Committee AG-006, Gas Installations, to supersede AS/NZS 5601.2:2013.

A2 *This Standard incorporates Amendment No. 1 (February 2021) and Amendment No. 2 (September 2024). The start and end of changes introduced by the Amendments are indicated in the text by tags including the amendment numbers 1 and 2.* A2

If a Standard is referenced in legislation, the legislative instrument or regulation specifies when the Standard or Amendment comes into effect. Regulatory Authorities have indicated 12 months, following the date of publication, as an appropriate transition period for Clauses 1.3.59, 2.3.1, 5.2.8, 5.2.9, and Table 5.1.4.3, with respect to the cylinder quick-connect device.

General gas installation requirements for applications other than caravans and boats can be found in AS/NZS 5601.1, *Gas installations, Part 1: General installations*.

The objective of this Standard is to provide essential requirements and deemed-to-conform solutions to promote uniform standards of gas installation, and to provide a stand-alone Standard for LP Gas installations in caravans and boats for non-propulsive purposes.

This Standard is based on the general installation requirements of AS/NZS 5601.1.

This Standard is not to be regarded as a design specification or an instruction manual for untrained persons.

This Standard has no legal standing in its own right, but may acquire legal standing in either of the following circumstances:

(a) Where adopted by a Government or other authority having jurisdiction over relevant installations.

(b) Where adopted as part of an installation specification.

Regulatory bodies (Technical Regulators) may adopt this Standard.

Matters of an advisory or explanatory nature are indicated in the following manners:

(i) The word “NOTE” followed by a statement(s).

(ii) By inclusion in an informative appendix.

(iii) By inclusion in examples or caution statements.

Words that are indicated by italics in the body of the text are terms defined in Clause 1.3. This indication of italics does not apply to the text in the Preface, headings or figures. Section 1 contains the definitions of such terms as they apply to this Standard.

This Standard includes a statement that its requirements do not apply retrospectively.

Section 2 of this Standard details the various aspects of a gas installation that contribute to its safety, stating performance criteria for compliance with legislative requirements for safety of gas installations. Sections 3 to 9 provide more detailed information on conformance to the performance criteria.

The means of conformance in Sections 3 to 9 are not the only means of conformance to the performance criteria in Section 2.

Major changes from AS/NZS 5601.2:2013 include the following:

(A) The terms “pipe”, “piping”, “tube” and “tubing” are used throughout this Standard. They are to be considered to have the same meaning.

(B) Where the term "installation" is used, it is deemed to include the appliances, flues, ventilation, piping, components and other ancillary items.

(C) Introduction of definitions for "controlled area", "domestic caravan", "encapsulated", "ignition source", "non-sparking by nature", "quick-connect device (cylinder)" and "toughened safety glass".

(D) Prohibition of *in situ* fill cylinders on caravans, see Clause 2.4.5 and Clause 3.1.5.1.

(E) Introduction of requirement for orientation of cylinders on caravan drawbars to allow for unobstructed relief of cylinder pressure, see Clause 3.1.4.

(F) Figures showing "controlled area" and clearances on caravan drawbars for ignition sources, see Clause 3.1.8.

(G) A figure showing venting through a drain outlet from a cylinder compartment in a caravan, see Figure 3.3.1(B).

(H) Introduction of the requirement for shut-off solenoid valves to be "encapsulated" in LP Gas cylinder compartments, see Clauses 3.3.1(g) and 3.3.3(i).

(I) Clarification of access to internal cylinder compartments in caravans, see Clause 3.3.4.1.

(J) Allowance of hard drawn copper for use on houseboats on inland waterways on the low pressure side of the gas installation, see Clause 5.1.4.2.

(K) Limitations of hose assembly pigtails to only be class F, see Clause 5.1.4.3.

(L) Prohibition on the use of press-fit connections, see Clause 5.1.4.4(g).

(M) Introduction of requirements for "encapsulated" electrical devices, see Clause 5.3.

(N) Introduction of increased requirements for new installations of distance between cookers and rangehoods, see Clause 6.11.1.

(O) Introduction of requirement of carbon monoxide detectors in boats to conform with referenced internationally recognized Standards, see Clause 7.5.

(P) Additional requirements for thermal protection of combustible surfaces, see Appendix B.

(Q) New pipe sizing tables allowing for more flow capacity, see Appendix C.

(R) Additional requirements for gas leakage tests for appliances with interlocks, see Clause E.3.2(b).

(S) Introduction new appendix on purging, see Appendix L.

(T) The inclusion of references to a cylinder quick-connect device.

The terms "normative" and "informative" have been used in Standards 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.

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Part 2: LP Gas installations in caravans and boats for non-propulsive purposes

Section 1 Scope and general

1.1 Scope, exclusions and application

1.1.1 Scope

This Standard specifies requirements and means of conformance for the design, installation, repair, alteration, modification, replacement and *commissioning* of *LP Gas installations* in *caravan*s and *boats* for non-propulsive purposes.

The requirements cover —

(a) *caravans*;

(b) mobile homes, mobile holiday homes, campervans and motor homes;

(c) transportable structures with fixed *gas installations,* other than transportable homes and classroom units;

(d) trucks and trailers incorporating fixed *gas installations*;

(e) *boats*;

(f) houseboats;

(g) floating restaurants, whether fixed or mobile; and

(h) catering vehicles, whether self-propelled or towed.

NOTE 1 A mobile home includes what is often referred to as a “tiny house”, which is a relocatable home as distinct from a permanent structure that is transported from one fixed location to the next (see exclusions below).

NOTE 2 Where commercial catering equipment is to be installed, refer to AS/NZS 5601.1 for specific appliance installation requirements downstream of the appliance installation valve.

1.1.2 Exclusions

This Standard does not apply to —

(a) installations covered by statutory requirements such as the New Zealand *Maritime Transport Act 1994* and the Australian Maritime Safety Authority, *National Standard for Commercial Vessels*;

(b) the use of *LP Gas* as a fuel for automotive or propulsion purposes;

(c) installations in transportable homes and classroom units;

(d) installation of commercial catering equipment;

(e) portable or mobile A2 *appliances* A2 (such as barbeques or patio heaters) that are connected to an *LP Gas cylinder*, other than where an *LP Gas cylinder(s)* is connected to *piping*; and

(f) the service or repair of A2 an *appliance* A2.

1.1.3 Application

1.1.3.1 Conformance

The user of this Standard is expected to be familiar with the properties and characteristics of *LP Gas* and the principles of combustion, ventilation and flueing applicable to the safe installation and operation of [A2] *appliances* [A2].

The requirements of this Standard shall be used in conjunction with, but do not take precedence over, statutory regulations that may apply in any area. Where no requirement is given, good practice shall apply.

NOTE 1 In a matter of uncertainty, advice should be sought.

This Standard applies to new installations, alterations and extensions commenced after its publication date or the date of adoption by the relevant *Technical Regulator*. It does not apply retrospectively to existing installations or to their repair. However, modifications to existing installations shall conform to the requirements of this Standard.

[A2] NOTE 2 Although this clause does not apply to the repair of an *appliance* in an existing installation, immediate steps should be taken to make safe any unsafe *appliance(s)* or gas installation. [A2]

NOTE 3 The *Technical Regulator* may require a risk assessment and HAZOP to be conducted on the *gas* installation. This will ensure that appropriate safety measures, additional to those specified in this Standard, are provided. The scope of this analysis will depend on the size, nature and complexity of the *gasinstallation*.

Section 2 of this Standard contains the mandatory performance requirements for the design, installation, and *commissioning* of *gas installations*. It includes, in Clauses 2.9.2 and 2.10.2, some specific prohibitions, as the performance requirements cannot be reliably met if those prohibitions are breeched.

Sections 3 to 9 of this Standard contain a means of conformance for the design, installation, and *commissioning* of *gas installations,* including location of storage cylinders, high and low pressure *piping* systems and appliances.

1.1.3.2 Application in Australia

Approval for any variation to the requirements of Sections 3 to 9 or the normative appendices may need to be obtained from the *Technical Regulator*.

1.1.3.3 Application in New Zealand

The *Technical Regulator* does not provide approvals for variations to the means of conformance in Sections 3 to 9. References to approval by the *Technical Regulator* are not applicable. The installation certifier is responsible for ensuring that the installation, including any variations, meets the requirements in Section 2.

Where a Standard is cited as part of a means of conformance, any Standard with equivalent performance requirements may be used as an alternative means of conformance.

1.1.3.4 Interpretation

The terms "*caravan*" and "*boat*" are used to Include various types of vehicle or marine craft. The user of this Standard is expected to be familiar with the properties and characteristics of *LP Gas* and the principles of combustion, ventilation and flueing applicable to the safe installation and operation of [A2] *appliances* [A2].

Where the term "installation" is used it is deemed to include the pipework, *appliances*, *flues*, air ducts and other ancillary items.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1357.1, *Valves primarily for use in heated water systems, Part 1: Protection valves*

AS 1397, *Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium*

AS 1432, *Copper tubes for plumbing, gasfitting and drainage applications*

AS 1530.1, *Methods for fire tests on building materials, components and structures, Part 1: Combustibility test for materials*

AS 1572, *Copper and copper alloys—Seamless tubes for engineering purposes*

AS 1906.1, *Retroreflective materials and devices for road traffic control purposes, Part 1: Retroreflective sheeting*

AS 2030 (series), *Gas cylinders*

AS 2473.2, *Valves for compressed gas cylinders, Part 2: Outlet connections (threaded) and stem (inlet) threads*

AS 2738, *Copper and copper alloys—Compositions and designations of refinery products, wrought products, ingots and castings*

AS 3688, *Water supply and gas systems—Metallic fittings and end connectors*

AS 3814, *Industrial and commercial gas-fired appliances*

AS 4617, *Manually operated gas valves*

AS 4621, *Regulator for use with liquefied petroleum—Vapour phase*

AS 4623, *Jointing compounds and materials for use in gas pipe joints*

AS 4627, *Quick-connect devices for gas*

AS 4629, *Automatic shut off valves and vent valves*

AS D26. *Tube fittings with Dryseal American standard taper pipe and unified threads for automotive and industrial use*

AS ISO 7.1, *Pipe threads where pressure-tight joints are made on the threads, Part 1: Dimensions, tolerances and designation*

AS/NZS 1530.3, *Methods for fire tests on building materials, components and structures, Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release*

AS/NZS 1596, *The storage and handling of LP Gas*

AS/NZS 1734, *Aluminium and aluminium alloys—Flat sheet, coiled sheet and plate*

A2 AS 1869 (all parts), *Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas* A2

AS/NZS 2208, *Safety glazing materials in buildings*

AS/NZS 60079.14, *Explosive atmospheres, Part 14: Design selection, erection and initial inspection*

[A2] **[Text deleted]** [A2]

AS/NZS 60079.29.2, *Explosive atmospheres, Part 29.2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

ASTM A269, *Specification for seamless and welded austenitic stainless steel tubing for general service*

ASTM C518, *Test method for steady-state thermal transmission properties by means of the heat flow meter apparatus*

[A1] EN 50291-2, *Electrical apparatus for the detection of carbon monoxide in domestic premises, Part 2: Electrical apparatus for continuous operation in a fixed installation in recreational vehicles and similar premises including recreational craft — Additional test methods and performance requirements* [A1]

NZS 3501, *Specification for copper tubes for water, gas and sanitation*

UL 144, *Standard for LP-Gas Regulators*

UL 2034, *Standard for Single and Multiple Station Carbon Monoxide Alarms*

[A2] AS/NZS 1167.1, *Welding and brazing—Filler metals, Part 1: Filler metal for brazing and braze welding*

EN 14324, *Brazing–Guidance on the application of brazed joints* [A2]

1.3 Terms and definitions

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

1.3.1
accessibility
1.3.1.1
accessible
access can be gained without hazard or undue difficulty for inspection, repair, testing, renewal, or operational purposes

1.3.1.2
readily accessible
access can be gained without hazard, undue difficulty, or use of a tool

1.3.2
appliance
In New Zealand — same meaning as "gas appliance" in the *Gas Act 1992*

In Australia — assembly, other than a vehicle refuelling *appliance*, part of which uses *gas* to produce flame, heat, light, power or special atmosphere

1.3.2.1
Type A appliance
In Australia only — *appliance* for which a *certification* scheme exists

1.3.2.2
Type B appliance
In Australia only — *appliance*, with *gas consumption* in excess of 10 MJ/h, for which a *certification* scheme does not exist

1.3.2.3
flueless appliance
appliance designed to operate without a *flue*

1.3.2.4
freestanding cooking appliance
cooking *appliance* comprising an oven or ovens, a number of open *burners* and usually a grill *burner*, which is designed to be installed on a floor

1.3.2.5
room-sealed appliance
indoor *appliance* which is sealed from the room in which it is installed so that it directly discharges *combustion products* to, and takes air for combustion from, outside the caravan or boat

1.3.3
authorized person
person authorized under the legislation of the appropriate jurisdiction

1.3.4
bedroom
room or cabin used or intended to be used for sleeping, including any combined living/sleeping area

1.3.5
boat
vessel
any seagoing or inland water craft including, but not limited to, a motorboat, yacht, cabin cruiser, launch, runabout, trailer-sailer, houseboat, motor-sailer or work-boat

1.3.6
burner
device that positions a flame in the desired location by delivering *gas* and air to that location in such a manner that controlled, continuous combustion is accomplished

1.3.7
caravan
structure designed or adapted to be moved from one place to another, whether towed or transported, which is intended for human habitation or use as a workplace, and includes a self-propelled recreational vehicle or mobile home, and any associated annex or similar structure, whether permanently or temporarily attached to, or adjoining the main portion of the structure

Note 1 to entry: A large structure assembled in a factory and transported to a permanent location is not considered a *caravan*, e.g. portable school classrooms or transportable homes. Refer to AS/NZS 5601.1 for conformance requirements relating to such structures.

1.3.8
caravan (domestic)
domestic caravan
caravan that is not used as a workplace and where no more than two *cylinders* with an individual capacity of no greater than 25 L water capacity (10 kg nominal *LP Gas* capacity) are in use

1.3.9
carbon monoxide detector
device capable of detecting carbon monoxide (CO), and which provides an alarm signal

1.3.10
certified
certification
In Australia — assessed by a *certifying body* and having a certificate number to demonstrate conformance to a Standard

In New Zealand — product satisfying the performance requirements of the cited Standard or an equivalent Standard

1.3.11
certifying body
body, acceptable to the *Technical Regulator,* that provides assurance of conformance of *appliances* and components with nominated Standards and other accepted safety criteria

1.3.12
combustible material
material that will ignite and burn, and includes material that has been flame-proofed

1.3.13
combustible surface
any material or object made of, or surfaced with, materials that are capable of being ignited and burned

1.3.14
combustion products
constituents resulting from the combustion of a fuel with air, oxygen or mixture of the two, including the inert *gases* associated with the fuel and the air but excluding any other diluent or contaminant

1.3.15
commissioning
process by which a gas installation (which is installed or is complete or near completion) is tested to verify that it functions according to its design objectives and its specifications

1.3.16
competent person
person or body who, through training, qualification or practical experience, or a combination of these, and understanding of the equipment and processes, is able to verify conformance with this Standard

1.3.17
controlled area
region surrounding an *LP Gas cylinder(s)* that is regulated so that the adverse effects of any gas leakage are reduced

Note 1 to entry: Figure 3.1.8(A) shows an example of a *controlled area* for *LP Gas cylinders* on the draw bar of a *domesticcaravan.*

1.3.18
cylinder
container for the storage of *LP Gas* with a capacity of more than 120 mL but not more than 500 L, and does not include an aerosol container

Note 1 to entry: Capacity is often referred to as “water capacity” and is the total internal volume.

1.3.18.1
cylinder (*in situ* fill)
[*in situ* fill] cylinder
cylinder that is filled from a tanker

1.3.19
cylinder compartment
compartment
enclosed area or a partitioned-off space primarily used for the installing of a *gas cylinder*, *pressure* regulator and other associated equipment

1.3.20
deck
floor or platform extending from side to side of a *boat* (see Figure 1.3.21)

1.3.20.1
upper deck
that part of the decking designed to prevent water entering the hull of a *boat*, generally at the gunwale line

1.3.20.2
main deck
level immediately below the *upper deck*

1.3.20.3
lower deck
level immediately below the *main deck*

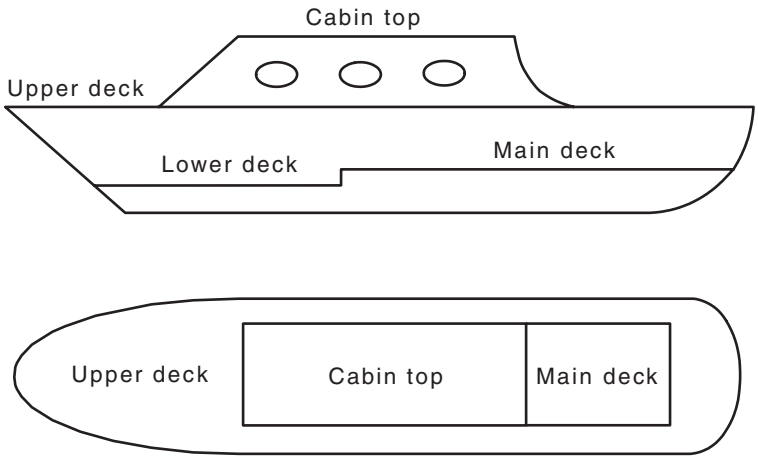


Figure 1.3.21 — Views of boat showing decks

1.3.21
DN
nominal diameter
see *nominal size*

1.3.22
encapsulated
form of protection whereby parts that could be capable of igniting an explosive atmosphere by either sparking or heating are fully enclosed in a compound in such a way as to avoid becoming a source of ignition

Note 1 to entry: Requirements for *encapsulated* items are in Clause 5.3.

1.3.23
exhaust fan
mechanical device other than a *range hood* for moving contaminated air from one interior space to another, or to outside of the space

1.3.24
explosive limits
1.3.24.1
upper explosive limit
UEL
concentration of flammable *gas*, vapour or mist in air above which an explosive gas atmosphere will not be formed

Note 1 to entry: *LP Gas*: nominal UEL 10 %.

1.3.24.2
lower explosive limit
LEL
concentration of flammable gas, vapour or mist in air below which an explosive gas atmosphere will not be formed

Note 1 to entry: *LP Gas*: nominal LEL 2 %.

1.3.25
fire resistant material
material having thermal and physical properties that protect a *combustible surface*

1.3.26
flame safeguard system
system consisting of a flame detector(s) plus associated circuitry, integral components, valves and interlocks, the function of which is to shut off the *gas* supply to the *burner*(s) in the event of ignition failure or flame failure

1.3.27
flue
passage through which *flue gases* are conveyed from an *appliance,* excluding draught diverter, barometric device, fan or similar part

1.3.27.1
natural draught flue
flue in which the draught is provided by the buoyancy effect of the hot *gases* within it

1.3.27.2
open flue
flue system containing a draught diverter or canopy

1.3.27.3
power flue
flue system in which *combustion products* are removed from the [A2] *appliance* [A2] by a fan in the *flue*

1.3.28
flue cowl
device placed at the end of a *flue* designed to prevent the entry of rain and minimize the disturbing effect of wind while not hindering the discharge of *flue gases*

1.3.29
flue gases
combustion products plus all diluents and contaminants

Note 1 to entry: These include, where applicable, excess air, dilution air, process air and waste products from the process.

1.3.30
flue terminal
point at which *flue gases* discharge from a *flue*

1.3.31
gas
liquefied petroleum gas
LP Gas
gas composed predominantly of any of the following hydrocarbons, or any combination of them in the vapour phase: propane, propene (propylene), butane, butene (butylene) and pentane

1.3.32
gas consumption
rate at which *gas* is consumed by an *appliance* under specific conditions and expressed in megajoules per hour (MJ/h)

1.3.33
gas detector
electronic device capable of indicating the presence of LP Gas at specified concentrations, which provides an audible or visual warning

Note 1 to entry: For guidance on *gas detectors*, refer to AS/NZS 60079.29.2.

1.3.34
gas installation
combination of the following used or intended to be used in the supplying and utilization of *gas*, taken as separate items or as a whole: *piping*, fittings, components, *appliances*, *flues*, apparatus or other devices and associated requirements

1.3.35
gas load
total *gas consumption* of all downstream *appliances*

1.3.36
gas pressure regulator
device that automatically regulates the outlet *pressure* of the *gas* passing through it to a predetermined value

1.3.36.1
automatic changeover regulator
combination valve/*gas pressure regulator*, fitted to an *LP Gas* multiple-*cylinder* installation, which will automatically change over from a *cylinder*(s) in use to a reserve *cylinder* at a predetermined *pressure*

1.3.36.2
piping gas pressure regulator
gas pressure regulator installed in the *piping* to reduce the *gas pressure* to a section of *piping*

1.3.36.3
cylinder regulator
gas pressure regulator on a *cylinder* installation that is subjected to the *gas pressure* directly from the *cylinder*

1.3.37
gastight
condition of a *gas installation* or *piping* in which there is no leakage of *gas*

〖A2〉1.3.38
hazardous area
area in which an explosive gas atmosphere is present or can be expected to be present, in quantities such that special precautions for the construction, installation and use of equipment are required

Note 1 to entry: This definition aligns with AS/NZS IEC 60079.10.1, which should be referred to for hazardous area requirements.〈A2〉

1.3.39
hob
part of a *gas* cooking *appliance* that supports the *trivet* and is usually constructed of enamelled steel, stainless steel or *toughenedsafety glass*

1.3.40
hose assembly
flexible tube or pipe complete with end couplings

1.3.41
ignition source
source of energy that can ignite an explosive atmosphere

Note 1 to entry: Such sources include, but are not limited to flames, incandescent material, electric sparks, hot surfaces and mechanical impact sparks.

Note 2 to entry: For the purposes of *domestic caravans* and *boats*, items of equipment within a controlled area that are *non-sparking by nature* or *encapsulated* are NOT considered to be *ignition source*s.

Note 3 to entry: For hazardous areas, equipment that is selected and *installed* according to AS/NZS 60079.14 is not considered to be an *ignition source*.

1.3.42
LP Gas locker
fully enclosed compartment for the storage of *LP Gas cylinders* and associated equipment

Note 1 to entry: See "*cylinder compartment*".

1.3.43
main run
run of *piping* from the outlet of the first *pressure* regulator at the *LP Gas cylinder* to the furthest *appliance* position

1.3.44
manual shut-off valve
manually operated valve that allows an *appliance* or a section of *piping* to be shut off

1.3.45
manufacturer's instructions
manufacturer's specifications
document supplied with, and relevant to, the *appliance* or equipment that provides authoritative instructions on matters such as installation, *commissioning*, testing, maintenance and operation of the *appliance* or equipment

1.3.46
may
indicates the existence of an option

1.3.47
nominal size
nominal diameter
DN
numerical designation of size, in millimetres, which is common to all components in a *piping* system other than components designated by outside diameters or by thread size

Note 1 to entry: It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.

1.3.48
non-sparking by nature
device that does not have electrical contacts that move, i.e. "make" or "break" during normal operation, and thus presents a lower risk of ignition of a flammable atmosphere

Note 1 to entry: Devices such as plugs, fixed terminals and *encapsulated* solenoids are considered *non-sparking by nature*. Devices such as mechanical switches, commutating motors, relays and contactors are considered sparking by nature.

1.3.49
operating pressure
gas pressure that any part of the *gas installation* is or will be subjected to under normal operating conditions

1.3.50
outdoor(s)
above-ground open-air situation with natural ventilation, without stagnant areas, and where *gas* leakage and products of combustion are rapidly dispersed by wind and natural convection

Note 1 to entry: Appendix K provides diagrammatical representations of *outdoor* areas.

1.3.51
oxygen-depletion sensor
ODS
oxygen depletion device
device designed and installed to shut off the *gas* supply to an *appliance* when the oxygen content of the ambient air is depleted to a specified concentration

1.3.52
pigtail
short length of small bore copper pipe or *a hose assembly* (to allow flexibility) used for the high-*pressure* connection between an *LP Gas cylinder* and the *cylinder regulator* or the *cylinder* manifold

1.3.53
piping
system of pipes, fittings, components and equipment that conveys *gas* from a *cylinder regulator* to the *appliance* inlet

1.3.54
POL fitting

LP Gas union connection having only a left-hand thread

Note 1 to entry: The specification for a *POL fitting* is that of Type 21 in AS 2473.2.

1.3.55
pressure
pressure above atmospheric *pressure* (gauge *pressure*)

1.3.56
proprietary system
manufacturer-specific system using matched components, which may require special tools for installation

Note 1 to entry: *Proprietary systems* may be incompatible with those of other manufacturers and may include *piping*, *flues*, and fittings.

1.3.57
purge
purging
with respect to *piping* —

(a) replacing the air in *piping* with *gas* or inert *gas*; or

(b) removing the gas from *piping* by replacing the *gas* with either air or an inert *gas*.

Note 1 to entry: The purpose of *purging* is to prevent the presence in the *piping* of an explosive mixture of *gas* and air.

1.3.58
quick-connect device
two-part mating plug and socket assembly for connecting an *appliance* to a gas supply without the use of tools

Note 1 to entry: Type 1 *quick-connect devices* are sometimes referred to as “bayonet fittings”.

1.3.59
quick-connect device (cylinder)
cylinder quick-connect device
quick-connect device designed to connect with an *LP Gas* cylinder valve with an external thread

Note 1 to entry: In Australia the cylinder quick-connect device conforms with AS 4627, Type 27.

Note 2 to entry: In New Zealand the cylinder quick-connect device conforms with UL 2061.

Note 3 to entry: For New Zealand, acceptable valve types are defined in the Health and Safety at Work (Hazardous Substances) Regulations.

1.3.60
range hood
mechanical extraction unit to collect contaminated air from above a cooking *appliance*, pass the air through a filtration system and then either discharge it from the space or recirculate it back into the space

1.3.61
rated working pressure
maximum allowable inlet *pressure* of any 〖A2〗 *appliance* 〖A2〗, or pipe fitting, or any section of gas pipework

1.3.62
safety shut-off valve
valve within a safety shut-off system that stops *gas* flow

1.3.63
semi-rigid connector
assembly of semirigid pipe, with permanently attached end fittings, that is designed for infrequent movement

1.3.64
shall
indicates that a statement is mandatory

1.3.65
should
indicates a recommendation

1.3.66
Technical Regulator
government appointed person, body or authority that has jurisdiction over *gas* safety legislation (or other entity authorized by that person, body or authority)

1.3.67
toughened safety glass
glass that has been processed by controlled thermal treatments to increase its strength

Note 1 to entry: For requirements on toughened safety glass, see Clause B.3.

1.3.68
trivet
pan support
grid located over the open *burners* of a *gas* cooking *appliance* to support vessels being heated

1.3.69
vapour barrier
wall or other barrier constructed and placed with the objective of preventing the passage of vapour from any one place to some other place, to achieve the separation distances required to ignition sources or openings into structures

1.3.70
vent line
pipe that is connected to a *gas pressure regulator*, relief valve or a safety shut-off system, and will convey escaping *gas* to a safe location

1.3.71
water heater
appliance for the supply of water at a temperature not exceeding 99 °C

1.3.72
living space
space that is used for living, sleeping, eating or cooking and may include an annex or covered deck that forms a part of any item listed in Clause 1.1.1

1.4 Work health and safety

Safe working practices shall be employed when working on *gas installations*. Work health and safety (WHS) requirements shall form the basis of the process of installing *appliances*. These requirements pertain to all aspects of access, installation, operation and maintenance. Persons installing *appliances* need to be aware of their responsibilities in accordance with local WHS requirements. Precautions shall be taken to avoid any electrical hazards present in the *gas installation*.

CAUTION — SAFETY PRECAUTIONS NEED TO BE OBSERVED WHEN CUTTING INTO PIPEWORK OR DISCONNECTING FITTINGS AND DEVICES ON PIPEWORK. THERE HAVE BEEN FATALITIES AND INJURIES THAT HAVE BEEN ATTRIBUTED TO GAS SERVICES CARRYING AN ELECTRICAL CURRENT.

1.5 System of units

International System of Units (SI) is used in this Standard.

NOTE Appendix A provides a list of conversion factors for other commonly used units.

Section 2 Essential safety and performance-based design requirements

2.1 General

Where *gas installations* are designed based on the performance requirements of this Section, rather than by using the means of conformance under Sections 3 to 9, the level of safety, convenience and efficiency of operation shall be not less than an installation carried out according to Sections 3 to 9. Such designs shall be capable of being independently verified. Any justification for conformance using Section 2 shall be documented and kept for 7 years.

NOTE 1 For performance based designs some *Technical Regulators* will require to be consulted prior to work commencing.

NOTE 2 Written design specification and drawings together with justification for the deviation of the means of conformance may be required by the *Technical Regulator*.

NOTE 3 Where the installation is of a complex nature, the *Technical Regulator* may require the design to be verified by a *competent person*.

NOTE 4 See Appendix I for a list of symbols for use in diagrams of *gas* control systems.

2.2 General work

2.2.1 Verification of gas supply

Before commencing an installation, the *LP Gas* type and *pressure* shall be verified to ensure the *gas* is —

(a) compatible and safe for the ▌A2⟩ *appliances* ⟨A2▐ and pipe fittings to be installed; and

(b) available at a flow rate that meets the anticipated maximum *gas load*.

2.2.2 Work on a gas installation

Any *gas installation*, or part affected, that contains *gas* shall be isolated and, if necessary, safely *purged* before any gasfitting commences on that *gas installation*.

During work on the *gas installation*, all parts of an unattended *gas installation* shall be left in a safe condition.

▌A2⟩ All air and contaminants shall be *purged* from the *piping* after work on the *piping* has been completed, and before any attempt to commission the gas installation or operate any connected *appliance*.

Piping shall be free of debris or other harmful material before that *piping* is connected to an *appliance*.

Immediate steps shall be taken to make safe any unsafe *gas installation* or *appliance* that may be discovered. The consumer or operator shall be notified. ⟨A2▐

NOTE 1 In New Zealand, the Gas (Safety and Measurement) Regulations 2010 require that when a licensed person has reasonable grounds to believe that an installation presents an immediate danger to life and property they are required to notify the owner or occupier of the property and the *Technical Regulator*.

NOTE 2 In Australia, the *Technical Regulator* may require to be informed.

2.2.3 Sealing of open ends

All open ends of *piping* and outlets intended for future connections of ▌A2⟩ *appliances* ⟨A2▐ shall be sealed to be *gastight* and prevent ingress of deleterious materials.

NOTE The closing of a valve will not satisfy this requirement unless the outlet of the valve is sealed to be *gastight*.

2.2.4 Testing of gas installations for leakage

Gas installations shall be tested and confirmed to be *gastight* before connection to the *gas* supply.

2.2.5 Acceptable substances for testing

Air, the *gas* for which the system is designed, or an inert *gas* shall be the only substances used within *piping* for testing purposes. Oxygen is not to be used as a substitute for air.

2.2.6 Safe practices and WHS

Safe work practices shall be employed when working on *gas installations.*

2.2.7 Decommissioning

Every *gas installation*, or part of a *gas installation*, that is permanently decommissioned shall be disconnected from the *gas* supply and *purged*.

2.3 LP Gas cylinders

2.3.1 Cylinders and cylinder valves

Cylinders and *cylinder* valves shall be fit for purpose for the environment in which they are used.

Adaptors on the cylinder valve outlet are considered to be hazardous due to the risk of leakage and inadvertent separation. Adaptors to convert a Type 21 to a cylinder *quick-connect device* shall not be used.

2.3.2 Corrosion

Cylinders shall be protected from corrosion.

2.3.3 Cylinder orientation

A *cylinder* shall be installed in accordance with its specific design requirements.

2.3.4 Multi-cylinder installations

In multi-*cylinder* installations, service and reserve *cylinders* shall be connected to a common manifold which permits a *cylinder* to be removed without shutting down the system.

NOTE Solenoid valves may be used if suitably rated.

2.4 Location of LP Gas cylinders

2.4.1 Restriction on location of cylinders

LP Gas cylinders shall be *readily accessible* and installed in areas where an accumulation of gas cannot occur.

2.4.2 Required clearances around a cylinder

Clearances shall be maintained to ensure separation from *ignition sources, openings* and heat sources.

2.4.3 Mounting and stowage

LP Gas cylinders and all high *pressure piping* shall be located in a position which is protected from impact and minimizes the risk of *LP Gas* entering the interior of the *caravan* or *boat*.

2.4.4 Cylinder restraint

Cylinders shall be restrained to restrict movement of the *cylinders* and their attachments.

2.4.5 Use of [*in situ* fill] cylinders

[In situ fill] cylinders shall not be installed or stored on or in a *caravan. [In situ fill] cylinders* shall not be installed or stored on or in a *boat* unless it can be demonstrated to the *Technical Regulator* that by its design or location that the *gas installation* is safe.

2.5 Cylinder compartments and LP Gas lockers

2.5.1 Design and construction

Cylinder compartments and *gas lockers* shall be designed and constructed to —

(a) be sized to house the *cylinders* and their associated equipment;

(b) allow safe removal and reconnection and be capable of securing the *cylinder/s*;

(c) allow sufficient ventilation of the compartment or locker to prevent buildup of *LP Gas* in case of a leak; and

(d) be *readily accessible.*

NOTE A key is not regarded as a tool.

Cylinder compartments and *gas locker*s shall be constructed of materials that are fit for purpose for the environment in which they are located.

2.5.2 Identification of cylinder compartment or LP Gas locker

Cylinder compartments and lockers shall have durable and legible identification on the outside.

2.6 Materials and fittings

2.6.1 Material and components

Materials, fittings and components shall be free of damage, contamination and defects.

Materials, fittings and components selected for a *gas installation* shall be compatible and fit for purpose for use with —

(a) the *gas* being conveyed;

(b) the *pressure* to which they may be subjected; and

(c) the environment in which they will be installed.

2.6.2 Proprietary systems

Proprietary systems, where permitted, shall be installed as a complete entity in accordance with the relevant *manufacturer's instructions*.

2.6.3 Jointing

All interconnecting materials of jointed fittings and *piping* shall be compatible. Jointing compounds and sealing materials shall be fit for purpose for their application.

2.7 Piping

2.7.1 General

Piping shall be designed and installed to —

(a) convey *gas* at a predetermined *pressure* and volume;

(b) be *gastight*;

(c) avoid damage by corrosion, stress or other means; and

(d) not adversely affect the structural strength and fire resistance of any *caravan* or *boat*.

2.7.2 Design

Piping shall be —

(a) designed to ensure a *gas* velocity that minimizes adverse impacts;

(b) installed to avoid any obstruction to the *gas* flow;

(c) installed to safely supply the flow of *gas* at the *pressure* required; and

(d) designed to ensure the minimum required supply *pressure* is attained at each *appliance* with all *appliances* operating.

2.7.3 Location

Piping shall —

(a) be installed in a manner and in a location that protects it from damage;

(b) be designed and located to minimize any hazardous buildup of *gas* if leakage occurs;

(c) be placed in locations where it would not prejudice egress from a *boat* or *caravan*;

(d) be sufficiently clear of other services to ensure they can be safely operated and maintained and to minimize any hazard arising from the failure of either the *gas piping* or any other service; and

(e) when passing through partitions, be installed in a manner that avoids any escaping *gas* passing from one space to another.

2.7.4 Support of piping

Piping shall be securely supported and restrained to minimize stress from differential movements, with particular regard to those caused by vibration, flexing and thermal effects.

2.7.5 Gas pressure regulation

A means of regulating *gas pressure* shall be provided where the *pressure* supplied to any part of a *gas installation* may exceed the *rated working pressure* of that part.

Where provided, the means of regulating *gas pressure* shall —

(a) provide and maintain control of the *operating pressure* to all parts of the *gas installation* that it is intended to control; and

(b) be securely mounted and positioned in a safe location and *accessible* for maintenance and adjustment.

2.7.6 Over-pressure protection

Where an unsafe situation may occur in the event of malfunction or failure of any means of *gas pressure* regulation, over-*pressure* protection shall be provided.

2.7.7 Pressure test points

Pressure test points shall be provided to ensure all parts of the *gas installation* can be safely tested, *purged*, commissioned, operated and maintained.

2.7.8 Gas venting

Gas venting devices, vents or *vent lines* shall be installed to ensure vented *gas* discharges freely to a safe location. Spaces that contain *gas* venting devices shall either be ventilated to prevent any hazardous accumulation of gas or be free from all sources of ignition. Any *vent line* shall not affect the performance of the device or *gas installation* to which it is connected and shall terminate at a safe location.

2.8 Flues

2.8.1 General

Every [A2] *appliance* [A2] that requires a *flue* for safe operation shall be fitted with a *flue*. *Flues* shall be designed and installed to safely discharge outdoors *combustion products* from all connected *appliances*. The construction of a *flue* shall in no way impair the design strength or the fire resistance of the *boat* or *caravan*.

2.8.2 Design

*Flue*s shall be designed, constructed and installed to permit all connected appliances to operate safely and effectively, taking into account the types of *appliance* to be connected, their location and energy input.

If condensate is likely to accumulate, an *accessible* means of safely draining the *flue* or *appliance* shall be provided.

2.8.3 Materials

Materials and jointing methods used for the construction of the *flue* shall be fit for purpose.

2.8.4 Installation

[A2] *Flues* shall be supported independently of the *appliance* unless the *appliance* has been designed to support the weight of the *flue*. [A2]

*Flue*s shall be fastened to a robust structure capable of ensuring stability and to prevent stressing of joints.

Any penetration of the *boat* or *caravan* shall be sealed to prevent ingress of water.

2.8.5 Location

The *boat* or *caravan* shall be protected from the thermal effects of *flue*s.

*Flue*s shall be located to prevent damage or interference to or by any other utility or service.

2.8.6 Flue terminals

Flue terminals shall be —

(a) constructed of materials that are fit for purpose and for the environment in which they are installed;

(b) constructed and located to prevent ingress of any material or substance that could impair the performance of either the *flue* or any connected A2 *appliance* A2;

(c) constructed to prevent ingress of any material or substance that could impair the performance or place at risk the safety or integrity of the *boat* or *caravan*;

(d) located to minimize entry of *combustion products* into any *boat* or *caravan* and to minimize the effects of adverse draught on the performance of the A2 *appliance* A2;

(e) located so as to prevent harm to persons; and

(f) installed in a way that does not adversely affect the structural strength and fire resistance of the caravan or boat.

2.9 Installing gas appliances

2.9.1 Pre-installation

A2 *Appliances* A2 shall be checked before they are installed to ensure they will operate safely on the *gas* type being supplied.

2.9.2 General installation requirements

General installation requirement are as follows:

A2 (a) *Appliances* and equipment shall be installed in accordance with the manufacturer's instructions.

(b) The space in which an *appliance* is installed shall be ventilated to the extent required to ensure the safe and effective operation.

(c) *Appliances* shall be installed so that their operation is not affected by the operation of mechanical devices used to displace air, either within the same space or within a connected space.

(d) All manufacturer's instructions accompanying the *appliance* shall be provided.

(e) *Appliances* shall be installed so that adjacent combustible surfaces are protected from damage resulting from the thermal effects of their operation.

(f) *Appliances* shall be connected to existing gas piping only if that *appliance* does not affect the safety or effectiveness of any parts of the gas installation.

(g) Any safety device or system that permits an *appliance* to be operated remotely, automatically or unattended shall be of a type that ensures the *appliance* fails safe.

(h) *Appliances* shall be supported or secured to prevent stressing of the gas piping unless the gas piping has been specifically designed and constructed to safely support the *appliance*. A2

(i) An *appliance* shall be accessible so that it can be serviced.

NOTE 1 Removal of a panel or door to give access to a control compartment is acceptable.

(j) An *appliance* shall not cause a hazard to walls, nearby surfaces, curtains, furniture or opened doors, and shall not obstruct the free movement of persons.

A2 (k) *Appliances* shall include a system that prevents the uncontrolled release of gas.

NOTE 2 Electrical supplies to *appliances* should have a readily accessible and identifiable means of isolation located adjacent to the *appliance*. Requirements for means of electrical isolation are specified in AS/NZS 3000. A2

A2 2.9.3 *Appliance* location A2

A2 *Appliances* A2 shall be located to —

(a) avoid or be protected against the effects of corrosive and/or physical damage;

(b) permit functional adjustment, safe ignition, access for operation and maintenance;

(c) avoid any hazard to the *boat* or vehicle, or to the contents of the *boat* or vehicle;

(d) avoid undue restriction of the movement of persons;

(e) minimize the risks associated with the storage, use or release of hazardous or flammable substances in the vicinity or be protected; and

(f) minimize the risk of harm to persons.

A2 An *appliance* shall be installed only in a location or on a structure capable of supporting the weight of the *appliance*. A2

A2 2.9.4 Ventilation of the *appliance* space and air supply to *appliances*

Ventilation shall ensure proper operation of the *appliance* and flueing system and maintain safe ambient conditions.

The air supply to *appliances* shall provide for complete combustion of the gas.

The air supply to *appliances* shall be free of any substance that could adversely affect the safe operation or durability of the *appliance*. A2

A2 2.9.5 *Appliance* connection and isolation A2

A means of disconnection and isolation from the *piping* shall be provided for all A2 *appliances* A2.

The means of isolation shall be *readily accessible*.

A means of isolation shall be provided to prevent the flow of *gas* when an *appliance* is stowed.

2.9.6 Commissioning

Every A2 *appliance* A2 shall be commissioned upon installation to ensure safe start-up and operation, and shall include checks of safety and operating controls.

NOTE 1 See Appendix H for guidelines for A2 *appliance commissioning* A2.

NOTE 2 See Appendix J for a checklist for checking conformance of the installation prior to and during *commissioning*.

2.9.7 Fire resistant material

Fire resistant material shall be fit for purpose.

2.9.8 Flue materials

Flue materials and jointing methods shall be fit for purpose.

2.9.9 Jointing compounds and materials

Jointing compounds and materials shall be fit for purpose.

2.10 Hose assemblies

2.10.1 General

Hose assemblies shall be of a minimum practicable continuous length and installed so that —

(a) they are protected from exposure to ultraviolet light; and

(b) the possibility of damage by vermin attack is minimized.

2.10.2 Use of a hose assembly

In general, other than for *hose assemblies* between *cylinders* and regulators, *hose assemblies* shall be used only between the regulator and rigid *piping*, and between rigid *piping* and *appliances*. Flexible hoses shall be one continuous length and as short as practicable for the intended application in order to prevent kinking and damage to the hose. Flexible hose inside a *caravan* or *boat* shall be *accessible*. *Hose assemblies* shall not be connected to each other.

For *caravans* with a slide out section (e.g. for additional A2 *living space* A2), a *hose assembly* is permitted between the rigid *piping* of a *caravan* and the rigid *piping* of the slide out section.

Where the flexible hose is concealed (e.g. behind an *accessible* panel), information shall be supplied with the *caravan* instructions that state its location and the need for regular inspection by a *competent person*.

2.10.3 Hose assembly — Operating conditions

A *hose assembly* shall not be installed where, under normal operating conditions, it is —

(a) exposed to a temperature exceeding the maximum temperature specified in the hose *manufacturer's instructions*;

(b) subject to stress, abrasion, kinking or permanent deformation; or

(c) subject to damage by vermin.

2.10.4 Hose assembly connecting an appliance

A *hose assembly* for an *appliance* shall be —

(a) permanently connected to the *appliance* by a threaded or other metal connection; and

(b) permanently connected to the *piping* by a threaded or other metal connection.

2.11 Shut-off valves

Shut-off valves, whether manual or automatic, shall be fit for purpose.

2.12 Quick-connect devices

2.12.1 General

A *quick-connect device* shall be installed so as to avoid entry of water, dust or other debris.

2.12.2 Restriction on installation

A *quick-connect device* socket shall not be installed inside a *caravan* or *boat*.

2.13 Essential safety requirements

2.13.1 Prohibition of earthing through piping

Piping shall not be used as an earth for any electrical supply system.

NOTE This Clause does not preclude the application of equipotential bonding in accordance with AS/NZS 3000.

2.13.2 Restriction on use of thread sealant

Thread sealant, or any other sealing material, shall not be applied to a compression joint.

NOTE A compression joint includes a flare, a union, and any *fitting* for connection to a *cylinder* valve.

[A2] 2.13.3 Requirements for *appliances* [A2]

2.13.3.1 New Zealand requirements

[A2]The *appliance* shall be checked to ensure that the *appliance* markings and instructions indicate that it is designed to operate on the gas to be supplied to the installation and at the range of pressures supplied.[A2]

NOTE Gas (Safety and Measurement) Regulations 2010 cover requirements for *certification* or approval of *appliances*.

2.13.3.2 Australian requirements

Type A appliances shall conform to the current applicable specifications, standards of performance and *certification* requirements. The *appliance* shall be designed for use with the type of *gas* to be connected and —

(a) be *certified* as being in accordance with the applicable Standard; or

(b) be acceptable to the *Technical Regulator*.

Type B appliances shall conform to the requirements of AS 3814 and be acceptable to the *Technical Regulator*.

Before a second-hand [A2]*appliance*[A2] is installed, the *appliance* shall satisfy the safety requirements of the *Technical Regulator*.

2.13.3.3 Prohibition on installation

Except as provided below, the following *appliances* and equipment shall not be installed inside a *caravan* or *boat*:

NOTE 1 Inside a *boat* includes an enclosed area or an outside area that does not include any provision for the drainage of leaking *gas* to outside the *boat*.

(a) An *appliance* which is designed to operate on an unregulated *gas* supply or at a *pressure* exceeding 2.75 kPa.

(b) In Australia, a *water heater*, other than a room-sealed type.

(c) In New Zealand, *water heaters* other than room-sealed types shall only be installed in *caravans* or *boats* subject to the following requirements:

(i) The input of any flueless *water heater* shall not exceed 0.4 MJ/h/m^3 of room volume (100 W/m^3).

(ii) Flueless *water heaters* shall not be fitted underneath projecting shelves or cupboards, nor with a clearance less than 150 mm from side walls, and the *flue terminals* shall not be less than 300 mm below ceilings.

(iii) Instantaneous *water heaters* shall not be installed in *bedrooms* or areas used for sleeping unless the *water heater* is of the room-sealed type. There shall be no ventilation openings or other connections between any area used for sleeping and any compartment in which an instantaneous *water heater* is located if the *water heater* is not of the room-sealed type.

NOTE 2 An area used for sleeping includes any combined living/sleeping area.

(d) A space heater, other than a room-sealed type, see Note 3.

NOTE 3 In Australia, for a space heater installation on a houseboat, the *Technical Regulator* should be contacted, as a flueless space heater may be permitted in the living area of the houseboat where the area can be isolated from the sleeping area. The heater needs to be fitted with a flame safeguard, tilt safety switch and *oxygen depletion device*. The maximum *gas consumption* of the heater is not to exceed 0.2 MJ/h for each cubic metre of room volume.

2.13.3.4 Appliance location

An *appliance* shall not be installed in a location where it may ignite flammable vapours or materials or where chemicals may combine with combustion air and cause corrosion or malfunction of the *appliance*.

NOTE 1 Such materials include some cleaning solvents and some chemicals used in dry-cleaning processes.

NOTE 2 An *appliance* that is permanently fixed in place or an *appliance* that is fitted in a location where it is intended to be used or likely to be used is deemed to be installed.

2.13.4 Materials and components

2.13.4.1 Prohibited fittings

The following fittings or jointing systems shall not be used in *piping*:

(a) Croxed joints.

(b) Compression fittings with non-metallic olives.

(c) Compression fittings with metallic olives if not approved for use with *gas* in the *manufacturer's instructions.*

(d) Longscrew connectors.

(e) Capillary fittings containing soft-solder.

(f) Plain nipples, e.g. running nipples with parallel threads, except where no practical alternative is available.

NOTE 1 A brass external parallel thread to a brass internal parallel thread may be used, provided the joint is welded or a permanent quick-setting thread compound is used and a means of disconnection is provided immediately downstream. Wherever possible, the fitting should be secured against disturbance.

(g) In Australia, multilayer (composite) systems.

(h) In Australia, press-fit connectors.

(i) Threaded and welded steel pipe and fittings.

NOTE 2 In New Zealand, multilayer (composite) *piping* system may be used if the product *certification* provides for their use in *boat*s and *caravan*s.

Section 3 Means of conformance — Cylinders

3.1 General

3.1.1 Cylinders and cylinder valves

In Australia, *cylinders* and *cylinder valves* shall conform to the AS 2030 series and shall be fit for purpose for the environment in which they are installed.

In New Zealand, *cylinders* are required by the Health and Safety at Work (Hazardous Substances) Regulations 2017 to be of a registered type.

3.1.2 Restriction on cylinder capacity

LP Gas cylinders installed as part of a *domestic caravan* or *boat gas installation* shall be limited to an individual maximum water capacity of 25 L (nominal 10 kg). *LP Gas cylinders* of a greater capacity may be utilized in commercial applications, but they shall be transported, supplied, installed and exchanged in line with the requirements of the applicable dangerous and hazardous substances goods code, *LP Gas* suppliers and AS/NZS 1596.

NOTE Confirmation (e.g. engineering report) may be required to ensure the chassis and draw-bar construction will support the load of larger cylinders on commercial vehicles.

3.1.3 Corrosion

To prevent corrosion of *cylinders* under anchor straps, a rubber strip or similar non-metallic protection shall be positioned between *cylinders* and anchor straps.

NOTE 1 Checks should be made for the legislative requirements relating to the rendering safe, repair, retesting and disposal of faulty, damaged or severely corroded *cylinders*.

NOTE 2 *Cylinders* bearing the coating identification mark are unlikely to have corrosion resistance required for marine applications.

3.1.4 Cylinder orientation

A *cylinder* shall be installed upright.

NOTE *Cylinders* installed on a *caravan* drawbar should be orientated so that the *cylinder* relief valves of both *cylinders* discharge away from both the caravan and the towing vehicle, as shown in Figure 3.1.4.

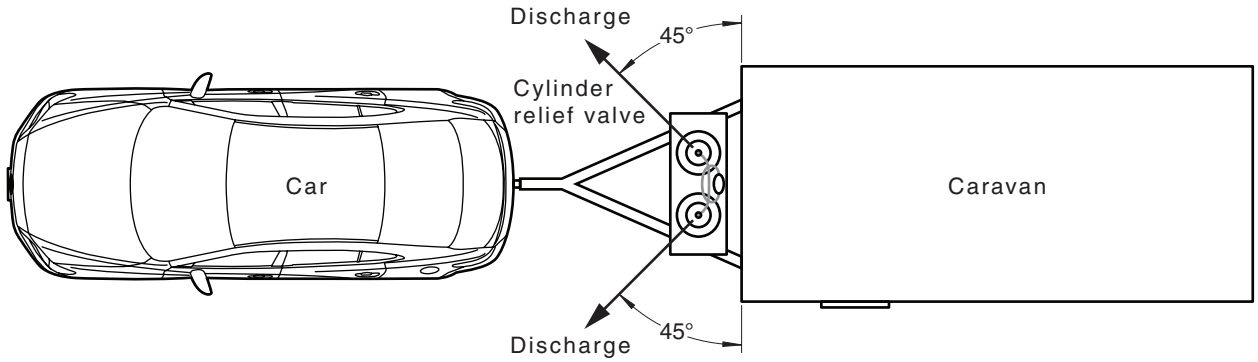


Figure 3.1.4 — Direction of cylinder relief valve discharge

3.1.5 Use of [*in situ* fill] cylinders

3.1.5.1 [*In situ* fill] cylinders on caravans

*[In situ fill] cylinder*s shall not be installed on *caravan*s.

3.1.5.2 [*In situ* fill] cylinders on boats

3.1.5.2.1 General

[In situ fill] cylinders shall not be installed inside a *boat.*

[In situ fill] cylinders shall not be installed on a *boat* unless it can be demonstrated that, by its design or location, *LP Gas* vapour cannot enter or accumulate in or on the *boat* and —

(a) the *cylinder* is located in accordance with the *hazardous area* requirements for *[in situ fill] cylinders* in Figure 3.1.8(B);

(b) the *cylinder*(s) are protected from accidental damage by location, are installed in an open well ventilated area and not enclosed in any type of locker or compartment; and

(c) any discharge from fixed ullage gauges is directed away from openings into the *boat.*

3.1.5.2.2 Location of fill point

The fill point shall be located so that the following conditions are satisfied:

(a) The fill connection cannot be accessed from within the *boat*.

(b) The fill connection can be supervised from the open *deck* of the *boat*.

3.1.5.2.3 Safety valve discharge

The discharge provisions for a safety valve shall be such that discharge *gas* shall not impinge directly on the container or on any adjacent craft, and shall not discharge into the interior of the *boat*.

3.1.6 Multi-cylinder installations

Multiple *LP Gas cylinders* connected to the installation as part of a *domestic caravan* or *boat gas installation* shall be limited to a maximum quantity of two *cylinders*.

For commercial installations where the individual *cylinder* capacity exceeds 25 L or there are more than 2 *cylinder*s they shall be transported, supplied and connected in accordance with applicable dangerous and hazardous substances goods codes. A means shall be provided to permit the *cylinders* to be isolated from the *gas* supply, to allow the *cylinders* to be disconnected. This may be achieved by either of the following:

(a) A manual or automatic changeover valve shall be installed immediately upstream of the regulator serving the system.

NOTE Such a valve may be an integral part of an *automatic changeover regulator*.

(b) *Isolation valves* shall be installed on the manifold, to allow each *cylinder* to be individually disconnected from the manifold without depressurizing the manifold.

3.1.7 Restriction on location of cylinders

LP Gas cylinders shall not be installed, nor shall provision be made for installing or storing any *LP Gas cylinders*, inside any *caravan* or *boat*, except as permitted in Clause 3.3.4.

3.1.8 Required clearances around a cylinder

Requirements for clearances around cylinders are as follows:

(a) Minimum clearances around a *cylinder* with a maximum water capacity of 25 L (nominally 10 kg or less) shall conform to the following:

(i) In respect to *ignition sources* for *cylinders* mounted on the draw-bar of a *domestic caravan*, the *controlled area* defined in Figure 3.1.8(A) shall be kept free of *ignition sources*, other than equipment that is required for vehicle operational safety. (See Note 2.)

NOTE 1 A *controlled area* should include an administrative control in the form of a label indicating the *cylinders* should be isolated when not in use or when the vehicle is in transit.

(ii) In respect to openings into a *boat*, in accordance with Figure 3.1.8(C).

(iii) In respect to openings into a *caravan*, in accordance with Figure 3.1.8(D).

NOTE 2 *Gas* safety shut-off valve(s) that are *encapsulated* are not considered an *ignition source* for the purposes of *domestic caravans* and *boats.*

NOTE 3 Examples of equipment required for vehicle operation safety include but are not limited to —

(a) electric braking systems;

(b) electric stability controls; and

(c) electrical break-away couplings.

(b) Minimum clearances around *cylinders* with a water capacity greater than 25 L (nominally greater than 10 kg) shall conform to the following:

(i) In respect to *ignition sources* the *hazardous area* requirements as shown in Figure 3.1.8(B).

(ii) In respect to openings into a *boat*, in accordance with Figure 3.1.8(C).

(iii) In respect to openings into a *caravan*, in accordance with Figure 3.1.8(D).

(c) A cylinder shall not be installed such that the areas specified in Figure 3.1.8(A), Figure 3.1.8(B) and Figure 3.1.8(D) encompass any air intake of an *appliance* of any fuel type.

Separation distances may be achieved by use of a *vapour barrier*.

Where *vapour barriers* are used to achieve separation, the separation distances shall be measured in direct line(s) around the end of any *vapour barrier* that shall —

(i) be impervious to *LP Gas* vapour over the whole of the area around which the separation distance is to be measured;

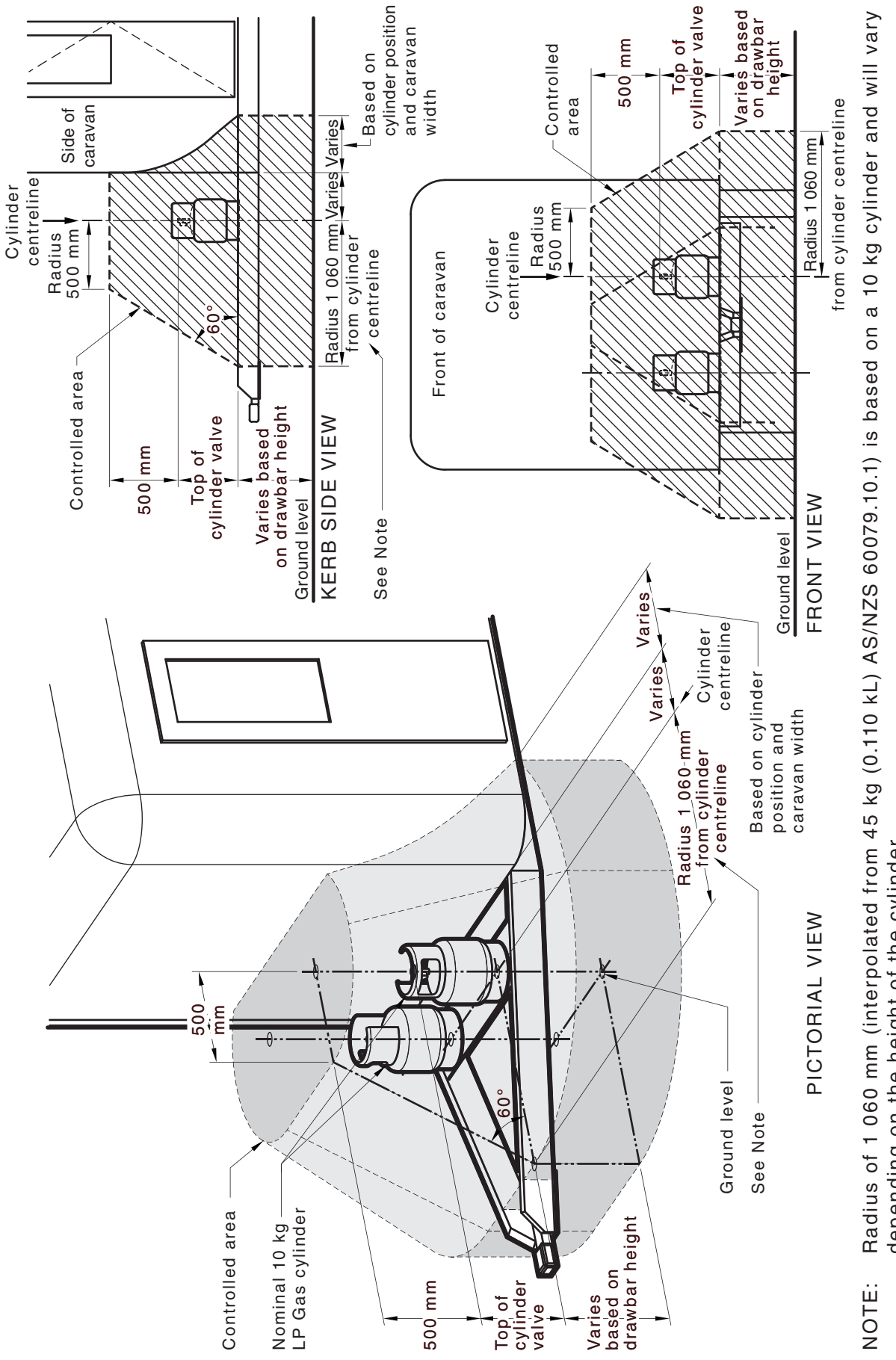
(ii) be constructed of a non-combustible material;

(iii) be sufficiently durable for the installation conditions; and

A2 NOTE 4 Durable includes being physically strong enough and secured to be unaffected by weather and debris impact during travelling. It should also be constructed of a material that is UV stable to avoid premature deterioration. A2

(iv) the top of the *vapour barrier* shall be above the controlled or hazardous area or shield the top of that area. Safety valves and relief valves are not considered release points.

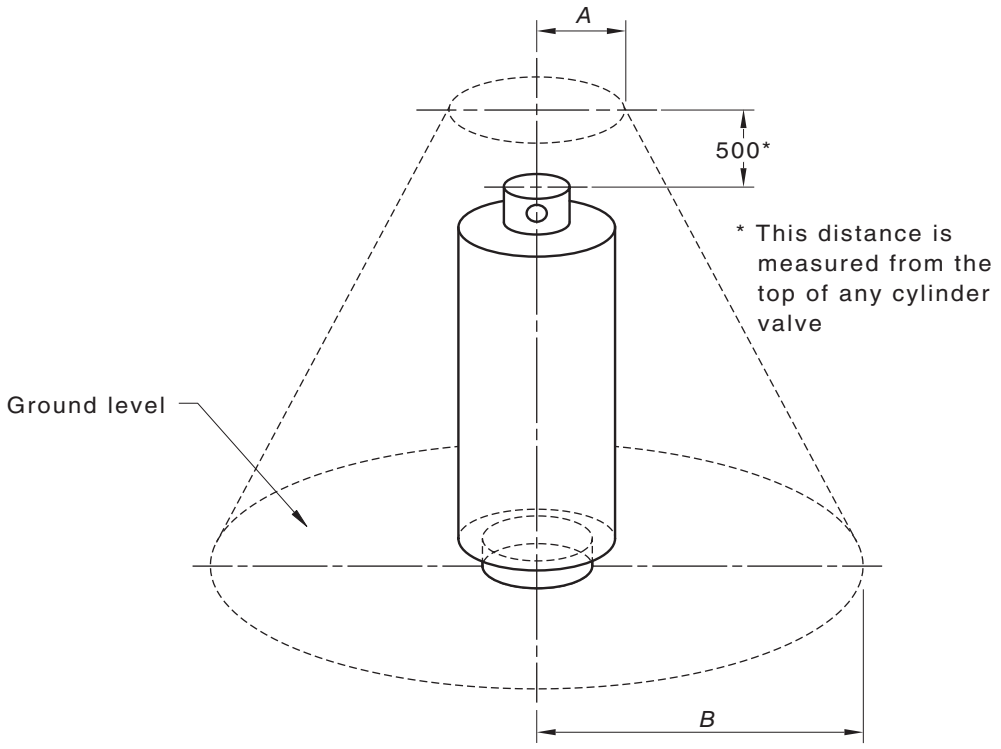
A2 Figure 3.1.8(E) provides guidance on how distances should be measured. A2



NOTE: Radius of 1 060 mm (interpolated from 45 kg (0.110 kL) AS/NZS 60079.10.1) is based on a 10 kg cylinder and will vary depending on the height of the cylinder.

Figure 3.1.8(A) — Controlled area for LP Gas cylinders up to 10 kg mounted on the draw-bar of a domestic caravan only

Dimensions in millimetres



	Exchange cylinder, mm	[*In situ* fill] cylinder mm
A	500	1 500
B	1 500	3 500

NOTE 1 See Clauses 2.3.4 and 3.1.4 if installation of *[in situ fill] cylinder*s is being considered.

NOTE 2 This figure does not apply to *domestic caravans*, see Figure 3.1.8(A).

Figure 3.1.8(B) — Hazardous area for any LP Gas cylinder other than on the drawbar of a domestic caravan

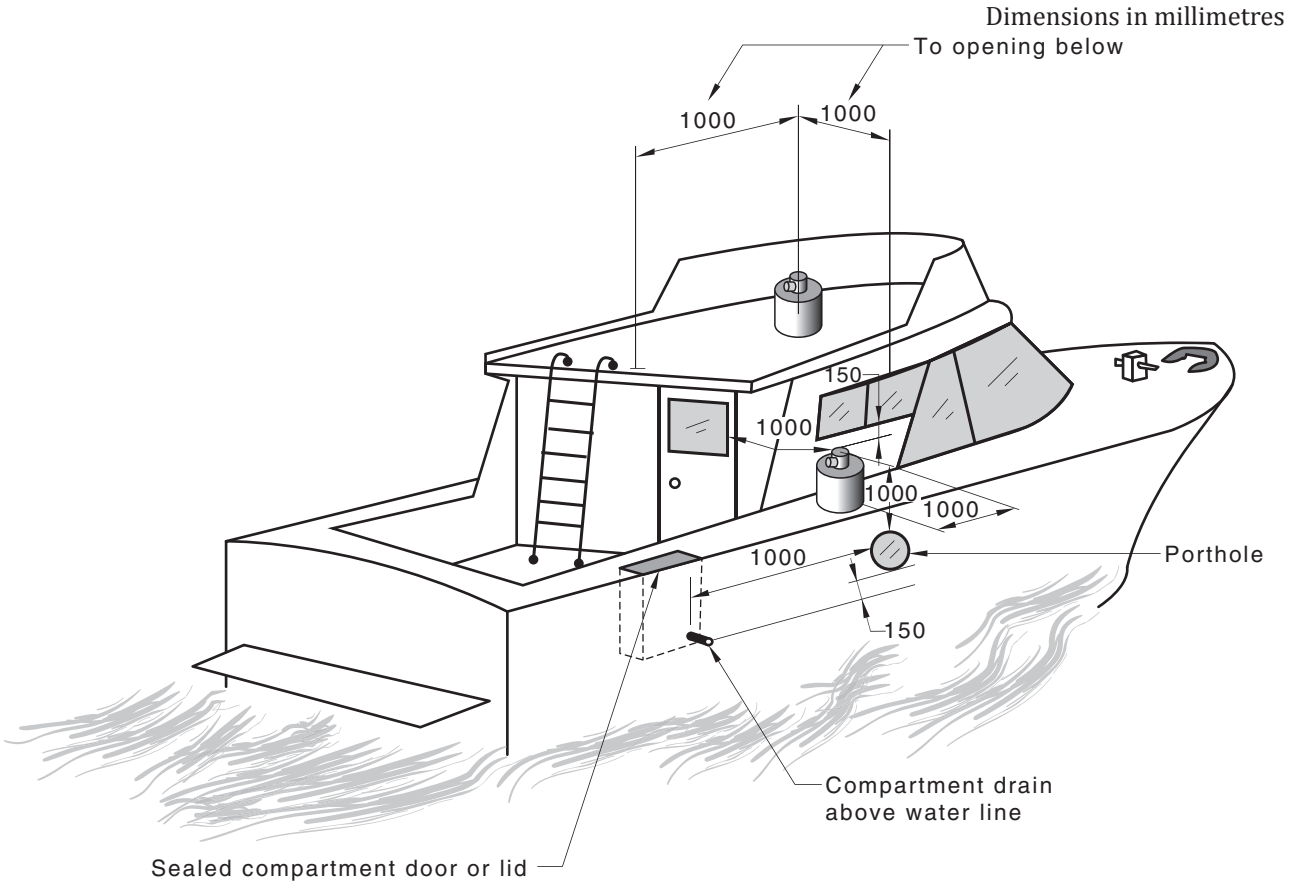
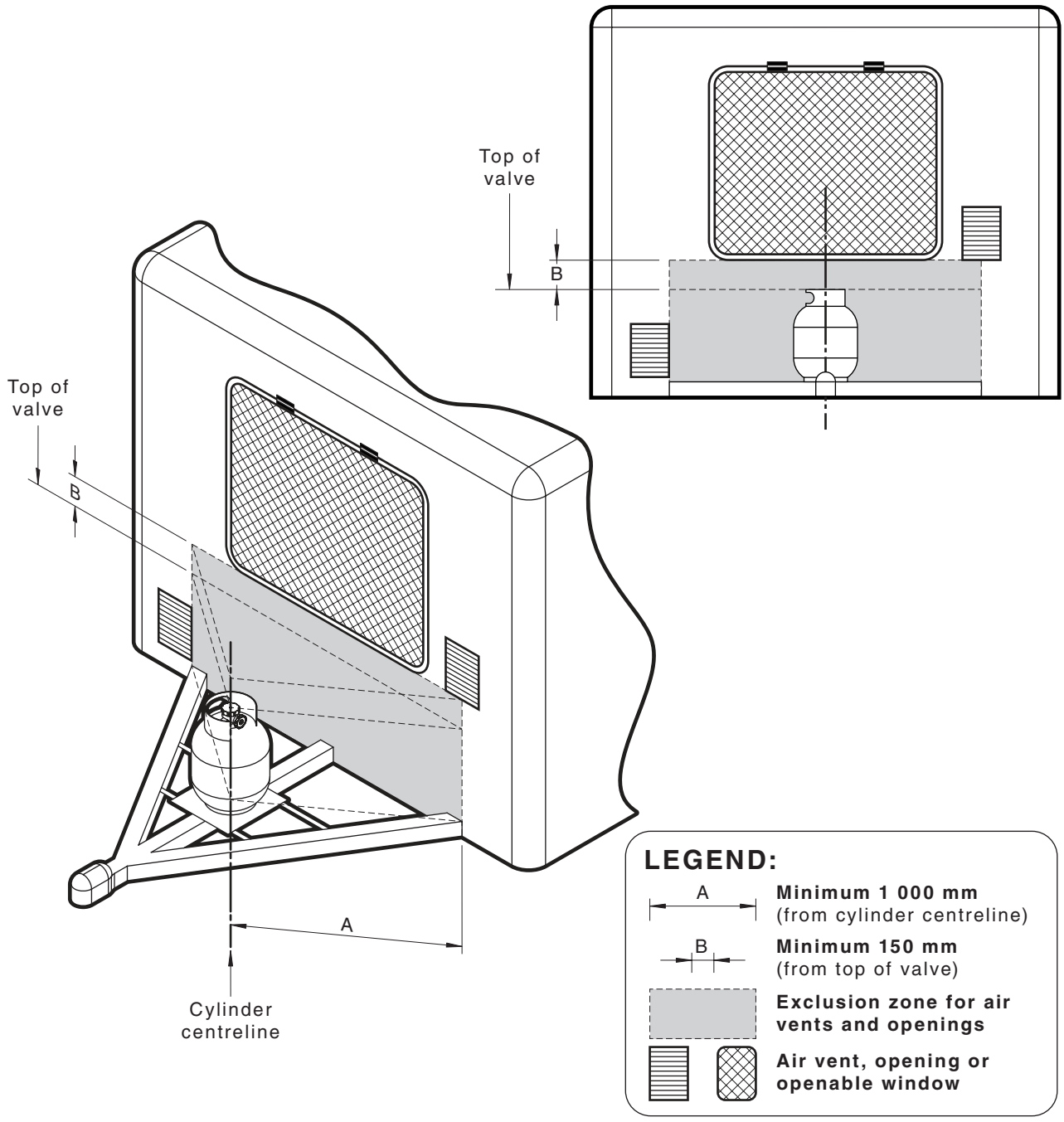


Figure 3.1.8(C) — Typical cylinder mounting location for boats

Dimensions in millimetres



NOTE 1 The clearances and exclusion zone apply to air vents and openings into the *living space* of a *caravan*.

NOTE 2 The minimum 1 000 mm clearance also extends to air vents, openings or openable windows located on the sides of a *caravan.*

Figure 3.1.8(D) — Typical cylinder mounting location on the a-frame of caravans

A2

Distance in metres

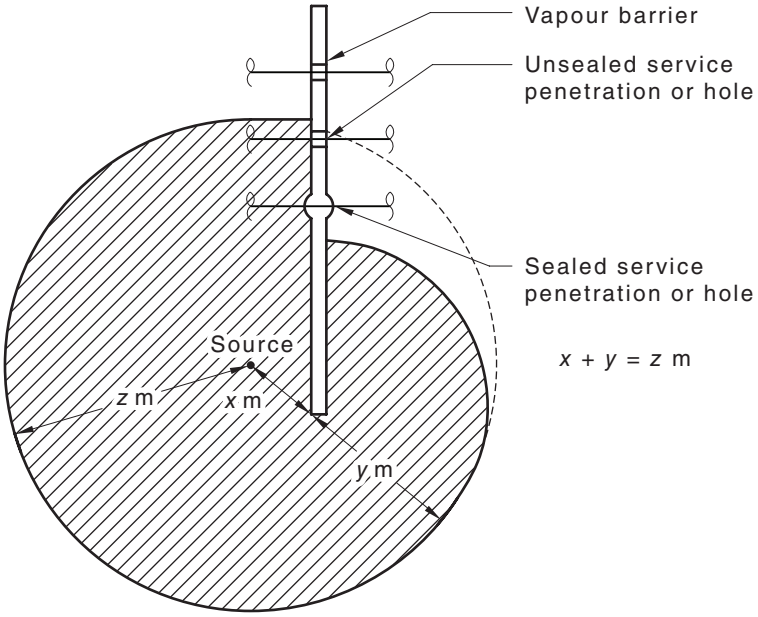


Figure 3.1.8(E) — Effect of a vapour barrier on the measurement of distances A2

3.1.9 Mounting and stowage

LP Gas cylinders and all high *pressure* stage *piping* shall be —

(a) installed in a *cylinder compartment* or *LP Gas locker* conforming to Clause 3.3;

(b) mounted on the drawbar or within the periphery of a *caravan* in a protected position;

(c) mounted externally on the chassis of a *caravan* under the skirt; or

(d) mounted externally on the *upper deck* or cabin top of a *boat* but not within one metre of an opening into the *boat*, or in such a way as to impede movement on board the *boat* and at least —

(i) 1 000 mm from any opening into the *boat* below the *cylinder* valve;

(ii) 150 mm from any opening into the *boat* above the *cylinder* valve for an exchange *cylinder* and 500 mm for *[in situ fill] cylinders*; and

(iii) the clearances specified in Figure 3.1.8(B) from an *ignition source*.

NOTE For application of Items (d)(i) and (d)(ii), see Figures 3.1.8(C).

3.1.10 Stowage of spare cylinders

Stowage requirements for unconnected or spare *cylinders* shall be the same as for connected *cylinder*s.

NOTE A *cylinder* that is restrained in a location where it is intended to be used or likely to be used is deemed to be installed.

3.1.11 Heat shield

Where the *cylinder* is mounted less than 200 mm from any heat source (e.g. exhaust or engine compartment), *cylinders* shall be shielded from the source of heat. The heat shield shall be at least 25 mm from the shielded surface and from the heat source.

3.2 Cylinder attachment

3.2.1 Restraints

Cylinders shall be restrained by attachments designed, constructed and secured in place to withstand a load equal to 4 times the weight of the full *cylinder* and fittings in all directions. The method of attachment shall not cause undue stresses to the *cylinder*. Unless installed in a compartment or locker all components of a *cylinder* restraint assembly shall be metallic.

NOTE A typical installation is shown in Figure 3.2.2. Other methods of installation are acceptable provided they conform to the intent of this Clause.

3.2.2 Structures

The *cylinder* mounting system to which the *cylinder* is attached shall be metallic and capable of withstanding the forces specified, and reinforcement shall be added where necessary to ensure conformance with Clause 3.2.1.

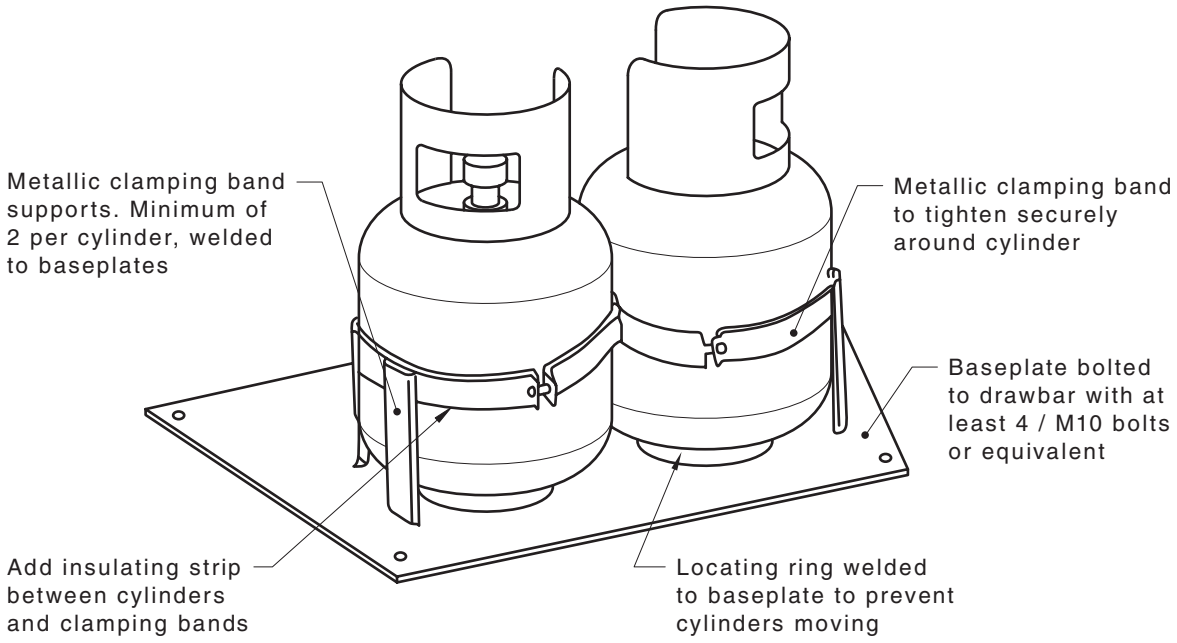


Figure 3.2.2 — Cylinder mounting system

3.3 Cylinder compartments and LP Gas lockers

3.3.1 Caravans

A *cylinder compartment* or *LP Gas locker* shall conform to the following:

(a) Be designed to —

(i) house *cylinder*(s) and their associated equipment only;

(ii) allow the *cylinder*(s) to be positioned in the compartment without obstructing the drain in Figure 3.3.1(A) or Figure 3.3.1(B);

(iii) not have access from the inside of a *caravan* to a *cylinder* installed in a compartment except as provided under Clause 3.3.4.1; and

(iv) permit easy and safe removal of the *cylinder*(s) and the operation of the *cylinder* valve(s) where required for exchange purposes.

NOTE 1 Consideration should be given to the location of the associated equipment when determining the compartment size.

(b) Be constructed of material that is water and corrosion resistant.

(c) Be capable of securing the filled *cylinder*(s).

NOTE 2 For requirements of securing methods see Clause 3.2.

(d) Be sealed to prevent *gas* vapour from entering the *caravan*.

(e) The access door or opening shall be openable without the use of tools.

NOTE 3 A key is not regarded as a tool.

(f) Have a drain in, or within 25 mm of, the base, as per Option 1 or 2 of Figure 3.3.1(A), with a minimum clear area of 500 mm^2. The drain outlet —

(i) shall not face the direction of travel;

(ii) shall be at least 1 000 mm from any opening into the *caravan* unless the opening is at least 150 mm above the drain outlet;

(iii) shall terminate at least 1 500 mm from any source of ignition unless the *ignition source* is at least 500 mm above the drain outlet; and

NOTE 4 See Figure 3.3.1(B) for an acceptable means of conformance where the drain outlet within a *LP Gas cylinder* compartment or locker is extended to achieve the 1 500 mm *exclusion zone*.

Alternatively, provide vents as shown in Figure 3.3.1(A) in the compartment/locker door at both high and low levels. Each opening shall provide a minimum free area of 5 000 mm^2 and shall meet the clearances specified in Items (i), (ii) and (iii) above. The bottom edge of the lower vent shall be within 25 mm of the base.

(g) Not contain any electrical equipment other than a *gas* safety shut-off valve(s) that is *encapsulated*.

NOTE 5 Confirmation of device encapsulation may be achieved by reference to the manufacturer's installation instructions and/or the product specification sheet.

(h) Wiring intended to connect the safety shut-off device to the electrical installation shall be double insulated, continuous and extend beyond the compartment or locker perimeter.

NOTE 6 A typical *LP Gas locker* is shown in Figure 3.3.1(A).

(i) Have a sign clearly indicating that only *cylinders* and their associated equipment are permitted in the *cylinder compartment*. The following wording shall be used:

WARNING — ONLY CYLINDERS AND THEIR ASSOCIATED EQUIPMENT ARE PERMITTED IN THE CYLINDER COMPARTMENT. ELECTRICAL EQUIPMENT, BATTERIES, OR IGNITION SOURCES MUST NOT BE INSTALLED IN THE CYLINDER (AND/OR STORAGE) COMPARTMENT.

NOTE 7 The font size in warning sign should be a minimum of 10 mm in height.

NOTE 8 See Figure 3.3.2 for an example of the warning sign and its location in the compartment.

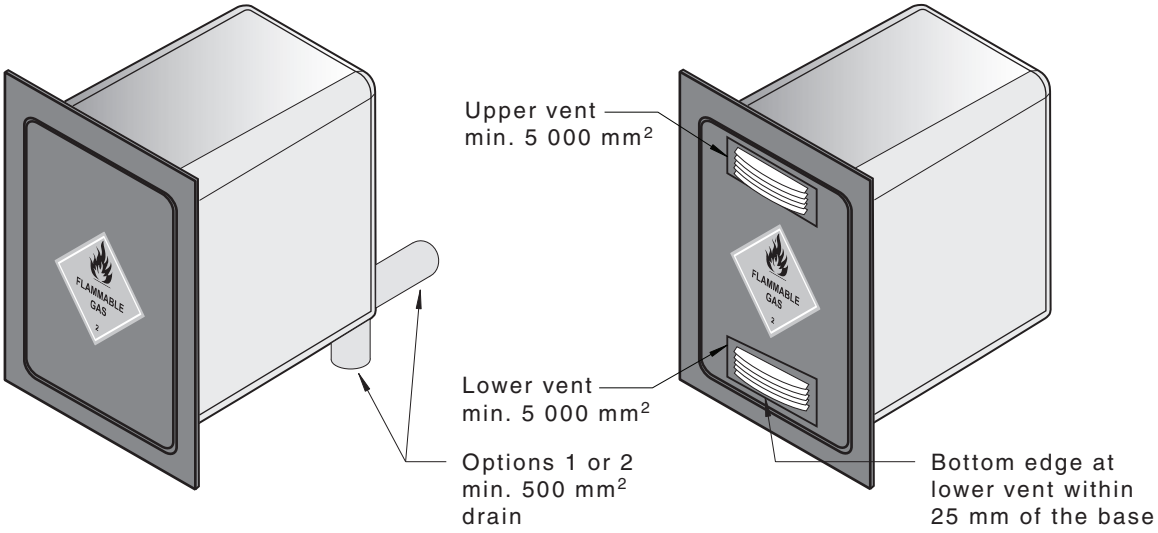


Figure 3.3.1(A) — Typical LP Gas lockers and cylinder compartments showing vent and drain alternatives

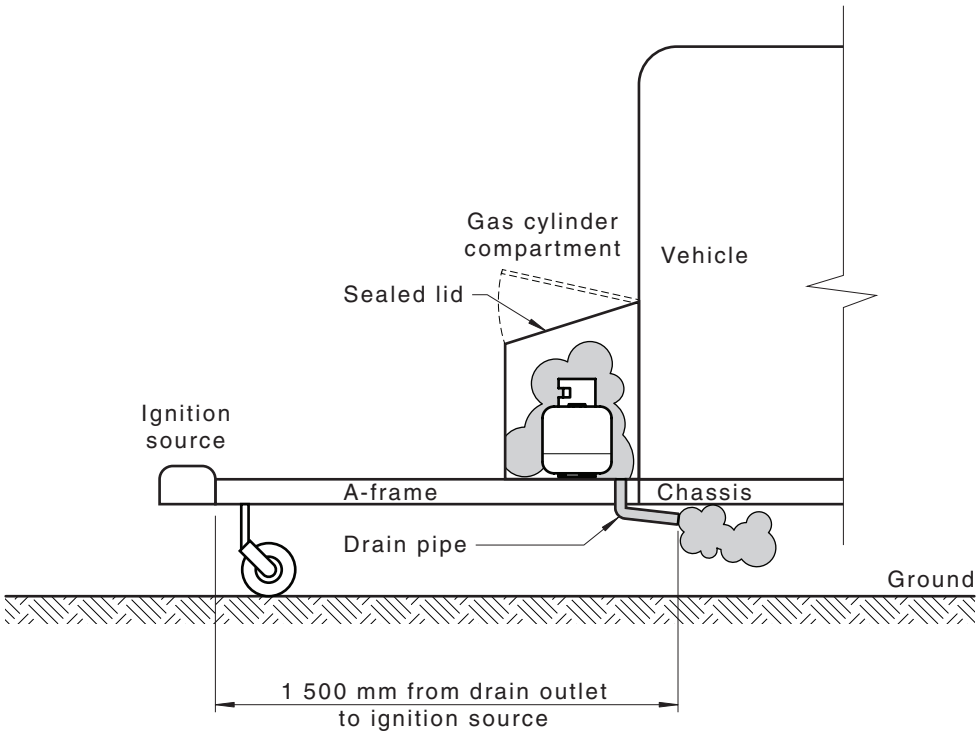


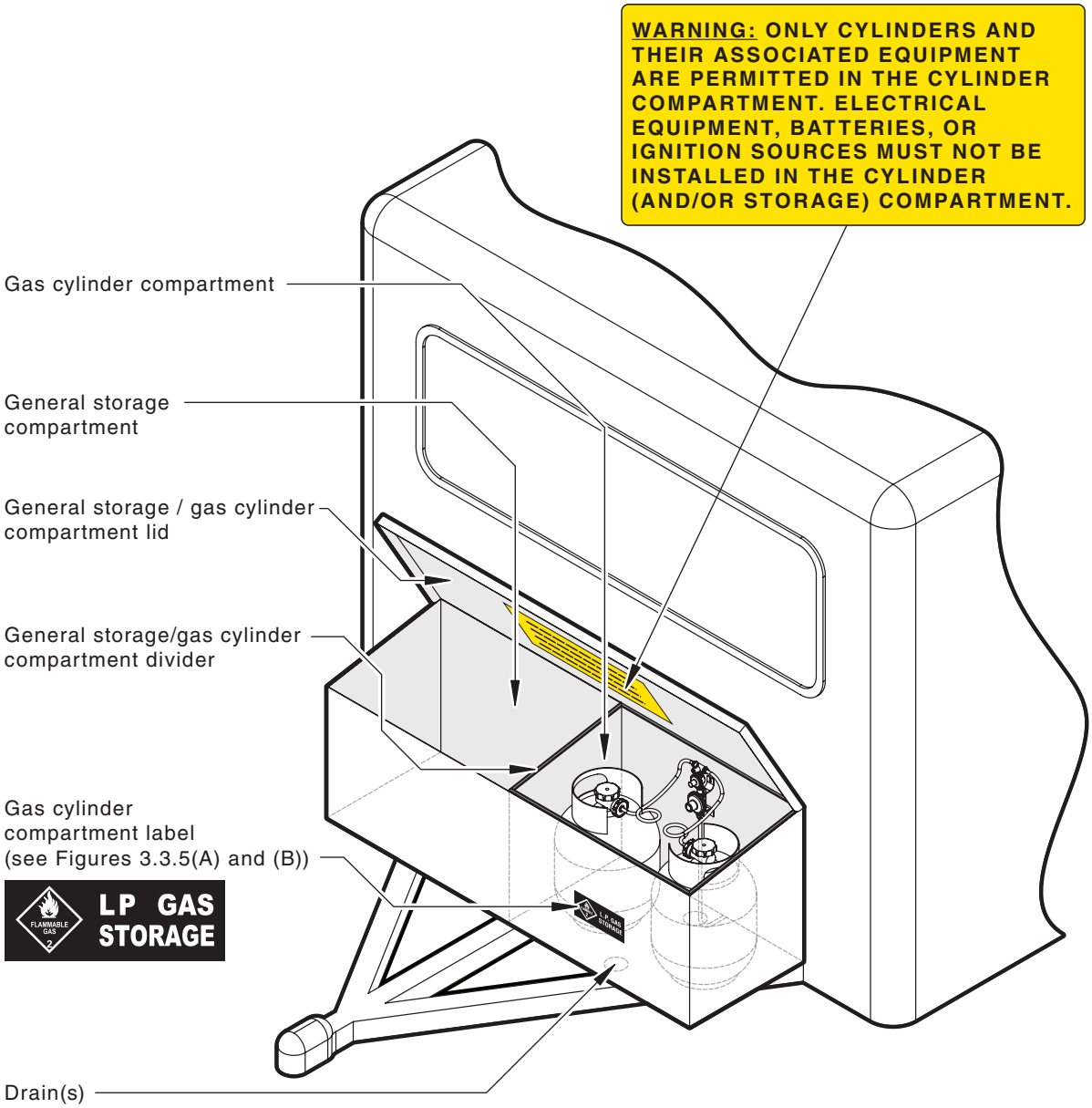
Figure 3.3.1(B) — Cross-section of a LP Gas locker with ventilation pipe installed on a caravan drawbar

3.3.2 Cylinders located in a combined storage compartment/locker for caravans

Where *cylinder*(s) are located in a combined external compartment also used for general storage, the *cylinder compartment* shall be separated from the general storage area by a vertical divider sealed to the sides and floor of the compartment and extending to the compartment lid.

The *cylinder compartment* space shall contain the *cylinder*(s) and associated *gas* equipment only, and be vented at the base as described in Clause 3.3.1 and shown in Figure 3.3.2.

NOTE See Appendix G for the recommended location for the regulator to mitigate possible fouling of diaphragm by condensate.



The font size in the warning sign shall be a minimum of 10 mm in height.

Figure 3.3.2 — Combined cylinder compartment/LP Gas locker

3.3.3 Boats

A *cylinder compartment* shall conform to the following:

(a) Not be *accessible* from an enclosed section of the *boat*.

(b) Be designed to —

(i) house *cylinders* and their associated equipment only; and

(ii) allow the *cylinder* to be positioned in the compartment without obstructing the drain in Item (h); and

(iii) permit easy removal of the *cylinder*(s) and the operation of the *cylinder* valve(s).

NOTE 1 Consideration should be given to the location of the associated equipment when determining the compartment size.

(c) Be constructed of material that is water and corrosion resistant.

(d) Be capable of securing the *cylinder*(s) when full.

NOTE 2 For requirements of securing methods, see Clause 3.2.

(e) Be sealed to prevent *gas* vapour from entering any enclosed section of the *boat*.

(f) The access door or opening shall be openable without the use of tools.

(g) Where the access opening into the compartment is other than at the top, a lower vertical return or lip of at least 100 mm shall be provided along the full length of the opening.

(h) Have a drain in the base of not less than 19 mm diameter, which is led outboard, without pockets that could retain water, to a point lower than the locker bottom. The outlet shall be positioned such that it cannot be submerged.

(i) Not contain any electrical equipment other than a *gas* safety shut-off valve(s) that is *encapsulated*.

NOTE 3 Confirmation of device encapsulation may be achieved by reference to the manufacturer's installation instructions and /or the product specification sheet.

(j) Wiring intended to connect the safety shut-off device to the electrical installation shall be double insulated, continuous and extend beyond the compartment or locker perimeter. Any wiring passing through the structure of a compartment or locker shall be protected and sealed.

(k) Have a sign clearly indicating that only *cylinders* and their associated equipment are permitted in the *cylinder compartment*. The following wording shall be used:

WARNING — ONLY CYLINDERS AND THEIR ASSOCIATED EQUIPMENT ARE PERMITTED IN THE CYLINDER COMPARTMENT. ELECTRICAL EQUIPMENT, BATTERIES, OR IGNITION SOURCES MUST NOT BE INSTALLED IN THE CYLINDER (AND/OR STORAGE) COMPARTMENT.

NOTE 4 The font size in warning sign should be a minimum of 10 mm in height.

NOTE 5 See Figure 3.3.2 for an example of the warning sign and its location in the compartment.

3.3.4 Access to cylinder compartments

3.3.4.1 Access to internal cylinder compartments in caravans

For *caravans* where both external mounting of *cylinders* and penetration of the bodywork is not possible, access to internal *cylinder compartments* shall only be provided where the following apply:

(a) The compartment —

(i) is designed to contain no more than two 10 kg cylinders;

(ii) is sealed to the prevent flow of vapour into the caravan when the *cylinder* compartment door is closed;

(iii) door opening edge is no less than 50 mm above the compartment floor; and

(iv) is drained in accordance with Clause 3.3.1(f).

(b) Access to any internal *cylinder compartment* requires the *caravan* access doors to be opened such that the operator is outside the *caravan*.

3.3.4.2 Cylinder compartments with internal access in boats

NOTE For *boats* where both external mounting of *cylinders* and penetration of the *boat* are structurally unacceptable, internal access to the *cylinder compartment* may be provided for removal and replacement of *cylinders*.

The compartment shall be able to contain no more than two 10 kg *cylinders.* The bottom edge of the door opening shall be no less than 100 mm above the compartment floor.

Where the compartment is *accessible* from within the *boat*, access to the compartment shall be provided only through a door that latches closed securely. The compartment shall be sealed to prevent flow of vapour into the *boat* when the door is closed.

3.3.4.3 Obstructions

Cylinders, equipment, pipework and cabling shall not obstruct any vents or drains from the compartment or *LP Gas locker*.

3.3.5 Identification of cylinder compartment or LP Gas locker

A durable label conforming to Figure 3.3.5(A) (for Australia) or Figure 3.3.5(B) (for New Zealand) shall be applied to the outside of the *cylinder compartment* or *LP Gas locker* to indicate the presence of an *LP Gas cylinder*(s).

Where there is external access to an internal *cylinder compartment* in a *caravan* the label shall also be applied to the outer door.

Dimensions in millimetres

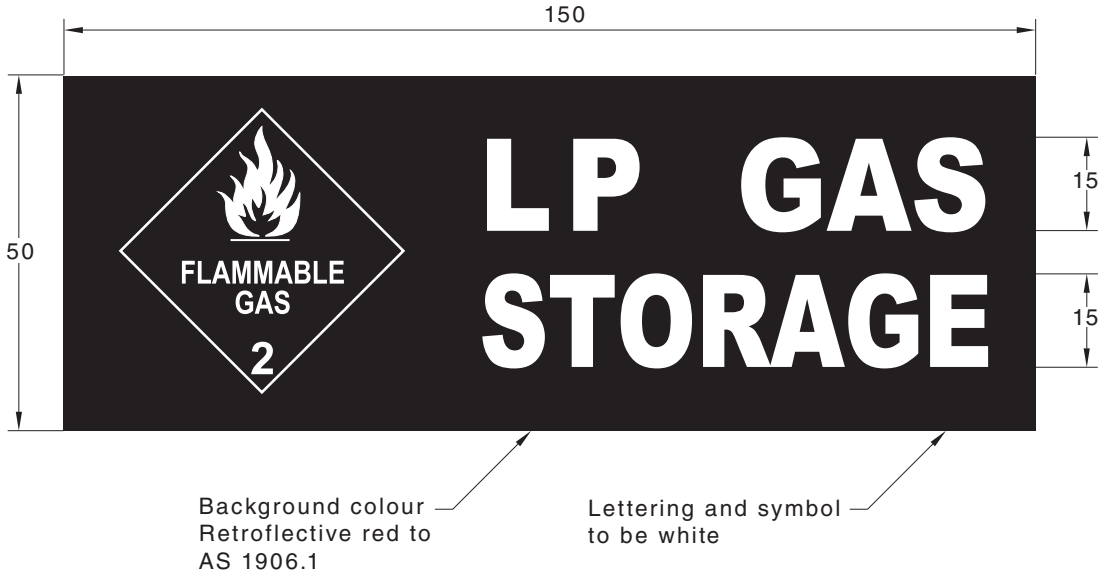


Figure 3.3.5(A) — Australian label for cylinder compartment or LP Gas locker

Figure 3.3.5(B) — New Zealand label for cylinder compartment or LP Gas locker

Section 4 Means of conformance — Gas pressure regulators

4.1 Suitability of pressure regulators

In Australia, *cylinder regulator*s shall be *certified* to AS 4621 or UL 144 and provide over-*pressure* protection to ensure the *pressure* downstream of the regulator will not exceed 14 kPa.

In New Zealand, *cylinder regulator*s and automatic changeover valves are required by the Health and Safety at Work Hazardous Substances Regulations 2017 to be of a registered type.

4.2 Outlet pressure

The outlet *pressure* shall be set to 3.0 kPa nominally to ensure correct simultaneous operation of all ▌A2⟩ *appliances* ⟨A2▐.

4.3 Mounting and support of regulator

Gas pressure regulators shall —

(a) be mounted in a location that will achieve ready dispersion of discharged gas;

(b) be mounted —

  (i) directly to the structure of the *caravan* or *boat*; or

  (ii) in New Zealand, directly on the *cylinder* valve, provided this does not unduly stress the *cylinder* valve.

(c) be located so as not to obstruct the removal or replacement of *cylinders*;

(d) be located to permit drainage of any liquid back into the *cylinder*;

NOTE See Figure G.1 in Appendix G for an example.

(e) have the vent positioned to avoid blockage by contaminants or ingress of water, if located externally; and

(f) be positioned in a safe location, *accessible* for maintenance and adjustment.

Section 5 Means of conformance — Piping and fittings

5.1 General

5.1.1 Location

Piping shall not be located where it could be subjected to damage.

5.1.2 Size

Piping shall be of sufficient size that the operation of *appliances* shall not be affected by the *pressure* drop in any pipe. With all *appliances* in operation, the maximum *pressure* drop across the *piping* shall not exceed 0.25 kPa at nominal *burner pressure*.

5.1.3 Material and components

Materials, fittings and components shall be free of damage, contamination and defects and shall conform with Table 5.1.4.3.

Materials, fittings and components selected for a *gas installation* shall be compatible and fit for purpose for —

(a) the *gas* being conveyed;

(b) the *pressure* to which they may be subjected; and

(c) the environment in which they will be installed.

Any existing unsafe materials shall be replaced.

5.1.4 Piping specification

5.1.4.1 High pressure piping

Piping between *cylinders* and regulators (high *pressure piping*) shall be any one of the following:

(a) Copper (*pigtail*) in the fully annealed condition, with a nominal wall thickness of 1.22 mm, conforming to, or equivalent to, AS 1572 and with an alloy designation C12200 to AS 2738.

A2 (b) A *hose assembly certified* to the relevant parts of the AS 1869 series, Class F. A2

(c) Stainless steel to ASTM A269 Grade 316 or 304.

5.1.4.2 Low pressure

Piping between the outlet of the *pressure* regulator and the inlet of A2 an *appliance* A2 (low *pressure piping*) shall be any one or a combination of the following:

(a) Copper *piping* in the fully annealed condition conforming to NZS 3501 or AS 1432 Type A or Type B, with the exception of houseboats used on inland waters, which may use fully annealed or hard drawn copper *piping*. Copper *piping* in *boats* shall have a pipe manufacturer applied bonded coating to protect against corrosion. Fittings shall be of the flared (to AS 3688 or AS D26) or capillary (to AS 3688) type, except that fittings with metallic olives may be used for connection to an *appliance* only in accordance with the relevant *manufacturer's instructions*.

(b) A *hose assembly* with a minimum working *pressure* of at least 14 kPa and working temperature range of at least 65 °C.

[A2] NOTE 1 Hoses *certified* to the relevant parts of the AS 1869 series (Class A, B, C or D), BS 3212 Type 2 and UL 21 are deemed to satisfy this requirement. [A2]

(c) Stainless steel to ASTM A269 Grade 316 with flared compression fittings to AS 3688.

NOTE 2 The possibility of galvanic corrosion should be investigated before different *piping* materials are combined in an installation.

NOTE 3 For pipe sizing, see Appendix C.

5.1.4.3 Materials for piping systems

Materials for *piping systems* are set out in Table 5.1.4.3.

Table 5.1.4.3 — Materials for piping systems in caravans and boats

Section of piping system	Materials	
	Pipe	Fitting
Between *cylinder* and regulator (high pressure)	Fully annealed copper tube to AS 1572 having an alloy designation C12200 to AS 2738 with a minimum wall thickness of 1.22 mm and size of DN 6	POL fitting or cylinder quick-connect device and tail piece as determined by the application in accordance with AS/NZS 1596
		Copper alloy flared compression fitting to AS 3688 or AS D26
		Copper or copper alloy capillary fitting to AS 3688 joined using open flame brazing conforming to EN 14324 with a minimum 1.8 % silver solder (AS/NZS 1167.1)
		Copper alloy thread fitting to AS 3688
	Hose assembly to the appropriate parts of the AS 1869 series, Class F with an excess flow valve immediately upstream of the *hose assembly* (see Note 1)	*POL fitting* or *cylinder quick-connect device* and tail piece as determined by the application in accordance with AS/NZS 1596
		Copper alloy threaded fitting to AS 3688
	Stainless steel conforming to ASTM A269 grade 316 or 304 assembly. Not to be used on *boats* or where high levels of chloride (salt) can be expected. Assemblies using 316 stainless with a pitting resistance equivalent of 22 or greater may be used	POL fitting or cylinder quick-connect device and tail piece as determined by the application in accordance with AS/NZS 1596
		Stainless steel threaded fitting to AS 3688
From outlet of *regulator* to *appliances* (low pressure)	Fully annealed copper tube to NZS 3501 or AS 1432 Type A or Type B When used on *boats*, to include pipe manufacturer applied bonded coating to protect against corrosion	Copper alloy flared compression fitting to AS 3688 or AS D26
		Copper or copper alloy capillary fitting to AS 3688 joined using open flame brazing conforming to EN 14324 with a minimum 1.8 % silver solder (AS/NZS 1167.1)
		Socket formed using a tube expanding tool
	Hose assembly to the appropriate parts of the AS 1869 series	Copper alloy threaded fitting to AS 3688
	Stainless steel to ASTM A269 Grade 316	Fittings to be compatible with pipe material and the *manufacturer's specifications*

NOTE 1 The excess flow valve may be an integral part of the *cylinder quick-connect device* or *POL fitting*.

NOTE 2 The use of hard drawn copper from the outlet of the *cylinder regulator* to *appliances* is acceptable for houseboats used on inland waters.

NOTE 3 In Australia, POL fittings are currently being phased out for cylinders less than 25 L water capacity and transitioning to *cylinder quick-connect devices*. Refer to AS/NZS 1596 for further details.

5.1.4.4 Prohibited types of piping, joints and fittings

In Australia, multilayer (composite) *piping* systems shall not be used.

In New Zealand, multilayer (composite) *piping* system may be used if the product *certification* provides for their use in *boats* and *caravans*.

As specified in Clause 2.10.2, the following fittings and jointing systems shall not be used in *piping*:

(a) Croxed joints.

(b) Compression fittings with non-metallic olives.

(c) Compression fittings with metallic olives if not approved for use with *gas* in the *manufacturer's instructions*.

(d) Longscrew connectors.

(e) Capillary fittings containing soft-solder.

(f) Plain nipples, e.g. running nipple with parallel threads, except where no practical alternative is available.

NOTE A brass external parallel thread to a brass internal parallel thread may be used, provided that the joint is welded or a permanent quick-setting thread compound is used and a means of disconnection is provided immediately downstream. *Wherever possible* the fitting should be secured against disturbance.

(g) Press-fit connections.

(h) Semi-rigid connectors.

5.1.5 Cylinder connections

The high *pressure piping* between the *cylinder* and the regulator shall allow for vibration, either by including a *hose assembly* with a maximum length of 600 mm, or alternatively by providing loops or U-bends in the connecting *piping*.

Hose assemblies between the *cylinder* and the regulator shall have a *nominal size* of 6 to 8 mm.

5.1.6 Pressure rating of piping and components

All *piping* and components in a consumer *piping* system up to and including the next downstream *gas pressure* regulator shall be able to withstand a *pressure* not less than 14 kPa.

5.1.7 Pressure test points

Pressure test points shall be *accessible* and provided at, or adjacent to, the —

(a) outlet of *gas pressure regulators; and*

〖A2〗(b) inlet of an *appliance*, if no test point is incorporated in the *appliance*.〈A2〗

Where a permanent *pressure* gauge is fitted, a provision to fit an alternate test point shall be provided.

5.2 Installation of piping

5.2.1 General requirements

Installed *piping* shall be —

(a) secured against vibration;

(b) protected by a rubber grommet or equivalent protection at all points at which it passes through the vehicle body, partitions or bulkheads, unless a bulkhead fitting is used;

(c) designed, constructed and installed so that it has sufficient flexibility to avoid excessive stresses due to possible relative movement of the *piping* and the supporting structure;

(d) at least 25 mm from any electrical service irrespective of voltage; and

NOTE Consumer *piping* should not be used as a component of an earthing system of any electrical installation. Refer to AS/NZS 3000.

(e) protected against abrasion, kinking or permanent deformation.

5.2.2 Piping in caravans

The *main run* of the *piping* system shall be located outside the *caravan* regardless of the number of *appliances* connected to the pipework.

In addition to Clause 5.2.1, *piping* in *caravans* shall be —

(a) firmly fastened in a protected location so that all hoses, unions and joints are *accessible*, and all shut-off valves are *readily accessible*. Any void between the 〖A2〗*living space*〖A2〗 and a false bottom containing consumer *piping* shall be sealed from the 〖A2〗*living space*〖A2〗 and shall be provided with a minimum 500 mm^2 ventilation area adjacent to any unions and joints to allow leaking *gas* to escape to atmosphere;

(b) arranged such that the branch pipe separately enters the interior of the *caravan* adjacent to each *appliance*; and

(c) where the *piping* lies along the chassis, fastened to the side of a structural member and not beneath it.

5.2.3 Piping in boats

In addition to Clause 5.2.1, *piping* in *boats* shall be —

(a) firmly fastened in a protected location outside any structure or false bottom. All hoses, unions and joints shall be *accessible*, and all shut-off valves shall be *readily accessible*;

(b) constructed from continuous lengths from regulator to branch points and from those points to the *appliance* unless it can be demonstrated that this is impracticable; and

(c) continuous where passing through an engine room or sleeping accommodation space.

Penetrations of *decks* or bulkheads shall be sealed to prevent vapour entry.

5.2.4 Rigid piping

In all cases, installed rigid *piping* shall be —

(a) protected from direct contact with metallic parts of the structure; and

(b) at least 100 mm from exposed live parts of electrical fittings.

5.2.5 Hose assemblies

Hose assemblies shall be —

(a) of a continuous length and as short as practicable for its application;

(b) used only between —

(i) the regulator and rigid *piping*;

(ii) rigid *piping* and *appliances*;

(iii) rigid piping of a caravan and rigid piping of a slide out section; or

(iv) the regulator and the *appliance* where there is only one *appliance*.

(c) installed so that they are —

(i) not subjected to temperatures above 65 °C;

(ii) at least 100 mm from components of the engine exhaust system;

(iii) protected from exposure to ultraviolet light; and

(iv) protected from kinking or damage.

NOTE 1 See Appendix F for consumer instructions in relation to hose assembly accessibility and inspection requirements.

NOTE 2 Installation should minimize the possibility of vermin attack.

5.2.6 Prohibition of earthing through piping

Piping shall not be used as a component of an earthing system of an electrical installation.

5.2.7 Isolation valves

5.2.7.1 Manual isolation valves

Manual isolation valves shall be in a *readily accessible* position. These valves shall be of a quarter turn type and constructed so as to indicate clearly whether the valve is in the open or closed position. If the purpose of the valve is not obvious from its location, the valve shall be labelled.

Manual shut-off valves shall conform to Type 1 requirements of AS 4617 or equivalent and be *certified*.

5.2.7.2 Automatic shut-off valves

Automatic shut-off valves shall conform to Class 1 requirements of AS 4629 or equivalent, and shall be *certified*.

〚A2〛 5.2.7.3 *Appliance* connection and isolation 〚A2〛

In Australia only, a shut-off valve shall be provided prior to the inlet connection of each *appliance*.

5.2.8 Quick-connect devices

A *quick-connect device* shall not be —

(a) installed inside a *caravan* or *boat*; and

(b) connected between a *cylinder* and a *regulator* with the exception of a *cylinder quick-connect device.*

NOTE A *quick-connect device* is an acceptable means of isolation for *appliance*s operated outside a *caravan* or *boat* however a separate means of isolation is also recommended.

5.2.9 Jointing compounds and materials

Jointing compounds shall not be used to compensate for ill-fitting joints and shall not be applied to compression joints, union joints, *cylinder quick-connect devices* or *POL fittings*.

Jointing compounds and materials shall —

(a) conform to AS 4623 or equivalent and, in Australia, be *certified*;

(b) be fit for purpose; and

(c) be used only with chemically compatible materials and where the surfaces have been prepared and cleaned strictly in accordance with the relevant *manufacturer's instructions* for the jointing compound or material.

5.2.10 Miscellaneous components

Components shown in Table 5.2.10 shall conform with the applicable Standard and in Australia be *certified*.

Table 5.2.10 — Miscellaneous components

Component	Standard
Automatic shut-off valves	AS 4629
Manual shut-off valves	AS 4617, Type 1
Quick-connect devices	AS 4627
Flue cowls	AS 4566

5.2.11 Pipe supports and fixings

5.2.11.1 Construction

All *piping* shall be supported by prefabricated clips of either the same material as, or of a material compatible with, the pipe and fastened with nuts and bolts, rivets or screws.

5.2.11.2 Support spacings

Supports shall be provided within 150 mm of every bend, elbow, tee or branch fitting, excluding loops, and elsewhere at spacings not greater than specified in Table 5.2.11.2.

Table 5.2.11.2 — Piping support intervals

Pipe material type	Vertical runs mm	Horizontal runs mm
Rigid	1250	600
Flexible	750	300

5.2.12 Sealing of open ends

5.2.12.1 Removal of debris

Before any section is permanently connected or sealed it shall be checked for debris and moisture. If required, it shall be cleared and dried before sealing.

5.2.12.2 Open ends to be sealed while work in progress

Where alteration, repair or extension to *piping* necessitates the removal of fittings or A2 an *appliance* A2 or cutting of an installed pipe, all open ends, other than those at the immediate work area, shall be sealed prior to and for the duration of the work. When the work site is vacated all open ends shall be sealed.

NOTE The closing of a shut-off valve will not satisfy this requirement unless the outlet of the valve is sealed.

5.2.12.3 Outlet provided for future connection to be sealed

Where an outlet has been provided for the connection of [A2]an *appliance*[A2] but is not to be used immediately, and the outlet is not fitted with a *quick-connect device*, it shall be sealed using a plug, cap, blank flange or a capped or plugged *manual shut-off valve*.

5.3 Encapsulated electrical devices

All *encapsulated* electrical items shall meet all of the following:

(a) Be fully sealed in a flame-retardant polymer.

(b) Provide a minimum IP55 protection.

(c) Have no exposed terminals, i.e. be pre-fitted with flying leads or be terminated via a mating connection enclosure and cable gland.

(d) Contain no moving electrical contacts.

Electrical coils shall also include diodes as overvoltage/spike protection *encapsulated* with the coil.

Wiring intended to connect the device to the electrical installation shall be double insulated, or be installed in conduit, be continuous and extend beyond the compartment or locker perimeter.

Mechanical protection shall be provided for at least the first 75 mm of the wiring leads and wiring connections to a coil.

NOTE 1 The wiring protection and connection requirements could also be met by a solenoid that is within a housing intended for a conduit connection where the flying leads are then installed in conduit which provides the required IP rating and mechanical protection.

NOTE 2 Confirmation of the above features may be achieved by reference to the manufacturer's installation instructions and/or the product specification sheet.

Section 6 [A2] Means of conformance — *Appliances* [A2]

[A2] 6.1 Requirements for *appliances* [A2]

6.1.1 Australian requirements

For Australian requirements for [A2] *appliances* [A2] means of conformance, refer to Clause 2.13.3.2.

6.1.2 New Zealand requirements

For New Zealand requirements for [A2] *appliances* [A2] means of conformance, refer to Clause 2.13.3.1.

6.1.3 Appliance conversion

In Australia, an *appliance* may be converted to suit another *gas* type provided —

(a) the *appliance* is *certified* for that *gas*; and

(b) the conversion is in accordance with the *manufacturer's instructions*.

NOTE 1 Where an appliance is to be converted to a *gas* type that is not shown on the *appliance* data plate the *Technical Regulator* may require to be specifically advised prior to the commencement of the work.

NOTE 2 When converting an *appliance* from another fuel to *gas*, the conversion should be in accordance with a conversion procedure acceptable to the *Technical Regulator*.

NOTE 3 Some jurisdictions may require a specialized licence to convert [A2] *appliances* [A2] from one gas to another.

In New Zealand, if an *appliance* is converted (other than by simple exchange of injectors) the Gas (Safety and Measurement) Regulations 2010 apply.

6.1.4 Appliance location restrictions

[A2] *Appliances* shall only be installed in suitable locations.

(a) *Appliances* designed for internal *installation* shall be —

(i) installed internally; or

NOTE 1 The inclusion of an annex or awning in the caravan design may be considered an internal space. Consumer instructions should include advice that use of the *appliance* without annex or awning may adversely affect the safety and operation of *appliances*.

(ii) provided with adequate weather protection to ensure safe and correct operation of the *appliance*.

NOTE 2 Refer to the *appliance manufacturer's* instructions for any methods of weather protection.

(b) *Appliances* designed for external installation shall only be installed in outdoor locations.

NOTE 3 See Appendix K for representations of outdoor areas. [A2]

6.2 Prohibited appliances

See Clause 2.13.3.3 for the prohibition on installation of appliances.

6.3 General installation requirements

6.3.1 General

An *appliance* that is permanently fixed in place or an *appliance* that is fitted in a location where it is intended to be used or likely to be used is deemed to be installed.

6.3.2 Restriction for stowed appliances

〖A2〗Stowing or covering an *appliance* can adversely affect the *appliance* and can create an elevated safety risk.

Where an aftermarket lid or cover can enclose all or part of an *appliance*, or where an *appliance* is installed as part of an external slide-out kitchen that must be retracted and stowed for travel, then either —

(a) the gas supply to the *appliance* shall include a means to ensure gas cannot flow when the *appliance* is in the stowed position; or

(b) the gas supply to an *appliance* shall be disconnected to allow it to be stowed.

Where an external slide-out cooking *appliance* includes a windshield or cover that encloses the *appliance*, then both —

(i) the windshield or cover shall be constructed of a non-combustible material; and

(ii) a durable/permanent and legible warning label with a minimum character height of 4 mm shall be affixed to both sides of the windshield or cover with the following wording:

WARNING — CAUTION HOT SURFACE!

WARNING — DO NOT CLOSE UNTIL THIS APPLIANCE HAS COOLED.

NOTE 1 For the purpose of this clause the term “stowed” means the *appliance* is packed away and stored when travelling. For example, a slide out kitchen with a retractable gas cooktop.

NOTE 2 For the purpose of this clause the term “aftermarket” means a lid or cover that is not *certified* as part of the *appliance* design.

NOTE 3 For the purpose of this clause the term “cover” means any object (lid, cover, door, or similar) that encloses the *appliance* or part of the *appliance* and that adversely affects the safe operation of the *appliance*. For example, enclosing burners, combustion air intakes or *flue terminals*.〖/A2〗

〖A2〗6.3.3 *Appliance* support

Appliances shall be supported by, or secured to, a durable structure. The supports shall maintain the *appliance* in position and the means of securing the *appliance* to its support shall comprise materials and strength that are fit for purpose.

Appliances shall not be supported by *gas pipework* unless the pipework has been designed for that purpose. The *appliance* shall be supported and placed so that the weight of the *appliance* will not cause deformation of any part of the structure and wherever possible shall be located directly over or close to a load-bearing member.〖/A2〗

6.3.4 Protection from physical damage

〖A2〗Protection shall be provided if an *appliance* is located where physical damage to the *appliance* is likely to occur.〖/A2〗

6.3.5 Accessibility

[A2]*Appliances*[A2] shall be installed only in *accessible* locations and with sufficient clearances to allow access to, and removal of, all serviceable components.

NOTE Removal of a panel or door to give access to a control compartment is acceptable.

6.3.6 Hazards to caravans, boats or persons

[A2]*Appliances*[A2] shall be installed so as to not cause a hazard to *caravans, boats* or persons, walls, nearby surfaces, curtains, furniture or opened doors, and not obstruct the free movement of persons.

6.3.7 Proximity of flammable goods or chemicals

An *appliance* shall not be installed in a location where it may ignite flammable vapours or materials or where chemicals may combine with combustion air and cause corrosion or malfunction of the *appliance*.

6.4 Flame safeguard system

All *appliances* shall be fitted with *flame safeguard systems* to all *burners*.

NOTE This requirement also applies to appliances connected to quick connect devices.

6.5 Manufacturer's instructions

[A2]*Appliances*[A2] shall be installed in accordance with the *manufacturer's instructions* using good installation practices.

In Australia, where there is conflict between the *manufacturer's instructions* and the requirements of this Standard, the matter shall be referred to the *Technical Regulator* for a ruling.

In New Zealand, where there is any conflict between the relevant *manufacturer's instructions* for *installation* and the requirements of this Standard, the matter shall in the first instance be referred to the [A2]*appliance manufacturer*[A2] or the New Zealand representative for a ruling. This does not relieve any responsibility for conformance with performance requirements of Section 2.

6.6 Clearances

[A2]*Appliances*[A2] shall be installed with clearances from *combustible materials* as specified in the *manufacturer's instructions*. In any case the temperature rise of surrounding *combustible materials* shall not exceed 65 °C above ambient temperature.

6.7 Distance from sources of fuel

Except for *caravans* and *boats* fuelled by diesel, [A2]*appliances*[A2] fitted with a continuous source of ignition shall not be fitted, or vented, within 1 000 mm (vapour path), of the fuel filler cap or fuel tank vent.

6.8 Restriction on installation of an appliance on a petrol-fuelled boat

Where an *appliance* with a continuously burning flame is to be installed below the *upper deck* of a petrol-fuelled *boat* and where there is a possibility of petrol vapour entering the space where the *appliance* is to be mounted, the *appliance* shall be installed so that the air intake to the continuously burning flame is at least 600 mm above the *deck* on which the *appliance* is to be mounted.

6.9 Electrical requirements

A *gas appliance* connected to the electricity supply shall be provided with a means of electrical isolation that is adjacent to the *appliance* location and is *readily accessible* with the *appliance* in the installed position.

Where the *appliance* is installed in a location that is exposed to the weather, the electrical isolation shall be either a weatherproof type, or located in a position that is not exposed to the weather.

NOTE 1 The requirements for electrical isolation of *gas appliances* are prescribed in AS/NZS 3000.

NOTE 2 In Australia, the means of isolation should be one of the following:

(a) A plug to a *readily accessible* switched socket-outlet.

(b) A plug to a socket-outlet that may be located in an inaccessible position but has a separate switch operating in all live (active and neutral) conductors that is located in a *readily accessible* position.

(c) A *readily accessible* isolating switch (lockable) operating in all live (active and neutral) conductors.

NOTE 3 In New Zealand, the means of isolation should be one of the following:

(a) A plug to a *readily accessible* switched socket-outlet.

(b) A plug to a socket-outlet that may be located in an inaccessible position but has a separate switch operating in all active conductors that is located in a *readily accessible* position.

(c) An isolating switch (lockable) operating in all active conductors.

6.10 Space heaters

Permanently fitted space heaters shall be of a room-sealed type.

6.11 Cooking appliances

6.11.1 Clearances around gas cooking appliances

Clearances around *gas* cooking *appliances* shall be in accordance with the cooking *appliance manufacturer's specifications*. In the event that clearances are not specified, clearances shall be as in Figure 6.11.1 and as follows:

(a) *Requirement 1 — Overhead clearances — Measurement A*

Range hoods and *exhaust fans* shall be installed in accordance with the *range hood* or *exhaust fan* and the ⟩A2⟨ *appliance* ⟩A2⟨ *manufacturer's instructions*. Where a difference occurs, the greater clearance shall apply. Where no dimensions are specified in the *manufacturer's instructions,* the following shall apply:

(i) The clearance between the supporting surface for the cooking vessels of the *gas* cooking *appliance* and a *range hood* or *exhaust fan* (overhead clearance), shall be no less than 650 mm for a *range hood*, and no less than 750 mm for an *exhaust fan*.

⟩A2⟨ (ii) For existing installations, from the date of adoption of this Standard, where the *appliance* is being replaced, the overhead clearance from the highest part of the highest burner of the *appliance* to the *range hood* shall be not less than 600 mm unless the *appliance manufacturer's instructions* specify a greater clearance. Where no dimension is specified in the *appliance* instructions, the overhead clearance from the highest part of the highest *burner* of the *appliance* to the *range hood* shall be no less than 600 mm and no less than 750 mm for an *exhaust fan*.⟩A2⟨

(iii) Any other downward facing *combustible surface* less than 650 mm above the supporting surface for the cooking vessels shall be protected for the full width and

depth of the *hob* in accordance with Clause 6.11.2. This clearance to any surface shall not be less than 450 mm.

Removable accessories such as a wok *trivet* that sits upon a *hob trivet* shall not be taken into account in determination of the supporting surface for the cooking vessels.

Minor elevations in *trivets* such as a wok *trivet* formed into a *trivet* shall not be taken into account in determination of the supporting surface for the cooking vessels.

Where the required clearance to a *range hood* (650 mm) cannot be met, a *range hood* constructed of non-*combustible materials* may be installed with a lesser clearance, provided that —

(A) the *range hood* is installed at the clearance specified by the range hood manufacturer's installation instructions;

(B) the A2 *appliance* A2 *manufacturer's installation instructions* allows *installation* of a range hood at less than 650 mm; and

(C) the installed clearance is not less than 450 mm in all cases.

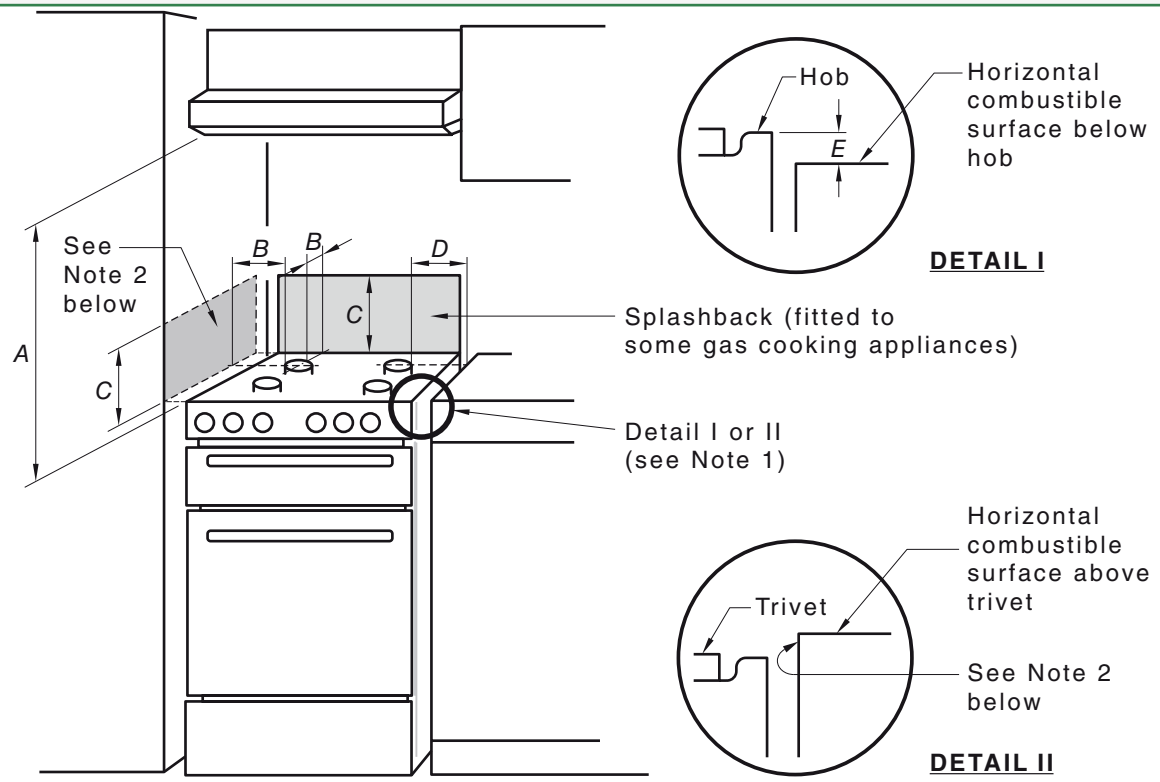
NOTE This requirement does not apply to the *installation* of commercial catering equipment.

(b) *Requirement 2 — Measurements B (side clearances) and C (height)*

Where *B*, measured from the periphery of the nearest *burner* to any vertical *combustible surface* is less than 200 mm, that surface shall be protected in accordance with Clause 6.11.2 to a height (*C*) of not less than 150 mm above the periphery of the nearest *burner* for the full dimension (width or depth) of the cooking surface area. Where the *gas* cooking *appliance* is fitted with an integral "splashback", protection of the rear wall is not required provided the splashback achieves protection of any *combustible surface* less than 200 mm from the periphery of the nearest *burner* to a height not less than 150 mm above the periphery of the nearest *burner*.

(c) *Requirement 3 — Additional requirements for freestanding and elevated gas cooking appliances — Measurements D and E*

Where *D*, the distance from the periphery of the nearest *burner* to a horizontal *combustible surface* is less than 200 mm, then *E* shall be 13 mm or more, or the horizontal *combustible* surface shall be above the *trivet*. See Details I and II in Figure 6.11.1.



NOTE 1 Details I and II relate to Requirement 3 of Clause 6.11.1(c).

NOTE 2 In this case, any vertical *combustible surface* needs to be protected in accordance with Requirement 2 of Clause 6.11.1(b).

Figure 6.11.1 — Required clearances around gas cooking appliances

6.11.2 Protection of a combustible surface near a gas cooking appliance

In order to meet the requirements of Clause 2.9.3, any *combustible surface* within the clearance zone specified in Clause 6.11.1 shall be protected in accordance with Appendix B for the applicable facing and backing materials.

6.11.3 Vapour seal

When a *gas hob* is installed above a refrigerator, the shelf shall be vapour sealed so that if any *gas* leaks from the cooker it cannot be ignited by the refrigerator.

6.11.4 Warning label

A permanent, durable and legible warning label with a minimum character height of 4 mm shall be affixed in a conspicuous position on, or adjacent to, the *appliance* and shall provide at least the following information:

WARNING — ENSURE VENTILATION WHEN THE COOKER IS IN USE. DO NOT USE FOR SPACE HEATING.

In addition, in *caravans*, a permanent, durable and legible warning label shall be fixed in a prominent position adjacent to cooking appliances and contain the following wording:

WARNING — WHEN OPERATING THIS APPLIANCE, COMBUSTIBLE MATERIALS MUST BE RESTRAINED IN THEIR INTENDED POSITION AND ANY POP-UP TYPE ROOF MUST BE ELEVATED.

6.11.5 Cooking appliances on boats

Where *gas* cooking *appliances* are mounted on gimbals to provide a stable cooking surface the following requirements shall apply:

(a) The *appliance* shall be connected by a flexible connection.

(b) Limit stops shall be fitted that permit movement during normal operating conditions to minimize stresses on the flexible connection.

(c) The required clearances to *combustible surfaces* shall be maintained at all possible positions of the *appliance* or a deflector shall be fitted.

(d) Means shall be provided to positively retain the *appliance* within the gimbals at all angles of tilt.

(e) Means shall be provided to prevent movement when the *appliance* is not in use.

NOTE Where a cooking *appliance* is to be installed, consideration should be given to the fitting of fiddle rails and potholders to the *appliance* to prevent unintentional movement of cooking vessels.

6.11.6 Under cooker connection

A *freestanding cooking appliance* having an under cooker connection point shall not be connected to that point using a *hose assembly* or a *semi-rigid connector.*

6.12 Refrigerators

6.12.1 Flues

Refrigerators shall be *flue*d to the outside.

NOTE *Flues* may be inclusive of the venting system as supplied by the manufacturer.

6.12.2 Vents

A wall vent measuring a minimum free area of 500 mm^2 shall be provided at the bottom level of the refrigerator compartment so that any accumulation of leaked *gas* can escape to outside.

NOTE Ventilation as required in Clause 6.12.4 may satisfy this requirement.

6.12.3 Location

A refrigerator installed in a *caravan* or *boat* shall be installed in a sealed recess to prevent the infiltration of *combustion products* into the ▌A2⟩ *living space* ⟨A2▐.

6.12.4 Ventilation

In addition to the requirements listed in Section 7, ventilation at the rear of the unit and to the exterior of the *caravan* shall be provided to ensure the proper functioning of the refrigeration unit.

In the absence of specific *manufacturer's instructions* —

(a) the ventilation shall comprise openings located at the top and bottom levels of the enclosed space;

(b) each opening shall be of a free area not less than specified in Table 6.12.4; and

(c) the upper ventilation opening shall be located entirely above the condenser/absorption fins.

NOTE Typical installation diagrams are shown in Figure 6.12.4.

Table 6.12.4 — Additional ventilation for refrigerators

Refrigerator storage capacity L	Free area for ventilation mm^2
Up to and including 100	32 500
101 to 200	45 000
Greater than 200	65 000

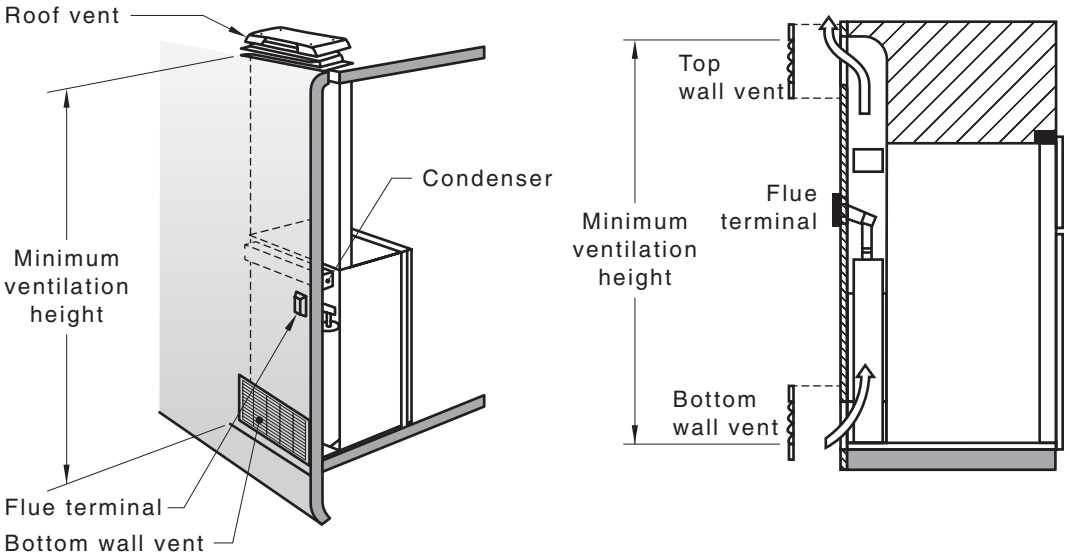


Figure 6.12.4 — Typical installations of a gas refrigerator

6.13 Instantaneous water heaters

See the essential safety requirements in Section 2 for prohibitions on installation related to instantaneous *water heaters*.

NOTE Refer to AS/NZS 3500.4 for limitations regarding heated water delivery temperatures from sanitary fixtures used primarily for personal hygiene purposes.

6.14 Spa pool heaters on boats

6.14.1 Prohibited locations

A spa heater shall not be installed in the following locations:

(a) Upstream of a filter or pump.

(b) Downstream of an automatic chlorinator.

(c) In a storage area for pool chemicals or flammable materials.

NOTE Pool chemicals may contain chlorine which, when drawn into the heater *burner*, will quickly cause corrosion and damage to the heater.

6.14.2 Supporting base

A pool heater shall, unless otherwise stated in the *manufacturer's instructions* for installation, be installed on a stable non-combustible base.

6.14.3 Control systems

Pool heaters for spa and therapeutic applications shall have the following controls:

(a) A system that ensures the water temperature in the pool does not exceed 40 °C.

(b) A manual reset high temperature limit device independent of the control system required by Item (a) to prevent the water temperature in the pool exceeding 45 °C.

(c) Controls that ensure water is flowing through the heater before the main *gas* valve allows *gas* to the *burners*.

6.14.4 Requirement for pool heater where flow and return water pipes are of plastic

Where the water flow and return pipes are of plastic, these pipes shall be connected to the heater with a minimum of 1 m of un-lagged metallic pipe unless stated otherwise in the relevant *pool heater manufacturer's instructions*.

NOTE This requirement prevents the plastic pipe being affected by residual heat when the pool heater is shut down.

6.14.5 Non-return valve required

A *non-return valve* shall be fitted in the water return line between the filter and the *pool heater* unless stated otherwise in the relevant *pool heater manufacturer's instructions*.

6.14.6 Restriction on fitting of a valve in water flow line

A valve shall not be fitted in the water flow line between the heater and the pool, unless there is an arrangement to vent the system when the valve is closed. Where a *pressure* relief valve provides such venting, that valve shall conform to AS 1357.1 and be fitted with a terminated drain.

6.15 Gas barbecues and radiant gas heaters for outdoor use

Gas barbecues and radiant *gas* heaters designed for *outdoor* use shall be installed *outdoors* or in areas that are considered as *outdoors*.

NOTE 1 Diagrammatical representations of areas that may be considered as *outdoors* are provided in Appendix K.

NOTE 2 These requirements do not apply to *appliances* with *flue terminals*. For *appliances* with *flue terminals*, see Clause 8.4.

Any enclosure in which the *appliance* is installed shall conform to one of the following:

(a) An enclosure with walls on all sides, but at least one permanent opening at ground level and no overhead cover.

(b) Within a partial enclosure that includes an overhead cover and no more than two walls.

(c) Within a partial enclosure that includes an overhead cover and more than two walls —

(i) at least 25 % of the total wall area shall be completely open; and

(ii) at least 30 % of the remaining wall area shall be open and unrestricted.

In the case of balconies, verandas or awnings, at least 20 % of the total of the side, back and front wall areas shall remain open and unrestricted. A permanent, durable and legible warning label with the following information in 5 mm font shall be displayed on or adjacent to the entry door of *caravans*:

WARNING — IF FITTING AN ANNEX, CONTACT A GASFITTER TO ADVISE ON THE VENTILATION REQUIRED FOR SAFE OPERATION OF GAS APPLIANCES.

Section 7 Means of conformance — Ventilation

7.1 General

Where *appliances*, including *room-sealed appliances*, are installed in the *living space*, ventilation shall be provided to prevent excessive condensation, build-up of products of combustion, or other toxic conditions.

The minimum free area of ventilation shall be provided in accordance with Clause 7.3.

7.2 Ventilation systems

In order to ensure flow of air for ventilation within the *living space*, high level and low level ventilation shall be provided directly from outside. Such ventilation may be assisted by wind-actuated self-trimming *cowls*, rotary exhauster heads, or an interlocked, fan-assisted ventilation system.

7.3 Ventilation openings — Caravans and boats

7.3.1 Minimum free area

Where an *appliance* is installed, such that any part of the *appliance* is within a *caravan* or *boat*, the total permanent ventilation within the *living space* shall be the greater value of either —

(a) 4 000 mm^2; or

(b) the value obtained from the formula below.

$$V = \left(610 \times U\right) + \left(650 \times P\right)$$

where

V = minimum free area, in mm^2

U = input rating for all *appliances*, (other than room-sealed) in the space, including cookers, in MJ/h, refer to rating plate

P = number of sleeping spaces in the *caravan* or *boat*

In cases where the *appliances* are only of the room-sealed type, or where part of a *room-sealed appliance* is within the *caravan* or *boat*, the minimum value for permanent ventilation shall be 4 000 mm^2.

EXAMPLE For a *caravan* designed to sleep 3 people, and having a gas cooker rated at 29 MJ/h (8 kW), the minimum free area for ventilation, V, is (610 × 29) + (650 × 3) = 19 640 mm^2.

This formula applies to any *living space* within a *caravan* or *boat* where *appliances* are installed and includes an annex or covered deck that does not meet the definition of *outdoors* (see Appendix K for examples). The following also applies:

(i) If the space is a normally divided part of the *caravan* or *boat*, or can be divided temporarily by means of doors, curtains, etc., the ventilation openings shall be provided —

  (A) in the same space as any *appliances*; and

  (B) where any part of the *appliance* is located (see Note 2).

(ii) Where the upper or lower ventilation direct to outside is taken from within an enclosed annex or covered deck that does not meet the definition of *outdoors*, the same sized ventilation openings shall be installed on an outside wall of the enclosed annex to maintain the required permanent ventilation.

NOTE 1 A *room-sealed appliance* is considered to be within the *caravan* or *boat*, irrespective of whether the *appliance* is installed, serviced, or operated from outside.

NOTE 2 For the purposes of this clause, the following are not considered to be within the *caravan*:

(a) An *appliance* in a compartment or locker outside of the *caravan* floorplan. See Figure 7.3.1.

(b) An *appliance* stowed within the *caravan* floorplan that conforms to Clause 6.3.2.

NOTE 3 The calculated ventilation area is strictly the minimum for safety and should be exceeded where possible. It does not in any way replace or reduce the normal adjustable ventilation provided by a window, or the like.

NOTE 4 A gas refrigerator installed in a sealed recess is considered a *room-sealed appliance* for the purpose of the above calculation..

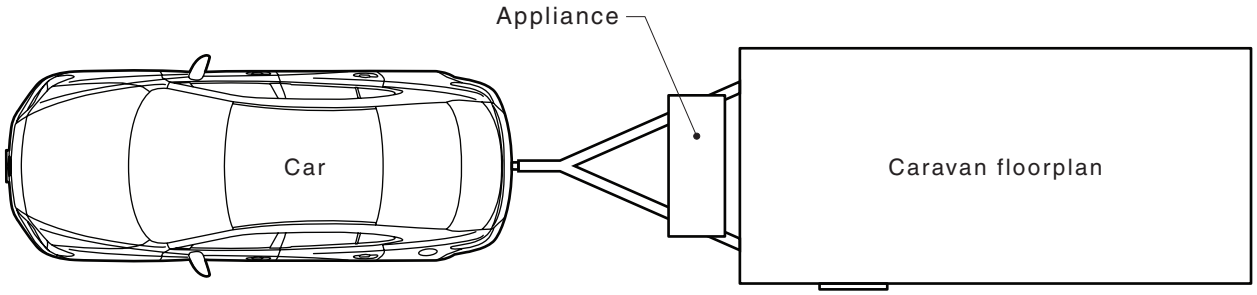
NOTE 5 For *appliances* with input ratings given in other units the following conversion factors may be used:

(a) 1 kW = 3.6 MJ/h.

(b) 1 000 BTU/h = 1.055 MJ/h.

NOTE 6 The use of louvres and/or mesh screens will reduce the free area of an opening. Allowance should be made to ensure free areas are achieved. As a guide, where mesh is used, the area should be doubled.

NOTE 7 Refer to AS/NZS 5601.1 for ventilation requirements for mobile catering vehicles.



NOTE See Clause 3.3.2 for requirements for the storage of cylinders in compartments/lockers.

Figure 7.3.1 — Example of *appliance* located outside of the *caravan* floorplan A2

7.3.2 Special requirements for camper trailers and boats

A2 For pop-up (or pop-top) A2 type recreational vehicles and *boats*, ventilation shall be effective whether the top is up or down. For camper-trailers and *boats* of the fully collapsible type, ventilation need only be effective when the structure is erected.

7.3.3 Special requirements for RVs (motorized caravans)

In motorized *caravans*, regardless of the location of the vehicle exhaust, vents shall not be installed in the rear wall.

7.4 Position of openings — Caravans only

7.4.1 Cross ventilation

A2 The ventilation shall be provided directly from outside by at least two openings fitted at opposite ends or sides of the *living space* in accordance with Clauses 7.4.2 and 7.4.3. A2

NOTE Roof hatches without fixed ventilation when closed or roof hatches that are not at opposite ends to a lower vent within the compartment do not satisfy this requirement.

7.4.2 Distance from ceiling

Permanently open ventilation equal to a minimum of 50 % of the required ventilation area shall be provided not lower than 150 mm from the highest point of the ceiling. An externally vented stove *rangehood*/extractor lower than 150 mm from the highest point of the ceiling shall not be used for high level ventilation.

7.4.3 Distance from floor

〖A2〗Ventilation equal to a minimum of 50 % of the required ventilation area shall be provided as low as possible but not more than 150 mm from the *living space* floor.

If the permanent ventilation is intended to be covered while travelling (i.e. to avoid ingress of water or dust) then both the following requirements apply:

(a) The ventilation shall be designed to ensure the *living space* is ventilated in accordance with Clause 7.3.1 when *appliances* are in use.

NOTE 1 Examples of how this can be achieved include covers that require removal to access the *living space*, or ventilation systems that are interlocked with the gas installation.

(b) A *carbon monoxide detector* conforming to EN 50291-2 or UL 2034, capable of detecting low concentrations of carbon monoxide (CO) and having an audible alarm shall be installed.

NOTE 2 Ventilation through the floor of a *caravan* may contravene road traffic authority requirements.〖A2〗

7.5 Position of openings — Boats only

Effective, unrestricted, permanent ventilation shall be provided, comprising at least two (2) openings fitted at opposite ends or sides of the cabin, or preferably, at the *deck* head to the underside of the *deck*.

Where a *boat* otherwise meets the requirements of this Clause but it is impractical to use the *boat* without covering the permanent ventilation, a *carbon monoxide detector* in conformance with 〖A1〗EN 50291-2〖A1〗 or UL 2034, capable of detecting low concentrations of CO and having an audible alarm shall be installed.

7.6 Gas detection system required — Boats only

Where an *appliance* with a continuously burning flame is to be installed below the *upper deck* of a *boat* and there is no low level ventilation in the area where the *appliance* is to be installed, a combustible *gas* detection system conforming to Appendix D shall be installed.

NOTE If 50 % of the total ventilation required by Clause 7.3 is supplied at low level the requirement of this Clause will be satisfied.

7.7 Vent warning label for caravans and boats

A permanent legible warning label with a minimum character height of 4 mm shall be affixed or adjacent to the upper and lower vents (see Clauses 7.4.2 and 7.4.3) and shall state —

WARNING — THIS VENT MUST REMAIN PERMANENTLY OPEN, CLEAN AND UNRESTRICTED TO PROVIDE VENTILATION WHEN GAS APPLIANCES ARE IN USE.

Section 8 Means of conformance — Flueing

8.1 Flue construction and clearances

Unless the *flue* is designed to prevent adjacent *combustible materials* exceeding 50 °C above ambient where a *flue* passes through a wall or a roof, it shall be fitted with a protective sleeve of *fire resistant material*, and be secured. Where the structure includes *combustible material*, a minimum clearance of 25 mm shall be provided between the *flue* and the *combustible material*. The effective internal cross-sectional area of the *flue* shall be not less than the outlet of the [A2] *appliance* [A2]. *Flues* shall not be fitted with dampers.

8.2 Protection from environmental effects

Every *flue* shall be fitted with a *flue cowl* that prevents the ingress of rain.

*Flue*s shall be constructed of materials that withstand the effects of the environment.

8.3 Disturbances

*Flue*s shall be secured to withstand vehicle movement and weather conditions.

8.4 Location of flue terminal

8.4.1 General

Flue terminals shall not be located within 300 mm of a combustion air intake, another *flue terminal* ventilator, opening port, hatch or window, or within 500 mm of a refuelling point or fuel tank vent outlet.

NOTE 1 This requirement does not apply to flue terminals for appliances that are *certified* for closer *installation*.

There shall be a minimum 50 mm clearance between the lowest opening of a *flue cowl* and the roof of a *caravan*.

NOTE 2 [A2] Gas refrigeration [A2] vents are not considered openings.

A *flue terminal* shall not to be installed in a wheel arch or the underside of the floor of a *caravan*.

8.4.2 Termination of a flue under a cover

Where the *flue terminal* of a balanced *flue appliance*, *room-sealed appliance*, a fan-assisted *appliance* or the *flue terminal* of an *appliance* designed for *outdoor* installation is to be installed under a covered area, where *combustion products* might not readily disperse or a nuisance could occur, either —

(a) the covered area shall be open on at least two sides and the terminal shall be located to ensure a free flow of air across it is achieved; or

(b) in the case of a fan-assisted *flue appliance* only, when one side is open, the terminal shall be within 500 mm of the opening, discharging in the direction of the opening and there shall be no openings into the *caravan* or *boat* along the wall within that distance and the terminal shall be located to ensure that a free flow of air across it is achieved.

NOTE These requirements do not apply to domestic *gas* barbecues and radiant *gas* heaters designed for *outdoor* use. For these *appliances*, see Appendix K.

8.5 Flue materials

Materials for a flue shall conform to Table 8.5.

Table 8.5 — Flue materials

Material	Protective finish	Application and limitations
Low temperature applications (not exceeding 300 °C)		
Aluminium alloy 1100, 3003 in accordance with AS/NZS 1734 Minimum thickness 0.7 mm	None	Only where *accessible* for inspection and renewal
Mild steel Minimum thickness 0.6 mm	Aluminized 122 g/m^2, or Z275 zinc to AS 1397, or aluminium zinc in accordance with AS 1397	Only where *accessible* for inspection and renewal
High temperature applications (up to 500 °C)		
Stainless steel Minimum thickness 0.5 mm	300 and 430 Series Grade	

8.6 Proprietary flueing systems

Proprietary flueing systems shall be installed according to the *manufacturer's instructions*.

Section 9 General requirements and safe work practices

9.1 Gas supply

Before commencing an installation, all of the following shall be established:

(a) The type of *gas* available.

(b) That the capacity of the *cylinder* supply is sufficient to meet the anticipated maximum demand.

(c) The *pressure* of the *gas* available at the inlet to the consumer *piping*.

(d) The maximum *pressure* supplied from the outlet of the *cylinder* in the event of failure of the supply regulator or control.

(e) Location of the *cylinder*.

NOTE In Australia, the *gas* supplier and/or *Technical Regulator* may require, for complex jobs, notification before work commences and confirmation that completed work is in accordance with this Standard and any other relevant requirements.

9.2 Gas demand

A2 The gas pressure and flow requirements for all *appliances*, including any existing *appliances*, shall be established from the *appliance* data plates or by reference to the *appliance manufacturer's instructions*. A2

9.3 Safe work practices

9.3.1 General

Safe working practices shall be employed, including —

(a) when working on *gas installation*s;

(b) for locating *gas* leaks;

(c) for repair of *gas* leaks;

(d) to avoid any hazard arising from electrical currents in, or voltages on, the *gas installation*; and

(e) when *purging*.

9.3.2 Purging

9.3.2.1 Purging prior to work

All existing pipework shall be isolated from its *gas* supply and safely *purged* of *gas* before the work is started.

Purging of a *gas installation* shall be planned to —

(a) ensure no pockets of *gas* are left behind in any part of the *gas installation*;

(b) ensure that *gas* is vented from the pipe system to a safe place and level;

(c) prevent *gas* accumulation;

(d) provide good ventilation within the vicinity of the *purge* point;

(e) prevent inadvertent operation of any electronic device; and

(f) prohibit smoking or naked flames.

Purging shall continue until tests indicate the *gas installation* is completely free of *gas* at all *purge* points.

NOTE Further information on *purging* procedures is given in Appendix L.

9.3.2.2 Purging after completion of work

After performing any work on consumer *piping*, all air or inert *gas* shall be *purged* from the consumer *piping* before any attempt is made to light an *appliance*. All branch lines shall be individually purged. *Purging* shall be completed before *appliance* testing and *commissioning* commences.

NOTE Further information on *purging* procedures is given in Appendix L.

9.4 Dealing with dangerous gas installations

Immediate steps shall be taken to make safe any unsafe *gas installation* or *appliance* that may be discovered.

NOTE 1 In New Zealand, the Gas (Safety and Measurement) Regulations 2010 require that when a person carrying out *gasfitting* has reasonable grounds to believe that an installation presents an immediate danger to life and property they shall notify the owner or occupier of the property and the *Technical Regulator*.

NOTE 2 In Australia, the *Technical Regulator* may require to be informed, and the consumer/operator should also be notified.

9.5 Safety requirements in the vicinity of gas leaks or suspected gas leaks

Where there is a *gas* leak or a suspected *gas* leak or *gas* is present in the atmosphere, taking into account the *gas* type and leakage rates, action shall be taken to ensure —

(a) all people in the vicinity are evacuated to a safe distance;

(b) the *gas* supply to the *gas installation* is isolated;

(c) all *ignition source*s are identified and are safely isolated, or extinguished where possible;

(d) all affected spaces are well ventilated to safely disperse any accumulating *gas*;

(e) emergency support services are notified when there is a need; and

(f) the owner and occupier of the property are notified of the action taken and the remedial options available.

NOTE Warning signs should be used and, depending on the severity of the situation, it may be necessary to evacuate people from the area.

9.6 Safe discharge of static electricity

When working on *piping*, any static electricity that may be present in the *piping* or become present during work shall be discharged safely.

NOTE 1 A method of discharging the static electricity is to wet the ground and dampen the pipe at the work area with a wet cloth. Then drape the cloth from the pipe to the ground to provide a path to earth. Under these conditions any static electricity should now have been discharged safely.

NOTE 2 When working on electronic devices, protection against the buildup of static electrical charge should be taken into account.

9.7 Electrical safety bonding or bridging

To avoid the risk of potentially fatal electrical shocks where a metal pipe is to be cut, or [A2] an *appliance* [A2], component or fitting is to be disconnected from *piping*, an insulated metallic bridging device shall be installed across the intended cut or break to ensure electrical continuity. The bridging device shall not be removed until all work is complete.

9.8 Clearing a blockage in piping

Where a blockage is to be cleared from the *piping* —

(a) all *gas cylinders* and *gas pressure regulators*, and all [A2] *appliances* [A2] shall be disconnected or isolated before any suction or force is applied;

(b) only *pressure* regulated air or inert *gas* shall be used to clear the blockage; and

(c) on completion of the work, the *piping* shall be tested in accordance with Appendix E.

9.9 Testing of piping

9.9.1 Testing a new gas installation

Before any new *gas installation* is put into operation the *piping*, [A2] *appliances* [A2] and *valve trains* shall be tested in accordance with Appendix E.

NOTE *Piping* that is to be installed in an inaccessible location should be tested prior to the *piping* being made inaccessible to enable any repairs that may be necessary to be carried out before the *piping* is made inaccessible.

9.9.2 Testing consumer piping after alteration, repair or extension

Where *piping* has been altered, repaired or extended, the section of the installation isolated to carry out the work shall, before being returned to operation, be tested in accordance with Appendix E.

NOTE When testing large existing *gas installation*s it may not be practicable to test the whole of the existing installation; in this circumstance the leakage test shall be applied downstream of the last *isolation valve*.

9.9.3 Acceptable substances for testing

Air, the *gas* for which the system is designed, or an inert *gas* shall be the only substances used within *piping* for testing. Oxygen shall not be used as a substitute for air.

9.10 Commissioning

9.10.1 Commissioning of appliance

The *commissioning* of an appliance shall take full account of special design features, the manufacturer's instructions and the appliance safety requirements.

The *commissioning* of an appliance shall include all of the following:

(a) Testing and *purging* of the *appliance* and installation.

(b) Checks to ensure the *appliance* is in safe working order.

(c) Ignition of each *burner* of the *appliance* and, where necessary, adjustment in accordance with the *manufacturer's instructions*.

(d) Testing of *flue* performance.

(e) Testing of all safety devices for correct operation.

(f) Instruction of the consumer, where available, on the safe and correct operation of the *appliance* and any auxiliary equipment.

(g) Making available the *appliance manufacturer's instructions* to the consumer.

NOTE 1 See Appendix H for guidelines for ⟨A2⟩ *appliance commissioning*.⟨A2⟩

NOTE 2 See Appendix J for a checklist for checking conformance of the installation prior to and during *commissioning*.

NOTE 3 See Appendix F for consumer instructions.

9.10.2 Other commissioning checks

Appliance operating instructions, the label on the *LP Gas locker* or *cylinder compartment*, and any cautionary labels shall be checked to ensure they are displayed in prominent positions.

Cylinders and *cylinder* restraints shall be examined for damage or corrosion.

9.10.3 Decommissioning

Every *gas installation*, or part of a *gas installation*, that is permanently decommissioned shall be disconnected from the *gas* supply and *purged*.

Section 10 Compliance plate, labels and markings

10.1 Gas compliance plate

A *gas* compliance plate shall be securely attached to the body work of the *caravan* or *boat* in a clearly visible location adjacent to the *cylinder*s. The compliance plate shall take the form shown in Figure 10.1. All information required for the compliance plate shall be provided by the *authorized person*.

A compliance plate shall be attached for new *gas installation*s, and modifications of existing installations. Each modification of a *gas installation* shall require an additional compliance plate to be attached. The compliance plate shall not compromise the structural integrity of the vehicle or *vessel*. The plate shall not be removed or altered.

The compliance plate shall be as follows:

(a) Durable.

(b) Metallic.

(c) UV resistant.

(d) Corrosion resistant.

(e) Clearly legible with a character height of a minimum 4 mm.

The information provided by the *authorized person* shall be permanently inscribed and clearly legible.

Gas Installations—AS/NZS 5601.2

Gas Compliance Plate

Jurisdiction:

ACT ☐ NSW ☐ NT ☐ QLD ☐ SA ☐ TAS ☐ VIC ☐ WA ☐ NZ ☐

Type of Installation:

New Installation ☐ Alteration-Addition ☐

VIN/HIN No:_____

Gas Compliance Certificate No or Approval No:_____

Date of Test:_____

Tested By:_____ **(Contractor Licence No)**

This plate shall not be removed once attached.

NOTE 1 Any statutory regulations regarding compliance procedures that differ from this requirement take precedence.

NOTE 2 The formatting of the text in Figure 10.1 is informative only. Only one jurisdiction may be nominated on the plate.

Figure 10.1 — Compliance plate

10.2 Labels and markings adjacent to cylinders

A permanent, durable and legible label containing the information shown in Figure 10.2.

(a) Close appliance valves before opening cylinder valve(s).

(b) At cylinder changeover, check connections at the appliances, regulators, hoses and cylinders for leaks using soapy water or its equivalent.

CAUTION: The ammonia present in some soaps and detergents can react with brass fittings and cause such fittings to crack after a short period of time. Therefore, caution should be exercised when using soap solutions on brass fittings and all connections should be rinsed thoroughly with fresh water as soon as possible after the application of the soap solution.

(c) Never use a match or flame when checking for leaks.

(d) Ensure cylinder valves are closed when connecting or disconnecting electrical connections.

(e) Close valve(s) and fit sealing plug to all spare cylinders not connected, whether full or empty.

(f) In the event of fire, immediately close cylinder valve(s) if safe to do so.

(g) Close cylinder valve(s) when appliances are not in use and while travelling or refuelling (caravans only).

(h) Close cylinder valve(s) when appliances are not in use and while refuelling (boats only).

Figure 10.2 — Label adjacent to cylinders

10.3 Labels and markings near appliance

10.3.1 General

A single permanent, durable and legible label shall be located in a prominent position within the area containing the A2 *appliance.* A2 The label shall be protected from damage and containing the information shown in Figure 10.3.1.

See Section 6 for specific appliance marking and label requirements.

(a) Close appliance valves before opening cylinder valve(s).

(b) Frequently check connections at the appliances, regulators, hoses and cylinders for leaks with soapy water or its equivalent.

CAUTION: The ammonia present in some soaps and detergents can react with brass fittings and cause such fittings to crack after a short period of time. Therefore, caution should be exercised when using soap solutions on brass fittings and all connections should be rinsed thoroughly with fresh water as soon as possible after the application of the soap solution.

(c) Never use a match or flame when checking for leaks.

(d) In the event of a gas leak, close cylinder valve and ventilate the space.

(e) In the event of fire, immediately close cylinder valve(s) if safe to do so.

(f) All additions or alterations to the LP Gas system shall be performed by a licensed person.

(g) Appliances must not be altered without the authorization of the manufacturer.

(h) All permanent ventilators, flues and vents should be checked regularly to ensure that they are clean, free from debris, unobstructed and operating correctly.

(i) All appliances must be turned off when not in use and while travelling or refuelling (caravans only).

(j) All appliances must be turned off when not in use and while refuelling (boats only).

Figure 10.3.1 — General *appliance* label

10.3.2 Additional marking for boats

For *boats,* the label specified in Clause 10.3.1 shall contain the information shown in Figure 10.3.2.

(a) In a petrol or gas driven vessel, no appliance with a continuously burning flame shall be left unattended when operating.

(b) When the vessel is fitted with a gas detector, the gas detector shall be checked for the presence of flammable vapours and the vessel shall be cleared of flammable vapour before lighting any LP Gas appliance or starting the motor.

(c) Gas or carbon monoxide detection systems shall be maintained in accordance with the manufacturer's instructions.

Figure 10.3.2 — Additional marking for boats

Appendix A
(informative)

Conversion factors

The units of measurement used in this Standard are those based on the metric system and in common use within the *gas* industry. The listing in Table A.1 is presented as a ready reference for conversion between different units of measurement.

Table A.1 — Conversion factors

Multiply	By	To give
Length		
metres (m)	3.281	feet (ft)
feet (ft)	0.3048	metres (m)
Area		
square millimetres (mm^2)	0.01	square centimetres (cm^2)
square millimetres (mm^2)	0.00155	square inches (in^2)
square inches (in^2)	645.16	square millimetres (mm^2)
square metres (m^2)	10.764	square feet (ft^2)
square feet (ft^2)	0.0929	square metres (m^2)
Volume		
cubic metres (m^3)	35.315	cubic feet (ft^3)
cubic feet (ft^3)	0.0283	cubic metres (m^3)
Energy		
British thermal units (BTU)	1.055	kilojoules (kJ)
therms	105.5	megajoules (MJ)
kilowatt hour (kWh)	3.6	megajoules (MJ)
megajoules (MJ)	0.2778	kilowatt hour (kWh)
Power		
megajoules per hour (MJ/h)	0.2778	kilowatts (kW)
kilowatts (kW)	3.6	megajoules per hour (MJ/h)
British thermal units per hour (BTU/h)	0.001055	megajoules per hour (MJ/h)
therms per hour	105.5	megajoules per hour (MJ/h)
Pressure		
millibar (mbar)	0.1	kilopascals (kPa)
kilopascals (kPa)	10.0	millibar (mbar)
pounds per square inch (lb/in^2) (psi)	6.895	kilopascals (kPa)
kilopascals (kPa)	0.145	pounds per square inch (lb/in^2) (psi)
inches water gauge (in.WG) @ 15 °C	0.2488	kilopascals (kPa)
kilopascals (kPa) @ 15 °C	4.016	inches water gauge (in.WG)
Miscellaneous		
square millimetres per kilowatt (mm^2/kW)	0.2778	square millimetres per (megajoule per hour) ($mm^2/(MJ/h)$)

Appendix B
(normative)

Thermal protection of combustible materials

B.1 Introduction

This Appendix sets out requirements for materials to provide thermal protection of *combustible materials* (combustibles) used in *gas installation*s and thereby prevent the combustibles reaching unsafe temperatures.

In certain applications the protective materials may also be required to support a load. This Appendix specifies the mechanical material properties. Protection of *combustible materials*.

In *gas installation*s, *combustible materials* require thermal protection when clearances from heat sources are insufficient and as otherwise stipulated in this Standard.

Clause B.3 sets out specifications for materials to provide thermal protection of combustibles.

B.2 Specification for materials to provide thermal protection of combustibles

Materials for the thermal protection of combustibles shall have properties (a) or (b) and, in addition, properties (c), (d) and (e).

(a) When tested to AS 1530.1, be deemed not combustible.

(b) When tested to AS/NZS 1530.3, have indices as follows:

  (i) Ignitability — zero (0).

  (ii) Spread of flame — zero (0).

  (iii) Heat evolved — zero (0).

  (iv) Smoke developed — zero to one (0 to 1).

(c) Minimum thicknesses and resulting coefficients of heat transfer as shown in Table B.2.

(d) If required to support a load, a compressive strength of not less than 1.5 MPa.

(e) If required to support a load, deform not more than 2 % of its thickness when subjected to a compressive stress of 350 kPa.

Table B.2 — Thermal protection of combustibles

Application	Minimum thickness mm	Maximum co-efficient of heat transfer (U) W/m^{2}K
Thermal protection of combustibles adjacent to appliances other than commercial catering appliance(s)	6	20
The maximum co-efficient of heat transfer shall be tested in accordance with ASTM C518Test samples for the method specified in ASTM C518 shall not be exposed to temperatures that will change the specimens in an irreversible manner. Test samples shall be conditioned at 22 °C and 50 % RH for a period of time until less than a 1 % mass change is observed over a 24-h period. For some materials, such as cellulose, considerably longer times may be required for both conditioning and testing. NOTE 1 The heat transfer coefficient U (W/m^{2}K), thermal resistance R (m^{2}K/W), thermal conductivity k (W/mK) and thickness t (m) of materials are related by the following formulas: $U = 1/R$ $R = t/k$ $U = k/t$ NOTE 2 For thermal protection of combustibles adjacent to commercial catering *appliance(s)* refer to AS/NZS 5601.1.		

B.3 Acceptable methods of thermal protection of combustible materials adjacent to domestic cooking appliances

Material conforming to the specifications of this Clause or the methods detailed in Table B.3 shall be used for thermal protection of combustibles adjacent to domestic cooking *appliances*.

Table B.3 — Acceptable methods of thermal protection of combustibles adjacent to domestic cooking appliances

Facing material	Minimum thickness mm	Backing material	Minimum thickness mm
Ceramic tiles	5	Gypsum based wall board	10
		Fibre cement board	6
Toughened safety glass	5	Gypsum based wall board	10
		Fibre cement board	6
Sheet metal	0.4	Fibre cement board	12
		Fibre cement board over 10 mm gypsum based wall board	6
Any other material that satisfies (a) or (b): (a) When tested to AS 1530.1, be deemed not combustible. (b) When tested to AS/NZS 1530.3, have indices as follows: (i) Ignitability – zero (0). (ii) Spread of flame – zero (0). (iii) Heat evolved – zero (0). (iv) Smoke developed – zero to one (0 to 1).	—	Fibre cement board	12
		Fibre cement board over 10 mm gypsum based wall board	6

Toughened safety glass shall conform to AS/NZS 2208.

All *toughened safety glass* used as a cooker splashback shall be marked as "*toughened safety glass*" to indicate that it is fit for purpose.

Where the glass is not marked, a document from the glass manufacturer shall be provided to confirm that the glass is toughened.

Reconstituted stone or quartz surfaces contain polymer resins and may not meet the requirements of Clause B.2, Item (a) or (b). If used, conformance shall be confirmed.

B.4 Examples to determine the required thickness of materials for thermal protection of combustible materials

EXAMPLE 1 *Fire resistant material* from supplier "A" has a thermal conductivity of 0.21 W/mK.

What minimum thickness of the material should be used?

$$\begin{aligned} t &= k / U \\ &= 0.21 / 20 \\ &= 0.010\,5\,\text{m} \\ &= 10.5\,\text{mm} \end{aligned}$$

EXAMPLE 2 *Fire resistant material* from supplier "B" has a thermal conductivity of 0.11 W/mK.

What minimum thickness of the material should be used?

$$\begin{aligned} t &= k / U \\ &= 0.11 / 20 \\ &= 0.005\,5\,\text{m} \\ &= 5.5\,\text{mm} \end{aligned}$$

In Example 2, as the value of t is less than the minimum thickness requirement of 6 mm, material of at least 6 mm is required.

Appendix C
(informative)

Pipe sizing

C.1 Introduction

C.1.1 General

The flow graphs and tables in this Appendix have been compiled through consistent application of the flow formulas, and make allowances for *pressure* losses that occur due to fittings. The "longest length" or "index length" method of pipe sizing has been used.

The pipe sizing table indicates the flow of *gas*, in megajoules per hour, through copper pipes to AS 1432 and NZS 3501. The heating value quoted in each table is a nominal figure typical of *LP Gas*.

The method described in this Appendix applies to *LP Gas* where the allowable *pressure* drop is 0.25 kPa. The sizing of *piping* for materials or conditions other than those in the pipe sizing table of this Appendix should be determined using recognized formulae, graphs or tables such as those in AS/NZS 5601.1.

C.1.2 Pipe conditions

The flows have been calculated assuming pipes of minimum internal diameter (which conform to the relevant Standard) that are horizontal and free from defects, deterioration and/or the accumulation of foreign matter. Pipes are taken to be smooth, that is, zero roughness.

C.1.3 Fitting allowance

A fitting allowance equivalent to a 50 % extension of the length for each point calculated is made. For example, when calculating the flow for a given type of *gas* in a pipe 20 m in length and a set of conditions (diameter, *pressure* drop, roughness), the flow has been calculated for 30 m (being 1.5 × 20) and the value obtained entered in the 20 m column.

C.1.4 Equations used

An algorithm based on the Churchill's friction factor equation was used in conjunction with the fundamental isothermal flow calculation for compressible fluids. This calculation involves an iteration procedure that continues until the calculated flow and friction factor are consistent at which point the flow is taken to be correct. The properties of the *gas* are assumed as HHV 96 MJ/m^3, SG 1.5 and viscosity 8 µPa.s.

C.1.5 Excessive gas velocities

Values shown in Figures C.6.6(A), C.6.7(A) and C.6.7(B) shaded in grey are not recommended and should not be used unless verified by a *competent person*. These would fall above the grey dotted lines "velocity threshold" on the pipe sizing graphs. High *gas* velocity through *piping* may cause noise and, over time, accelerated erosion of the pipe or fittings. Any use of values over the velocity threshold constitutes a performance based solution and is subject to the requirements of Section 2.

C.2 New piping systems

When sizing a new *piping* system, consideration should be given to foreseeable future needs.

C.3 Existing piping systems

Where an additional *appliance* is to be connected to an existing *piping* system, the existing *piping* and regulator should be checked to ensure that capacity is available for the additional load.

C.4 Information required

When determining the size of *piping* to be used in an installation using the graphs or tables in this Appendix, the following information should first be obtained:

(a) The *gas consumption* of each *appliance* (MJ/h) and the required input *pressure*.

(b) The diversity, if any, arising from use of different 〖A2〗*appliances*〖A2〗 at different times.

(c) The proposed layout of the *piping* system including all pipe lengths and the location of each *appliance*.

(d) The *pressure* available at the start of the *piping*.

(e) The allowable *pressure* drop. The *pressure* drop should ensure that at least the minimum inlet *pressure* required by the *appliance* is available at the *appliance*.

NOTE The tables and graphs in this Appendix include an allowance for the number of fittings that could be expected to be used in good practice.

C.5 Design procedure using pipe sizing graphs

C.5.1 Introduction

This Clause C.5 sets out a worked example to explain a graphical method of pipe sizing for a typical *piping* system using *LP Gas* with a *pressure* of 3 kPa at the start of the *piping*. Design graphs for *LP Gas* (propane) in copper pipe to AS 1432 or NZS 3501 are given in Figure C.5.7(A) or C.5.7(B), respectively. Multiply any input ratings in kilowatts (kW) by 3.6 to convert to megajoules per hour (MJ/h) if necessary.

C.5.2 Sketch the piping layout

Sketch the intended *piping* layout (see Figure C.5.2), include the *appliance* positions and allocate a letter to each 〖A2〗*appliance*〖A2〗 position and each pipe junction.

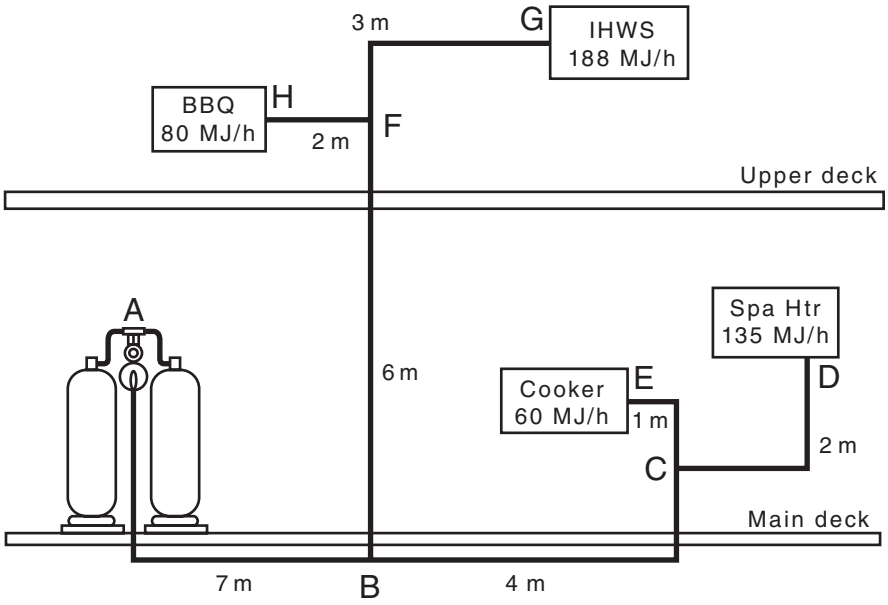


Figure C.5.2 — Example of piping layout

C.5.3 Tabulate the pipe runs

Draw up a table with a row for each pipe run, as shown in Table C.5.3.

Table C.5.3 — Installation details

Pipe section	Length m	Gas flow MJ/h	Pipe size (see Note) mm
A–B	7	60 + 135 + 80 + 188 = 463	
B–C	4	60 + 135 = 195	
C–D	2	135	
C–E	1	60	
B–F	6	80 + 188 = 268	
F–G	3	188	
F–H	2	80	

NOTE Pipe size is to be determined according to Clause C.5.6.

C.5.4 Determine the length of the longest pipe run

The longest run of *piping* from the meter to the furthest [A2] *appliance* [A2] position is pipe section A–G. The length of this section is 16 m (AB + BF + FG).

C.5.5 Determine the allowable pressure drop per metre

The design *pressure* drop is 0.25 kPa. Divide this by the length of the longest pipe run, 16 m, to give the allowable *pressure* drop of 0.0156 kPa/m.

C.5.6 Determine the required pipe size from the pipe sizing graphs

Select the pipe sizing graph appropriate for the type of *gas* available and the chosen *piping* material. For example, if copper pipe to NZS 3501 is being used, the applicable graph is Figure C.5.7(B) and is applied as shown in Figure C.5.6. Mark the *pressure* drop value of 0.0156 kPa/m on the graph. Find the value of

gas flow for each pipe section on the graph and read off the size of the pipe required and enter this in the installation table (Table C.5.3).

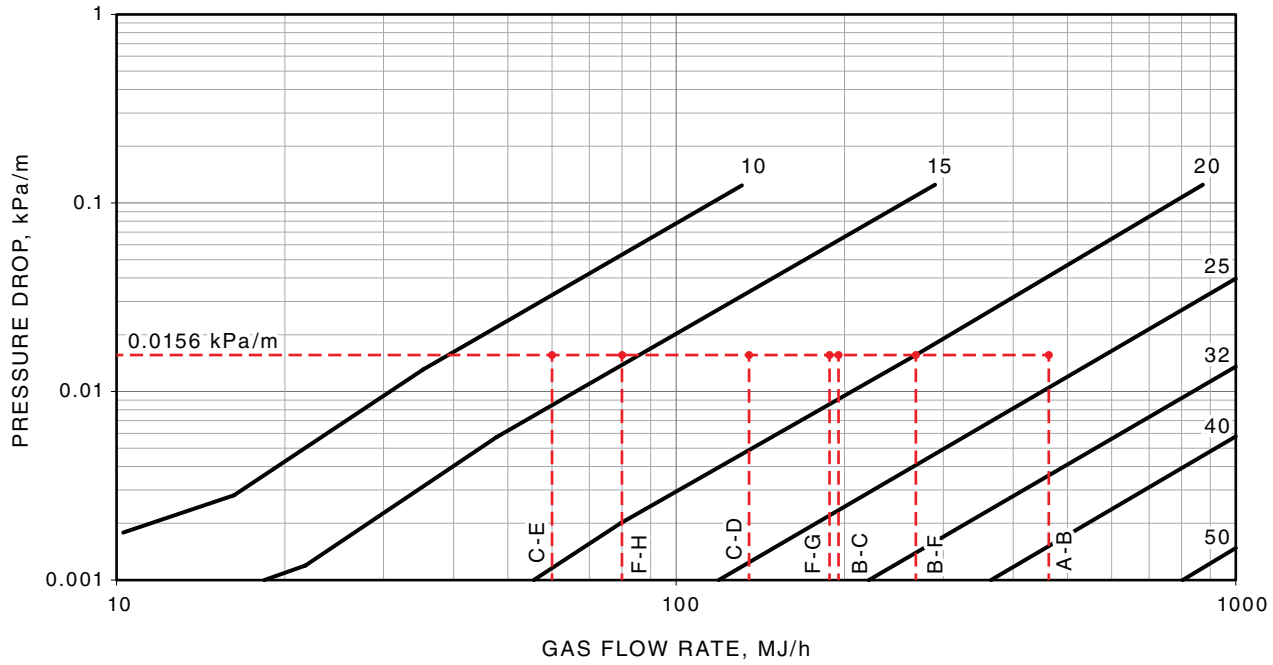


Figure C.5.6 — Example of pipe sizing for LP Gas in copper pipe to NZS 3501

Section A–B has a total flow rate of 463 MJ/h. Find 463 on the *gas* flow axis and draw a line up to the line at 0.0156 kPa/m for *pressure* drop. These lines intersect between the curves for 20 mm and 25 mm pipe sizes. The required pipe size is 25 mm, the larger size.

Repeat this procedure for each of the other pipe sections, entering the pipe size values in the table as shown in Table C.5.6.

Table C.5.6 — Installation details

Pipe section	Length m	Gas flow MJ/h	Pipe size mm
A–B	7	60 + 135 + 80 + 188 = 463	25
B–C	4	60 + 135 = 195	20
C–D	2	135	20
C–E	1	60	15
B–F	6	80 + 188 = 268	25
F–G	3	188	20
F–H	2	80	15

C.5.7 Pipe sizing graphs

Pipe sizing graphs for *LP Gas* (propane) in copper pipe to AS 1432 or NZS 3501 are given in Figure C.5.7(A) or C.5.7(B), respectively.

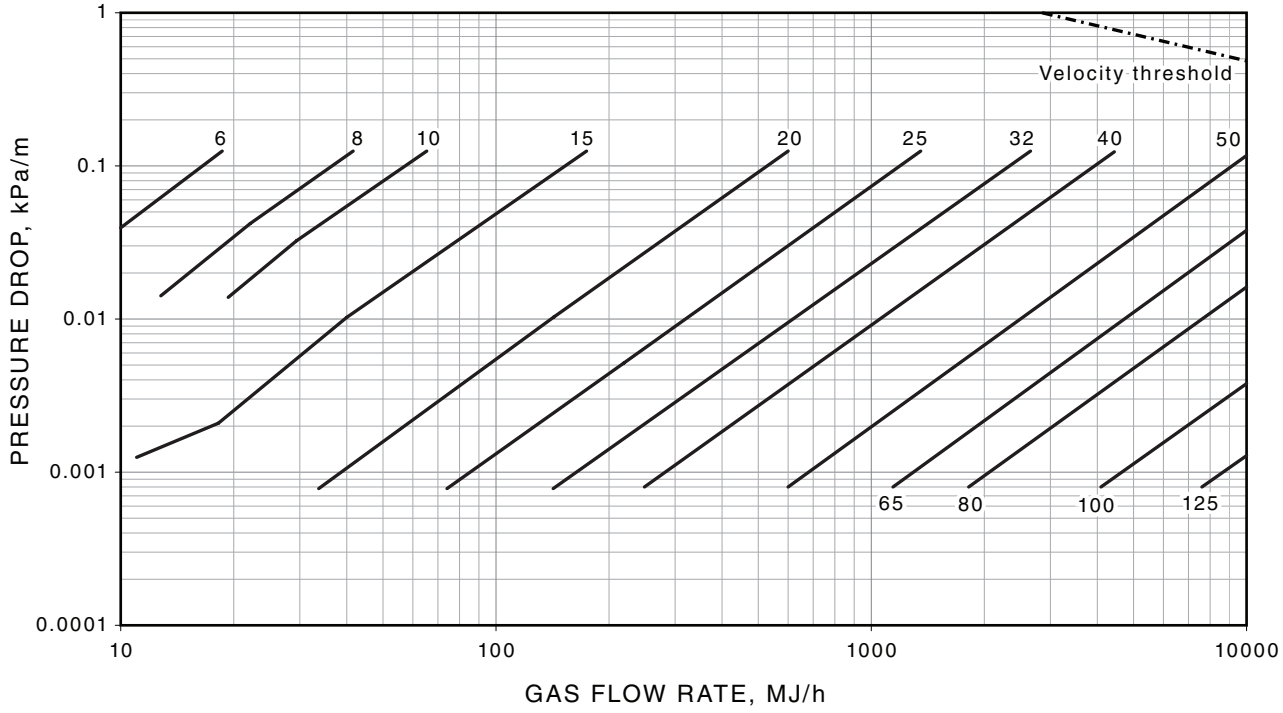


Figure C.5.7(A) — Pipe sizing for LP Gas through copper pipe (AS 1432)

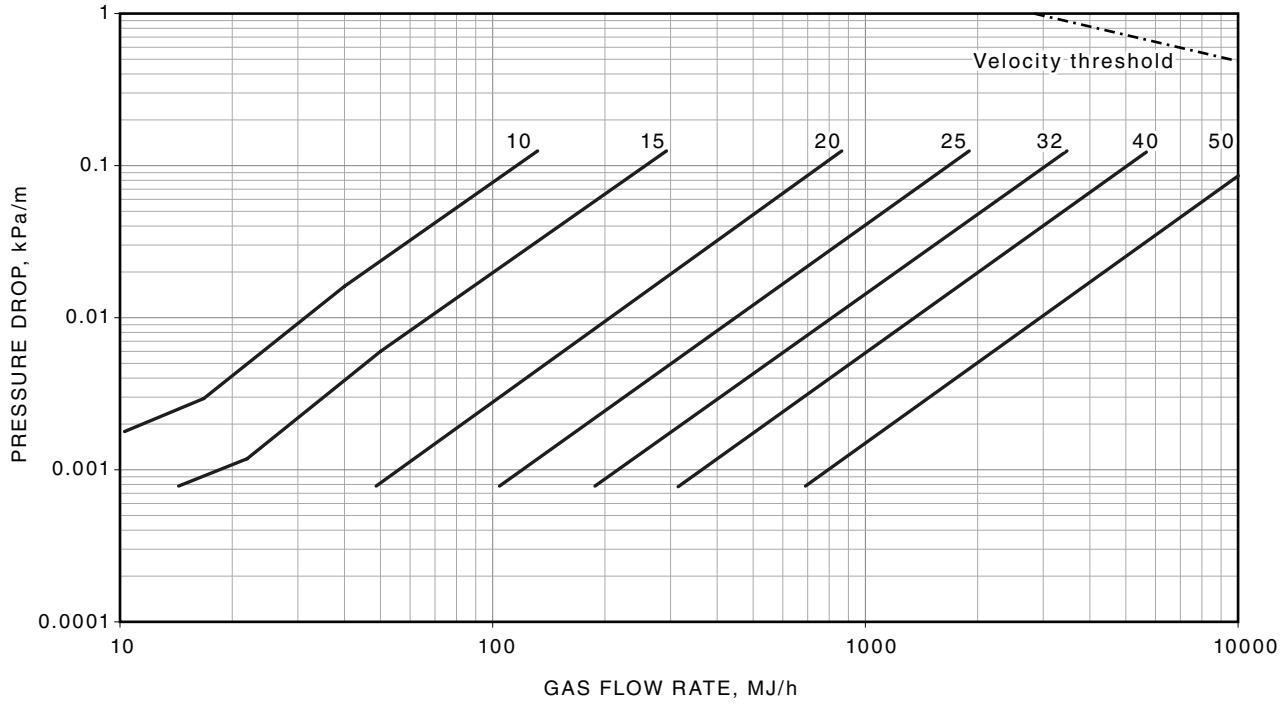


Figure C.5.7(B) — Pipe sizing for LP Gas through copper pipe (NZS 3501)

C.6 Design procedure using pipe sizing tables

C.6.1 General

This Clause C.6 sets out a worked example to explain a method of pipe sizing using *pressure* drop tables for a typical *piping* system that using *LP Gas* with a *pressure* of 3 kPa at the start of the *piping*.

C.6.2 Sketch the piping layout

Sketch the intended *piping* layout (see Figure C.5.2), include the *appliance* positions and add the following:

(a) All pipe lengths (in metres) and the *gas consumption* of each *appliance* (in MJ/h).

(b) Allocate a letter to each branch, commencing at the regulator with the letter "A".

(c) Allocate a letter to each *appliance* position.

C.6.3 Determine the main run

The *main run* is the length of *piping* from the *cylinder regulator* to the furthest *appliance* position. The *main run* length is a critical measurement that will be used throughout the pipe sizing calculations.

The *main run* in Figure C.5.2 is from the *cylinders* to the instantaneous *water heater*, length A to G, which is 16 m.

The distance covered by the *main run* of the installation is then used to size all branch pipework for their respective loads as if they were all as long as the *main run*.

C.6.4 Select the piping material

Select the material that will be used in constructing the *piping* system.

AS 1432 [A2] Type B [A2] copper *piping* is used for the example.

C.6.5 Tabulate the pipe runs

Draw up a table with a row for each pipe run, as in Table C.6.5, as follows:

(a) Indicate, in the column marked "Pipe section", each section of *piping* including each branch.

(b) Indicate, in the column marked "Gas flow", the amount of *gas* (MJ/h) flowing through each section.

(c) The column indicating *nominal size* will be completed in Clause C.6.6 and Table C.6.6(A).

Table C.6.5 — Installation details

Pipe section	Main run m	Gas flow MJ/h	Nominal size DN
A–B	16 (see Clause C.6.3)	60 + 135 + 80 + 188 = 463	
B–F		80 + 188 = 268	
B–C		60 + 135 = 195	
C–D		135	
C–E		60	
F–G		188	
F–H		80	

C.6.6 Selecting the pipe size

The table in Figure C.6.6(A), is provided as an example of how to select the pipe size by the following method:

(a) Determine *main run* length (see Clause C.6.3).

(b) If the *main run* falls between two figures, use the greater.

(c) Section A–B has a total flow rate of 463 MJ/h. Follow the 16 m column down until the value of 463 or the next larger value is reached, in this case, 814.

(d) Read across to the column ("Nom. dia. DN") to obtain the pipe size, 32 mm in this example.

(e) Insert the pipe size in the prepared table [see Table C.6.6(A)].

(f) Determine the pipe size of the remaining sections, continuing to use the *main run* length (16 m in the example), not the individual length of each section.

Table C.6.6 — (A) — Installation details

Pipe section	Main run m	Gas flow MJ/h	Nominal size DN
A–B	16	60 + 135 + 80 + 188 = 463	32
B–F		80 + 188 = 268	25
B–C		60 + 135 = 195	25
C–D		135	20
C–E		60	20
F–G		188	25
F–H		80	20

A1

Nom diam (DN)	Length of Straight Pipe								
	2	4	6	8	10	12	14	**16**	18
6	18	13	11						
8	42	28	22	19	17	16	14	13	13
10	66	44	34	29	26	24	22	20	19
15	175	117	93	78	69	62	56	52	48
20	602	406	322	273	240	216	197	183	171
25	1352	914	726	617	543	489	448	415	388
32	2632	1784	1420	1207	1064	959	878	814	761
40	4474	3039	2421	2060	1816	1639	1502	1392	1303
50	10435	7109	5673	4832	4265	3851	3532	3277	3067
65		13298	10625	9056	7999	7226	6630	6154	5761
80				14510	12822	11587	10636	9874	9247
	20	25	30	35	40	45	50	55	60
15	46	40	37	34	32	30	28	27	26
20	160	141	127	116	107	100	94	89	84
25	365	321	289	264	244	228	215	203	193
32	717	631	568	520	482	450	424	401	381
40	1227	1081	974	892	827	773	727	689	655
50	2890	2548	2299	2107	1954	1828	1722	1631	1552
65	5431	4793	4326	3967	3680	3444	3245	3075	2928
80	8719	7698	6952	6377	5917	5539	5221	4948	4712
100	19541	17266	15602	14320	13294	12449	11739	11130	10602
125									
150									

Use of values printed in shaded areas is not recommended and require professional advice

Figure C.6.6 — (A) — Example: Propane — Flow through — Copper pipe (AS 1432 Type B) (MJ/h) (Pressure drop of 0.25 kPa; for supply pressures around 3 kPa) A1

C.6.7 Pipe sizing tables

A pipe sizing table for *LP Gas* (propane) in copper pipe to AS 1432 is given in Figure C.6.7(A).

A pipe sizing table for *LP Gas* (propane) in copper pipe to NZS 3501 is given in Figure C.6.7(B).

Nom diam	Length of Straight Pipe								
(DN)	2	4	6	8	10	12	14	**16**	18
6	18	13	11						
8	42	28	22	19	17	16	14	13	13
10	66	44	34	29	26	24	22	20	19
15	175	117	93	78	69	62	56	52	48
20	602	406	322	273	240	216	197	183	171
25	1352	914	726	617	543	489	448	415	388
32	2632	1784	1420	1207	1064	959	878	814	761
40	4474	3039	2421	2060	1816	1639	1502	1392	1303
50	10435	7109	5673	4832	4265	3851	3532	3277	3067
65		13298	10625	9056	7999	7226	6630	6154	5761
80				14510	12822	11587	10636	9874	9247
	20	25	30	35	40	45	50	55	60
15	46	40	37	34	32	30	28	27	26
20	160	141	127	116	107	100	94	89	84
25	365	321	289	264	244	228	215	203	193
32	717	631	568	520	482	450	424	401	381
40	1227	1081	974	892	827	773	727	689	655
50	2890	2548	2299	2107	1954	1828	1722	1631	1552
65	5431	4793	4326	3967	3680	3444	3245	3075	2928
80	8719	7698	6952	6377	5917	5539	5221	4948	4712
100	19541	17266	15602	14320	13294	12449	11739	11130	10602
125									
150									

Use of values printed in shaded areas is not recommended and require professional advice

Figure C.6.7(A) — Propane — Flow through — Copper pipe (AS 1432 Type B) (MJ/h) (Pressure drop of 0.25 kPa; for supply pressures within the range 2.75 to 3 kPa)

A1

Nom	Length of straight pipe in metres								
(DN)	2	4	6	8	10	12	14	16	18
10	132	88	70	59	52	46	42	39	37
15	290	195	154	130	115	103	94	87	81
20	875	590	469	398	350	315	288	267	249
25	1902	1288	1024	870	766	691	633	586	548
32	3467	2353	1874	1593	1405	1267	1161	1076	1006
40	5649	3841	3061	2605	2298	2073	1901	1763	1649
50	12169	8296	6622	5641	4980	4497	4125	3827	3582
	20	25	30	35	40	45	50	55	60
10	35	31	28	26	24	23	22	21	20
15	76	67	60	55	51	48	45	43	41
20	234	206	185	169	157	146	137	130	124
25	516	454	409	374	346	323	304	288	274
32	948	835	752	689	638	596	561	531	505
40	1553	1369	1234	1130	1048	980	922	873	831
50	3376	2978	2687	2463	2284	2136	2013	1907	1815

Use of values printed in shaded areas is not recommended and require professional advice

Figure C.6.7(B) — Propane — Flow through — Copper pipe (NZS 3501) (MJ/h) (Pressure drop of 0.25 kPa; for supply pressures around 3 kPa) A1

Appendix D
(normative)

Combustible gas detection systems for boats

D.1 General

This Appendix specifies the minimum requirements for a combustible *gas* detection system that is to be installed in a *boat* where Clause 7.6 applies.

NOTE Some local marine regulations require petrol-fuelled *boats* to have a bilge blower.

D.2 Gas detection system

The *gas* detection system shall conform to all of the following:

(a) Be designed for the environment in which it is to be installed (marine).

(b) Be waterproof, resistant to corrosion and the entry of dust.

(c) Be capable of continuous operation from a low voltage source (i.e. wired direct to a battery) and indicate the operational status within 30 s of power being supplied.

(d) Be selected and installed to meet the requirements of AS/NZS 60079.14 and be installed in accordance with the manufacturer's instructions.

(e) Have at least two outlets for connection of external equipment (e.g. *gas* solenoid valve, audible alarm, bilge blower, etc.).

(f) Activate the alarm function and cause a solenoid valve to close off the *gas* supply whenever the concentration of *LP Gas* in air exceeds a value of not more than 25 % of the *lower explosive limit*.

NOTE Activation levels below 25 % of the LEL are recommended.

(g) Have a latching system that continues to indicate an alarm condition until cancelled.

(h) Be self-checking and indicate both normal and fault conditions.

(i) Have fully serviceable units and be supplied with full installation and operating instructions.

(j) All switches shall indicate their operational position. This indication shall be permanently marked.

NOTE 1 The use of adhesive labelling will not satisfy this requirement.

(k) Markings on the fascia of the unit, including the manufacturer's name and address, shall be permanent.

NOTE 2 The use of adhesive labelling will not satisfy this requirement.

(l) *Gas detectors* shall be selected and installed in accordance with AS/NZS 60079.29.2 .

D.3 Installation of the system

D.3.1 Solenoid valve

The solenoid valve shall be *encapsulated* or be selected and installed in accordance with AS/NZS 60079.14 and be located between the *cylinder* and the first *gas pressure regulator*.

The solenoid valve shall be compatible with the *pressure* rating.

D.3.2 Position of audible alarm

The alarm of the *gas* detection system shall be positioned to ensure that it is audible from all locations on the *boat* when the *boat* is under normal operating conditions.

D.3.3 Sensors

A minimum of two sensors shall be fitted. One sensor shall be fitted in the bilge or at the lowest level where *gas* would be likely to accumulate and one in the vicinity of the *appliance*, but below the level of the lowest flame.

Each sensor shall have the following:

(a) A visual indication of the condition of the sensor — “safe” or “malfunction”.

(b) A visual indication of an alarm condition. This shall be separate from Item (a).

D.3.4 Operation of the system when gas is detected

When *gas* is detected at or above the minimum set level, all of the following shall occur:

(a) The *gas* supply shall be automatically shut off by the solenoid valve and shall not be re-opened until the alarm has been manually cancelled and the system reset.

(b) The audible alarm shall sound.

(c) The visual alarm shall be activated.

Appendix E
(normative)

Testing gas installations

E.1 General

E.1.1 New installations

The following tests shall be carried out on all new installations:

(a) A pipework test, in accordance with Clause E.2, on the newly installed pipework.

(b) An installation test, in accordance with Clause E.3, including all [A2] *appliances* [A2].

E.1.2 Additions, repair and alterations to installations

The following tests shall be carried out on all additions, repairs and alterations to existing installations:

(a) A pipework test, in accordance with Clause E.2, on the newly installed, repaired or altered pipework before being connected to the existing pipework.

(b) An installation test, in accordance with Clause E.3, including all newly installed or repositioned [A2] *appliances* [A2] and pipework.

E.2 Pipework test

E.2.1 Method

The procedure shall be as follows:

(a) Ensure the installation is disconnected from the regulator.

(b) Ensure all [A2] *appliances* [A2] are disconnected or turned off at the *appliance* isolation valve(s).

(c) Ensure all open ends are plugged or capped.

(d) Connect the test instrument (e.g. manometer).

(e) Pressurize the *piping* to 14 kPa.

(f) Isolate the *pressure* source and allow a period (e.g. 2 min) for the temperature of the testing medium within the *piping* to stabilize.

(g) Measure any loss of *pressure* during a test period of 5 min.

E.2.2 Test result

The pipework shall be considered sound if there is no detectable loss of *pressure* during the test period.

E.3 Installation gas tightness test

E.3.1 General

The installation shall be tested using either method in Clause E.3.2 or E.3.3.

E.3.2 Method 1 — Pressure loss

E.3.2.1 Method

The installation test shall be carried out as follows:

(a) Ensure all open ends are plugged or capped.

〖A2〗(b) Ensure all *appliance* isolation valve(s) are open, and *appliance* control valve(s) turned off. Any *appliance* with an interlock shall be in the open position.〖A2〗

(c) Connect the test instrument (e.g. manometer).

(d) Open the *LP Gas cylinder* valve or apply *pressure* using regulated compressed air or inert gas to *operating pressure*.

(e) Isolate the *pressure* source and allow a period (e.g. 2 min) for the temperature of the testing medium within the installation to stabilize.

(f) Measure any loss of *pressure* during a test period of 5 min.

E.3.2.2 Test result

The installation shall be considered *gastight* and the test satisfactory if there is no detectable loss of *pressure* during the test period of 5 min. If a *pressure* loss is detected then any leakage shall be located and rectified, and the installation shall be retested.

E.3.3 Method 2 — Using bubble leakage detector

E.3.3.1 Method

The installation test shall be carried out as follows:

(a) Connect the bubble test set to the installation.

(b) Ensure all open ends are plugged or capped.

(c) Ensure all 〖A2〗*appliance*〖A2〗 isolation valve(s) are open, and *appliance* control valve(s) turned off.

(d) Open the *LP Gas cylinder* valve or apply *pressure* using regulated compressed air or inert *gas*.

(e) Allow the system to pressurize for 5 s then depress the “diversion valve” so that the *gas* stream passes through the liquid bowl.

(f) While depressing the “diversion valve” observe the liquid bowl for evidence of bubbles through the liquid.

E.3.3.2 Test result

The installation shall be considered *gastight* if there are no bubbles through the liquid for a period of 10 s. If bubbles are detected then any leakage shall be located and rectified, and the installation shall be retested.

E.4 Methods of locating gas leaks

A non-corrosive soap and water solution or leakage detection fluid applied externally or other *gas* detecting equipment or means shall be the only methods used to locate a *gas* leak. Matches, candles or any other *ignition source* shall not be used.

Testing of the connections between cylinders and the first-stage regulator shall be made at *LP Gas cylinder pressure*, using a non-corrosive soap and water, detergent solution or leakage detection fluid to detect leaks at all joints.

CAUTION — THE AMMONIA PRESENT IN SOME SOAPS AND DETERGENTS CAN REACT WITH BRASS FITTINGS AND CAUSE SUCH FITTINGS TO CRACK AFTER A SHORT PERIOD OF TIME. THEREFORE, CAUTION SHOULD BE EXERCISED WHEN USING SOAP SOLUTIONS ON BRASS FITTINGS AND ALL CONNECTIONS SHOULD BE RINSED THOROUGHLY WITH FRESH WATER AS SOON AS POSSIBLE AFTER THE APPLICATION OF THE SOAP SOLUTION.

Appendix F
(normative)

Consumer instructions

The following information, together with the *appliance manufacturer's instructions*, shall be provided to the customer.

Consumer instructions for *gas installations* shall include the following:

NOTE 1 These are applicable to both *caravans* and *boats* except where indicated otherwise.

(a) Close *appliance* valves before opening *cylinder* valve.

(b) Where *readily accessible*, check connections at the *appliances*, regulators, hoses and *cylinders* periodically for leaks with soapy water, or its equivalent.

NOTE 2 This should be done every time a *cylinder* is changed over or at least annually.

CAUTION — THE AMMONIA PRESENT IN SOME SOAPS AND DETERGENTS CAN REACT WITH BRASS FITTINGS AND CAUSE SUCH FITTINGS TO CRACK AFTER A SHORT PERIOD OF TIME. THEREFORE, CAUTION SHOULD BE EXERCISED WHEN USING SOAP SOLUTIONS ON BRASS FITTINGS AND ALL CONNECTIONS SHOULD BE RINSED THOROUGHLY WITH FRESH WATER AS SOON AS POSSIBLE AFTER THE APPLICATION OF THE SOAP SOLUTION.

(c) Never use a match or flame when checking leaks.

(d) Close *cylinder* valve when *appliances* are not in use or while refuelling is in progress.

(e) No *appliance* with a continuously burning flame shall be left operating in any fuel driven *boat* when left unattended for a period of, or in excess of, 12 h.

(f) Never use cooking *appliances* for comfort heating.

(g) When the *boat* is fitted with a *gas detector*, the *gas detector* shall be checked for the presence of flammable vapours and the *boat* shall be cleared of flammable vapour before lighting any *LP Gas appliance* or starting the motor.

(h) In the event of fire, immediately close *cylinder* valve if safe to do so.

(i) Ensure valve is closed to prevent the unintended release of gas from a cylinder.

NOTE 3 The cylinder valve should be protected from the entry of dirt or debris.

(j) All additions or alterations to the *LP Gas* system must be performed by an *authorized person*.

NOTE 4*: Appliances* should not be altered without the authorization of the manufacturer.

(k) Check all permanent ventilators, *flues* and vents regularly to ensure they are clear, open and unrestricted.

(l) In the event of an accidental *gas* leak, close *cylinder* valve and ventilate the area using a safe method until the air is clear.

(m) Test and maintain *gas* or carbon monoxide detection systems to the *manufacturer's instructions*.

(n) Orient *cylinders* installed on a *caravan* drawbar so that the *cylinder* relief valves of both *cylinders* discharge away from both the caravan and the towing vehicle, as shown in Figure F.1.

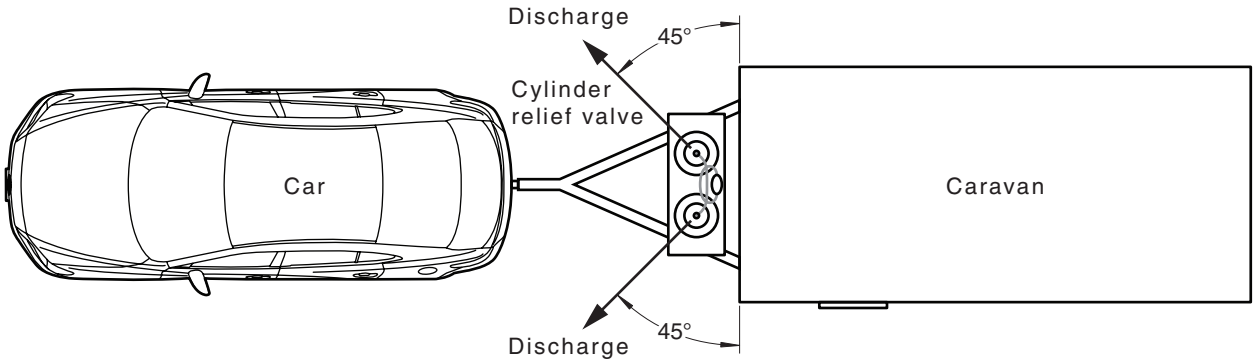


Figure F.1 — Direction of cylinder relief valve discharge

For flexible hoses, the consumer instructions shall include their —

(i) location;

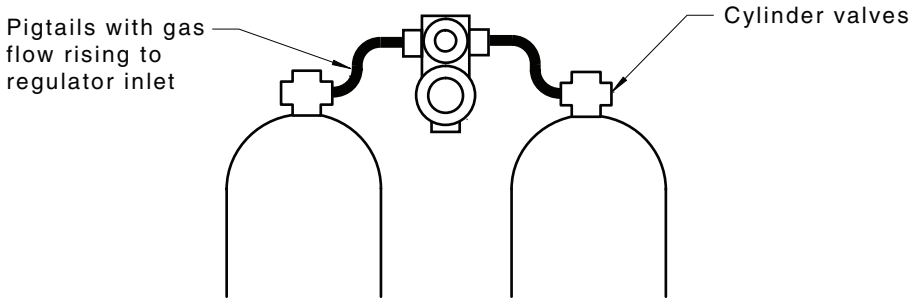
(ii) *accessibility*; and

(iii) need for regular inspection by a *competent person*.

Appendix G
(informative)

Method of locating gas pressure regulators

Figure G.1 illustrates a recommended method of locating a *cylinder regulator*.



NOTE 1 Only copper *pigtails* or flexible hoses with low extractable content should be used.

NOTE 2 The regulator should be located to permit drainage of any liquid back into the *cylinder*.

Figure G.1 — Location of cylinder regulator

Appendix H
(informative)

Guidelines for gas appliance commissioning

H.1 General

The following procedures should be used for the *commissioning* of domestic and small commercial [A2] *appliances* [A2] in the absence of the relevant *manufacturer's instructions*:

[A2] (a) Remove or loosen test screw, connect a manometer and light the *appliance*. (Electronic *appliances* require a digital manometer, as water gauge manometers are not accurate or sensitive enough). [A2]

(b) If a pilot light is used, check that pilot impinges on flame failure device. (Thermocouples should not glow red, as this indicates the pilot flame is set too high and will reduce the life of the thermocouple).

(c) Check *gas pressure*, against rating plate. (Remember that some [A2] *appliances* [A2] have both a cold and hot *pressure*.)

(d) Adjust *gas pressure* to specifications. (Remember some [A2] *appliances* [A2] have both a low and high-*pressure* setting.)

(e) Lock off the [A2] *appliance* [A2] regulator.

(f) Remove the manometer and replace the test screw, test for leaks.

(g) Turn [A2] *appliance* [A2] off and on, and up and down (if modulating type) several times, to ensure correct operation and smooth ignition.

(h) Observe operation of safety and operating devices (e.g. fan proving, ODS and tilt switch if mobile or portable type).

(i) Test that spillage of *combustion products* is not occurring.

(j) Replace panels or covers.

(k) Instruct householder in correct operation and regular maintenance requirements.

The same procedures should be followed to re-commission the appliance after maintenance or repair.

H.2 Stoves, cookers and hot plates

In addition to the procedures in Clause H.1, for stoves, cookers and hot plates —

(a) check ventilation to the [A2] *appliance* [A2] (especially if inbuilt);

(b) check distances from the *burners* to *combustible surfaces* conform to Figure 6.11.1;

(c) check that the [A2] *appliance* [A2] is level;

(d) check the restraining device (chain for example) on freestanding cookers;

(e) check the flexible hose for wear and damage, and ensure it is not kinked; and

(f) check operation of the oven thermostat and adjust low flame by-pass if necessary.

H.3 Instantaneous water heaters

In addition to the procedures in Clause H.1, for instantaneous *water heaters* —

(a) determine incoming water temperature;

(b) check and, if necessary, adjust maximum water flow rate. Use a flow meter, or a measured receptacle and a stopwatch;

(c) light the A2 *appliance* A2 and check the outlet temperature against rating plate;

(d) subtract inlet temperature from outlet temperature, to calculate temperature rise;

(e) if all is correct, the *water heater* will have raised the temperature of the water by the specified amount, at the flow rate indicated. If not, re-check *gas pressure*, and then injector sizes; and

(f) if still not correct, check with the manufacturer.

NOTE Electronically operated and controlled instantaneous *water heater*s have the same information on their rating plate, but the *commissioning* and checking procedures differ, and the relevant *manufacturer's instructions* should be followed.

H.4 Storage water heaters

In addition to the procedures in Clause H.1, for storage *water heater*s —

(a) check operation of the water valves;

(b) check that the temperature-*pressure* relief valve or *pressure* relief valve is not dripping continuously, or the open vent is not overflowing; and

(c) check operation of the thermostat.

Appendix I
(informative)

Symbols used in gas control system diagrams

1		Manual gas valve	
2		Filter	
3		Pressure point	
4		Pressure regulator	
5		Pressure regulator with over-pressure protection	
6		Over-pressure protection slam shut valve	
7		Slow-opening fast-closing value	Automatic safety shut-off valves
8		Slow-opening fast-closing two stage valve	
9		Fast-opening fast-closing valve	
10		Fast-opening fast-closing two stage valve	
11		Manual reset valve	
12		Vent valve	
13		Closed position indicator (CPI) switch on valve	
14		Proof of closure switch on valve (e.g. mechanical over-travel)	
15		Low gas pressure detector	
16		High gas pressure detector	
17		Flow rate control valve	
18		Flow limiting valve	

19		Burner
20		3-way valve
21		Non-return valve

Appendix J
(informative)

Gas installation checklist

This checklist, as shown below, is provided as guidance for installers to check conformance of a *gas installation* with the AS/NZS 5601 series.

The checklist is not exhaustive, and both Parts 1 and 2 of the AS/NZS 5601 series should be consulted when assessing any *gas installation* to ensure that the essential safety requirements are met.

Gas installation checklist

Consumer		**Date**	
Address		**Certificate No.**	
		Job No.	

Item	C	NA	Notes
General requirements			
Gas supply verified			
Installation tested and gastight			
Gas pipework			
General requirements			
Design			
Location			
Supports and anchoring			
Corrosion protection			
Gas pipework			
Materials and components			
Isolating valves			
Pressure regulation			
Overpressure protection			
Vent lines			
Test points			
Expansion and contraction			
Pipe protection			
Flexible connections			
Earthing			
Pipeline identification			
Disconnection			
Soundness testing			
Sizing			
Appliance installation			
Appliance(s) declaration			
Mounting and restraint			
Location			
Clearances			
Disconnection			
Combustible surfaces			
Temperature safety			
Flues			
Design			
Manufacturer's specifications followed			
Installation and location			
Materials			

Item	C	NA	Notes
Structure and supports			
Clearances			
Temperature safety			
Draught diverter			
Terminal and clearances			
Ventilation			
Appliances input			
Requirements			
Sizing of openings			
Location of openings			
Air not contaminated			
Mechanical ventilation			
LP Gas installations			
Location			
Clearances			
Weather protection			
Ventilation			
Drainage			
LP Gas installations			
Restraint chains			
Hoses and fittings			
Labelling and signage			
Commissioning			
Purging			
Controls tested and set			
Safety devices tested and set			
Gas rating			
Combustion testing			
Consumer instruction			
Certification			
Certificate issued			

C = Compliant

NA = Not Applicable

Name	Signature	Registration No.

Appendix K
(informative)

Diagrammatic representations of outdoor areas

Figures K.1 to K.5 are diagrammatical representations of *outdoor* areas as described in the definition. The areas used in these figures are examples — the same principles apply to any other shaped area.

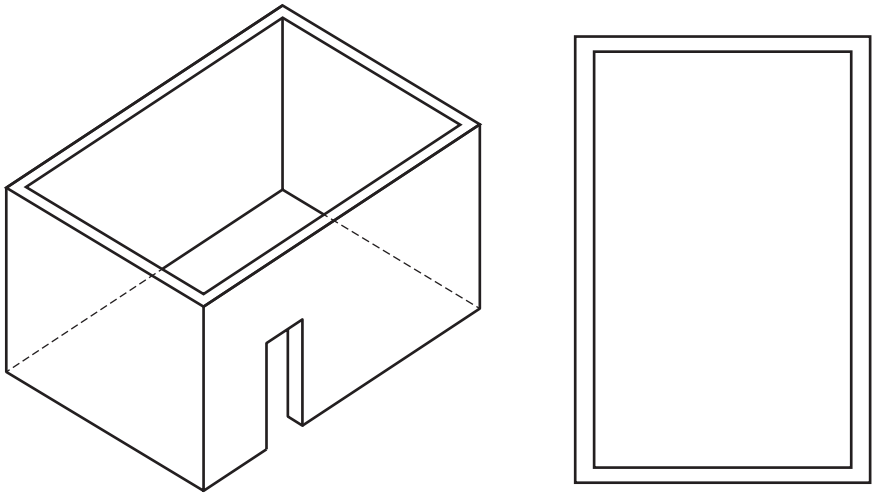


Figure K.1 — Example of an enclosure with walls on all sides, but at least one permanent opening at ground level and no overhead cover

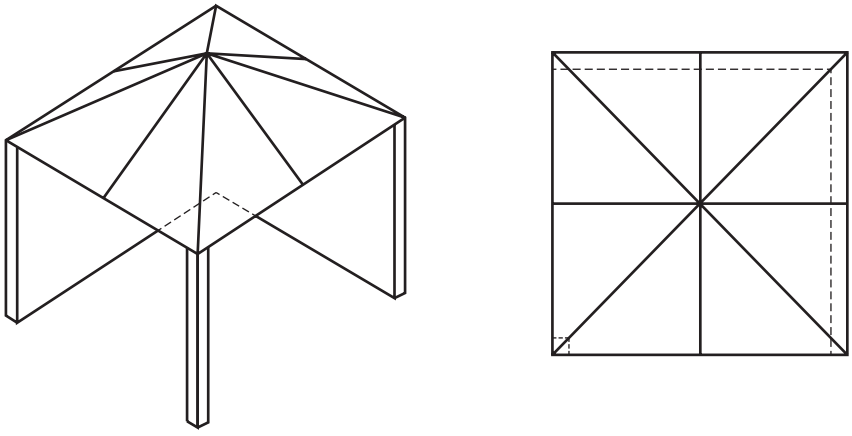


Figure K.2 — Outdoor area — Example 2

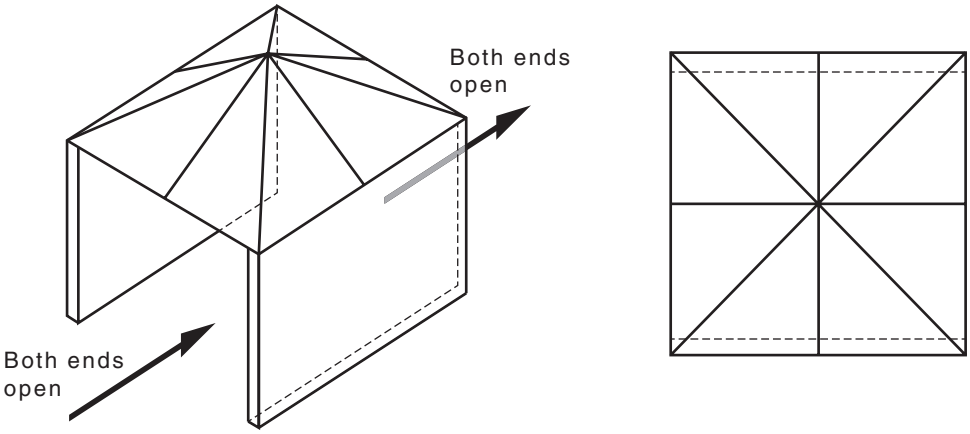


Figure K.3 — Outdoor area — Example 3

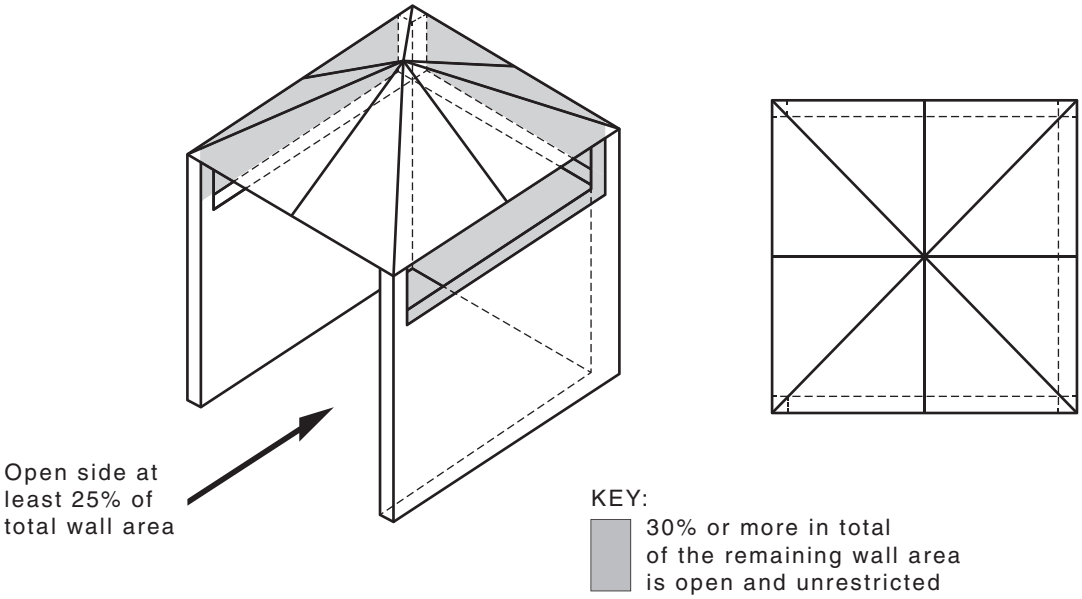


Figure K.4 — Outdoor area — Example 4

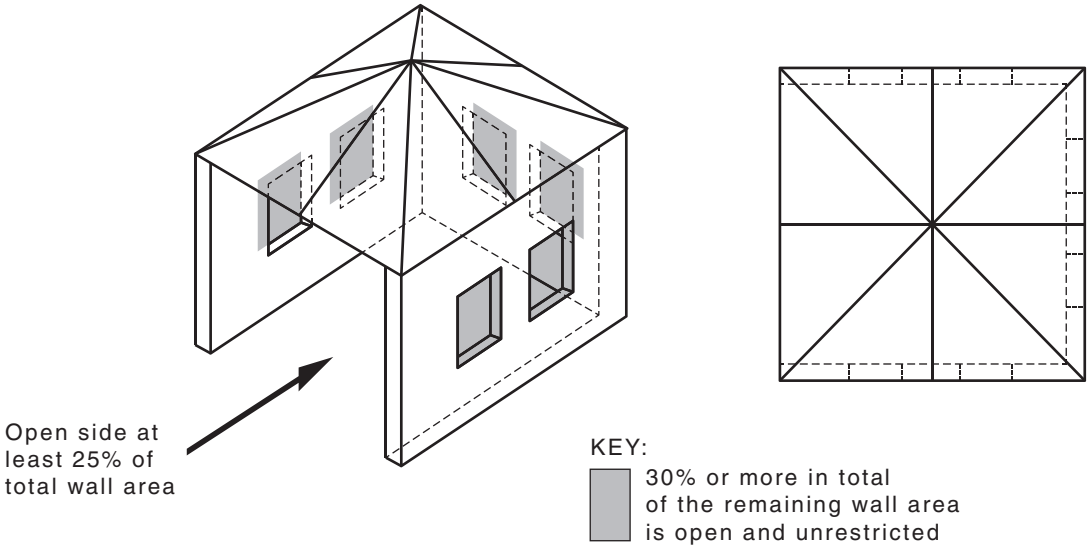


Figure K.5 — Outdoor area — Example 5

Appendix L
(informative)

Purging

L.1 Introduction

Purging is carried out to avoid the possibility of an explosive air/*gas* mixture existing or forming in *piping*, *appliances* or poorly ventilated spaces. *Purging* is the displacement of —

(a) air, or an inert *gas*, by a fuel *gas*; or

(b) a fuel *gas* by air, or an inert *gas*.

Nitrogen is the preferred inert *gas*.

L.2 Precautions before purging commences

The following precautions should be taken before *purging* commences:

(a) Do not commence any *purging* operation until a *purge* area has been defined, made safe and cleared of all *ignition sources*, e.g. naked flames, pilot lights, electrical switchgear, etc.

(b) Do not allow smoking or cell/mobile phones in or near the *purge* area.

(c) Be aware of adjacent *boats* and *caravans.*

L.3 Purging a small volume installation with gas to remove air

L.3.1 Pipe length in a small volume installation

A small volume *gas installation* is one with a total installed pipe volume of up to 0.03 m^3 (30 L). The values given in Table L.1 give volumes in litres per metre of pipe length. These volumes when multiplied by installed pipe length give the volume of the *gas installation*. All branches, as well as the *main run*, are to be taken into account in determining the volume of the installation.

L.3.2 Commencing the purge

When commencing the *purge* the procedure is as follows:

(a) Plan a method of *purging* that will ensure that no pockets of air will be left within any part of the *piping*.

(b) Ensure that all *appliance* connections are *gastight*, all *appliance gas* valves are turned off and there are no open ends.

(c) Where possible, select an *appliance* located outside (e.g. a *water heater*) or an *appliance* located at the end of the installation (with the longest *piping* from the point of supply meter). Where sufficient ventilation cannot be ensured, connect and use a flexible purge hose to direct the *purged gas* to outside well clear of openings and *ignition source*s. In other situations an *appliance* with an open *burner* or *burners* such as a cooking *appliance* can be used for *purging*.

(d) Ensure the area is well ventilated, unconfined and free of possible *ignition sources*, mechanical air inlets or other potential hazards.

(e) Branches which do not have an *appliance* connected also require *purging*. Ensure such branches are fitted with a plug or cap.

Special care should be taken to ensure that heavier than air *gases*, e.g. *LP Gas*, are fully dispersed before applying an *ignition source*. Do not *purge* into a combustion chamber or other enclosed space, such as below the *upper deck* of a *boat* (see Figure 3.1.8(C)).

Table L.1 — Approximate volume of pipe

Pipe material and Standard	Approximate volume of pipe, L/m								
Nominal size	6	8	10	15	20	25	32	40	50
Copper — NZS 3501	N/A	N/A	0.07	0.13	0.28	0.50	0.79	1.14	2.02
Copper — AS 1432 (Type B)	0.02	0.03	0.05	0.09	0.22	0.41	0.67	0.99	1.83
NOTE 1 All calculations use the mean internal diameter for the specified class of pipe.									
NOTE 2 N/A = not applicable; this *nominal size* does not exist in the relevant Standard.									
NOTE 3 In New Zealand, *nominal size* is in nominal bore. In Australia, *nominal size* is in DN.									

L.3.3 Purging through an appliance fitted with a flame safeguard device

L.3.3.1 General

Where *purging* is to be carried out through this type of *appliance*, ensure the main *burner gas* control is turned to the "OFF" position before proceeding as in Clause L.3.3.2 or L.3.3.3.

L.3.3.2 Electronic flame safeguard device fitted

Where an *appliance* is fitted with an electronic *flame safeguard system*, *purging* through the *appliance* is difficult. Manual ignition cannot be achieved.

Carry out the *purge* as follows:

(a) Isolate the electrical and gas supplies to the *appliance*.

(b) Fit a metallic bridging device across the *appliance* inlet union connection to ensure electrical continuity from the appliance to the gas pipe work.

(c) For installations that have sufficient ventilation, slacken the union to allow *gas* to flow out, but do not fully disconnect it. Where ventilation is not sufficient to connect a *purge* hose to the outlet of the *appliance manual shut-off valve*, direct the *purged* gas to outside.

(d) Slowly turn on the *appliance manual shut-off valve* to *purge* the installation.

(e) Monitor for the presence of gas through tonal change, odour or the use of a *gas detector.*

(f) As soon as the presence of *gas* is detected, reconnect or tighten the union and test the connections for gas leakage with a leak detection solution.

(g) Allow sufficient time for any *gas* to disperse and verify if the area is safe with a *gas detector.*

(h) Remove the electrical bridging device.

(i) Turn on the power supply and activate the *ignition source*.

(j) Ignition may not be successful immediately and *lockout* may occur a number of times before combustion is satisfactory.

(k) Allow sufficient time for any unburnt *gas* to disperse before re-setting the system.

If the *appliance* is located in an enclosed space or small room, particular care should be taken to ensure that all *gas* has dispersed before actuating any *ignition source*.

NOTE The use of a calibrated *gas detector* is highly recommended to verify when hydrocarbon gas is present. In the absence of a *gas detector* listen for tonal change. *LP Gas* is heavier than air and the gas hissing sound at the injector into the *burner* will become lower as *LP Gas* discharges from the injector. Odorant cannot always be relied upon as an indicator that gas is present due to environmental reasons, i.e. odorant stratification in *LP Gas cylinders* or tanks or fade as odorant may be absorbed by new *piping*, masking by other chemicals or an inability of the operator to smell. Check the area with the *gas detector* to verify that gas concentrations are at a safe level.

L.3.3.3 Thermoelectric device fitted

Where an *appliance* is fitted with this type of *flame safeguard system*, *purging* through an open *burner* is recommended. Do not *purge* into a combustion chamber, oven or enclosed space.

Carry out the *purge* as follows:

(a) Turn on one *burner* gas control and activate the thermoelectric control to permit gas flow from the *burner* until the presence of gas is detected. Monitor for odour, tonal change or the presence of gas with a *gas detector*.

(b) Let the gas flow for a few seconds longer, then turn off and allow sufficient time for any accumulated gas to disperse. Verify that the gas has dispersed with a *gas detector*.

(c) Turn on one *burner* gas control again and place a continuously burning flame at that *burner* while activating the thermoelectric valve until the gas is alight and the flame is stable.

(d) Continue to *purge* all *burners* until gas is available at each one.

L.3.3.4 Appliances with a flame safeguard system monitoring a pilot system

Purging through a pilot system can be quite time consuming.

To shorten the *purging* time —

(a) follow the Steps (b) to (g) of the procedure in Clause L.3.3.2;

(b) follow the normal *appliance* lighting sequence, applying a continuously burning flame to the pilot;

(c) continue to *purge* until the pilot flame remains alight and stable; and

(d) ensure the *appliance* main *burner* flame is stable and operates satisfactorily.

The use of a continuously burning flame may not be suitable with some *appliances*, for example, *balanced flue appliances*. Such *appliances* are normally fitted with an automatic *ignition source* which may have to be activated a number of times before successful ignition is achieved.

NOTE Some gas torches produce intense flames which may cause overheating and damage of the thermocouple.

Bibliography

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 3500.4, *Plumbing and drainage, Part 4: Heated water services*

AS/NZS 5601.1, *Gas installations, Part 1: General installations*

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BS 3212, *Specification for flexible rubber tubing, rubber hose and rubber hose assemblies for use in LPG vapour phase and LPG/air installations*

UL 21, *Standard for LP-Gas Hose*

Australian Maritime Safety Authority. *National Standard for Commercial Vessels (NSCV)*

New Zealand legislation, Gas (Safety and Measurement) Regulations 2010

New Zealand legislation, Hazardous Substances (Compressed Gases) Regulations 2004

New Zealand legislation, Health and Safety at Work (Hazardous Substances) Regulations 2017

New Zealand legislation, *Maritime Transport Act 1994*

Amendment control sheet

AS/NZS 5601.2:2020

Amendment No. 1 (2021)

Correction

Summary: This amendment applies to the following elements:

- Clauses 1.2, 7.5
- Figures C.6.6(A) and C.6.7(B)

Published on 26 February 2021.

Amendment No. 2 (2024)

Rvised text amendment

Summary: This amendment applies to the Preface, Clauses 1.1.2, 1.1.3.1, 1.1.3.4, 1.2, 1.3, 1.4, 2.2.1, 2.2.2, 2.2.3, 2.8.1, 2.8.4, 2.8.6, 2.9.1, 2.9.2, 2.9.3, 2.9.4, 2.9.5, 2.9.6, 2.13.3, 2.13.3.1, 2.13.3.2, 3.1.8, 4.2, 5.1.4.1, 5.1.4.2, 5.1.7, 5.2.7.3, 5.2.12.2, 5.2.12.3, 6, 6.1, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.6, 6.5, 6.6, 6.7, 6.11.1, 7.1, 7.2, 7.3.1, 7.3.2, 7.4.1, 7.4.3, 8.1, 8.4.1, 9.2, 9.3.2.2, 9.4, 9.7, 9.8, 9.9.1, 9.10.1, 10.3.1, C.4, C.5.2, C.5.4, C.6.4, E.1.1, E.1.2, E.2.1, E.3.2.1, E.3.3.1, H.1, H.2, H.3, L.3.3.4, Figures 3.1.8(E), 7.3.1, Table 5.1.4.3 and Bibliography.

Published on 6 September 2024.

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STANDARDS Australia

GPO Box 476 Sydney NSW 2001
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mail@standards.org.au
www.standards.org.au

STANDARDS NEW ZEALAND
TE MANA TAUTIKANGA O AOTEAROA

PO Box 1473 Wellington 6140
Free phone 0800 782 632
enquiries@standards.govt.nz
www.standards.govt.nz

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