

Australian/New Zealand Standard™

The storage and handling of LP Gas



AS/NZS 1596:2014

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee ME-015, Storage and Handling—Liquefied Petroleum Gases. It was approved on behalf of the Council of Standards Australia on 14 April 2014 and on behalf of the Standards Council of New Zealand on 27 March 2014. This Standard was published on 19 May 2014.

The following are represented on Committee ME-015:

Australasian Fire and Emergency Service Authorities Council
Department of Agriculture, Fisheries and Forestry, Qld
Department of Mines and Petroleum, WA
Department of the Premier and Cabinet, SA
Energy Safety, WA
Engineers Australia
Environmental Protection Authority, New Zealand
Fire Protection Association Australia
Gas Appliance Manufacturers Association of Australia
Gas Energy Australia
LPG Association of New Zealand
Ministry of Business, Innovation and Employment, New Zealand
WorkSafe, Tasmania
WorkSafe Victoria

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com or Standards New Zealand web site at www.standards.govt.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS 1596.

Australian/New Zealand Standard™

The storage and handling of LP Gas

Originated in Australia as AS CB 20—1965.
Originated in New Zealand as NZS 5434:1986.
Fifth edition AS/NZS 1596:1997.
Sixth edition AS/NZS 1596:2002.
Previous edition AS/NZS 1596:2008.
Eighth edition 2014.
Reissued incorporating Amendment No. 1 (August 2017).

COPYRIGHT

© Standards Australia Limited

© The Crown in right of New Zealand, administered by the New Zealand Standards Executive

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, PO Box 1473, Wellington 6140.

ISBN 978 1 74342 712 5

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-015, Storage and Handling—Liquefied Petroleum Gases, to supersede AS/NZS 1596:2008, *The storage and handling of LP Gas*.

This Standard incorporates Amendment No. 1 (August 2017). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

This edition is the result of a comprehensive review of the 2008 edition, in order to update procedures in light of industry best practice, and correct and update references.

A1 | Appendix Q, ‘Impact protection’, for assessing the requirements for the protection of tanks and cylinders from impact, has been changed from informative to normative (in Australia only), with some modifications, by Amendment No. 1:2017.

A new informative Appendix, ‘Transport of portable LP Gas cylinders for trade use’, covering the transport of cylinders for trade use, has been included. This has drawn heavily on safety notes and bulletins produced by various government bodies following an increase in safety incidents in this area. Addressing additional safety concerns regarding the hazardous nature of working in underground pits, a number of changes have been made in this area.

Appendix K has been reviewed to bring the emergency planning aspects of the Standard in line with current emergency services terminology and practice.

A1 | A new informative Appendix R, ‘Odour management’ has been introduced to provide guidance for the management of odour in LP Gas through the supply chain to reduce the risk of odour fade.

A significant number of minor changes have been made to align the Standard with New Zealand regulatory practice and it is envisaged that the Standard may be called up in legislation in New Zealand in the future.

This Standard has been revised in terms of safety and technical matters. The regulatory authorities in each state and territory determine how and when Standards are to be applied. The method of application may be full, part, with or without modifications or not at all. This application is not directed by the Standard. The relevant regulatory authority should be consulted regarding the application of this Standard.

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

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

Where Australian and New Zealand references are separated by the word ‘or’, a slash (/) or parentheses, Australian references apply in Australia, and New Zealand references apply in New Zealand. Joint Standards apply in both Australia and New Zealand.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE AND OBJECTIVE.....	6
1.2 APPLICATION	6
1.3 REFERENCED DOCUMENTS.....	12
1.4 DEFINITIONS.....	13
SECTION 2 MINOR STORAGE AND USAGE	
2.1 INTRODUCTION	20
2.2 APPLICATION OF SECTION	20
2.3 MINOR STORAGE AND USAGE OF LP GAS	20
2.4 GROUPS OF TEMPORARY STRUCTURES IN WHICH LP GAS IS USED	21
SECTION 3 GENERAL REQUIREMENTS	
3.1 SCOPE OF SECTION	25
3.2 RESTRICTIONS ON IGNITION SOURCES	25
3.3 PIPES, VALVES AND FITTINGS.....	25
3.4 CONTROL OF ACCESS.....	25
3.5 SEPARATION DISTANCES	25
3.6 FIREWALLS AND VAPOUR BARRIERS.....	26
SECTION 4 CYLINDERS AND CYLINDER SYSTEMS	
4.1 SCOPE AND APPLICATION OF SECTION.....	28
4.2 CYLINDERS	28
4.3 REGULATORS AND PIPING FOR CYLINDER SYSTEMS.....	29
4.4 CYLINDERS IN USE.....	31
4.5 CYLINDER STORAGE	38
4.6 EXCHANGE FACILITIES FOR PORTABLE CYLINDERS	41
4.7 STORAGE OF LP GAS CYLINDERS ON TROLLEYS.....	42
4.8 CYLINDER LOADING AND UNLOADING AREAS	43
SECTION 5 COMPONENTS FOR TANK SYSTEMS	
5.1 SCOPE OF SECTION	44
5.2 TANK DESIGN AND CONSTRUCTION	44
5.3 CONTROL OF LP GAS OUTFLOW	45
5.4 SAFETY VALVES.....	47
5.5 VALVES AND ACCESSORIES	48
5.6 PIPING	51
5.7 VAPORIZERS.....	53
SECTION 6 TANK SYSTEM INSTALLATION	
6.1 SCOPE OF SECTION	55
6.2 TANK SPACING AND SEPARATION DISTANCES.....	55
6.3 TANK SITE CONDITIONS	58
6.4 TANK FOUNDATIONS AND SUPPORTS	58
6.5 FLAME IMPINGEMENT	59
6.6 CONNECTIONS FOR TANK FILLING AND TANKER LOADING	60
6.7 EMERGENCY SHUT-DOWN SYSTEM.....	63
6.8 PIPING	64
6.9 VAPORIZER INSTALLATION.....	67

A1	6.10	REGULATORS	67
	6.11	PUMPS AND COMPRESSORS	68
	6.12	SECURITY AND IMPACT PROTECTION	69
	6.13	LIGHTNING AND BONDING PROTECTION	69
	6.14	LADDERS, STEPS AND PLATFORMS	70
	6.15	LEAK DETECTION	70
	6.16	MARKINGS AND NOTICES	70
	6.17	LIGHTING	70
	6.18	UNODOURIZED GAS INSTALLATIONS	70
	SECTION 7 UNDERGROUND TANK INSTALLATIONS		
	7.1	SCOPE AND APPLICATION OF SECTION	71
	7.2	CORROSION CONTROL	71
	7.3	LOCATION AND INSTALLATION	71
	7.4	ACCESS, PROTECTION, FITTINGS AND ACCESSORIES	75
	7.5	DISCHARGE FROM SAFETY RELIEF DEVICES	76
	SECTION 8 CYLINDER FILLING INSTALLATIONS—AUSTRALIA		
	8.1	SCOPE OF SECTION	78
	8.2	GENERAL REQUIREMENTS	78
	8.3	CYLINDER FILLING AREA	78
	8.4	DECANTING	79
	8.5	CYLINDER TO FORKLIFT AND AUTOMOTIVE CYLINDER—FILLING BY PUMP	82
	SECTION 9 CYLINDER FILLING INSTALLATIONS—NEW ZEALAND		
	9.1	SCOPE OF SECTION	84
	9.2	GENERAL REQUIREMENTS	84
	9.3	CYLINDER FILLING AREA	85
	9.4	DECANTING	87
	SECTION 10 AUTOMOTIVE FILLING INSTALLATIONS		
	10.1	INTRODUCTION	88
	10.2	COMMON REQUIREMENTS	88
	10.3	DISPENSING SYSTEMS	89
	10.4	NOTICES, SIGNS AND INSTRUCTIONS	92
	10.5	SPECIFIC REQUIREMENTS FOR SERVICE STATIONS	92
	10.6	SITE SUITABILITY FOR SERVICE STATIONS	97
	10.7	LAND USE CONTROLS FOR SERVICE STATIONS	97
	10.8	SAFETY MANAGEMENT SYSTEM FOR SERVICE STATIONS	100
	SECTION 11 OPERATIONS		
	11.1	SCOPE OF SECTION	102
	11.2	GENERAL PRECAUTIONS	102
	11.3	ESTABLISHMENT OF PROCEDURES	103
	11.4	COMPLIANCE, SUPERVISION AND RECORDS	106
	11.5	CONSTRUCTION, INSPECTION, TESTING AND MAINTENANCE	106
	11.6	SPECIFIC OPERATING PROCEDURES	109
	11.7	PREPARATIONS FOR THE TRANSPORT OR REMOVAL OF STORAGE TANKS	110
	11.8	TANKER OPERATIONS	110
	11.9	GENERAL PRECAUTIONS FOR TANKER TRANSFER	112
	11.10	SUPERVISION OF DELIVERY	112

Page

11.11 PROCEDURES FOR FILLING AND EMPTYING TANKS.....	113
11.12 CYLINDER FILLING	114
11.13 FILLING FROM TANKERS TO CYLINDERS OTHER THAN IN SITU.....	115

SECTION 12 EMERGENCY MANAGEMENT

12.1 SCOPE OF SECTION	117
12.2 PLANNING FOR EMERGENCIES	117
12.3 MANIFEST	118
12.4 PLACARDING.....	118

SECTION 13 FIRE SAFETY

13.1 INTRODUCTION	119
13.2 APPLICATION OF SECTION	119
13.3 GENERAL REQUIREMENTS FOR FIRE PROTECTION EQUIPMENT	120
13.4 CYLINDERS	120
13.5 TANK INSTALLATIONS.....	122
13.6 AUTOMOTIVE FILLING INSTALLATIONS	123
13.7 DETAILED REQUIREMENTS.....	123

APPENDICES

A LIST OF REFERENCED DOCUMENTS.....	126
B TANK OR CYLINDER FILLING LEVEL.....	131
C APPROXIMATE CAPACITIES OF CYLINDERS FOR LP GAS	138
D MARKINGS, SIGNS AND NOTICES	139
E HAZARDOUS AREAS	145
F EXCHANGE FACILITIES FOR PORTABLE CYLINDERS—AUSTRALIA.....	148
G EXCHANGE FACILITIES FOR PORTABLE CYLINDERS—NEW ZEALAND..	151
H DISCHARGE CAPACITY OF SAFETY VALVES	155
I LEAKAGE TESTING OF PIPEWORK.....	157
J DECANTING PROCEDURE	159
K EMERGENCY PLANNING.....	161
L MOTOR VEHICLE REFUELLING	163
M FIRE EXPOSURE PROTECTION	164
N FIRE SAFETY	168
O TRANSPORT OF PORTABLE LP GAS CYLINDERS	171
P TRANSPORT OF PORTABLE LP GAS CYLINDERS FOR TRADE USE	172
Q IMPACT PROTECTION	174
R ODOUR MANAGEMENT	183

A1 |

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

The storage and handling of LP Gas

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE AND OBJECTIVE

This Standard specifies requirements for the location, design, construction, commissioning and operation of installations for the storage and handling of LP Gas, and includes the management of emergencies.

The objective of this Standard is to provide designers, planners, operators and regulators with technical and procedural requirements for installations for the safe storage and handling of LP Gas.

1.2 APPLICATION**1.2.1 Application of Standard**

This Standard shall be read as defining the minimum requirements of acceptability.

This Standard applies to installations commenced after its publication date. Unless specifically indicated in this Standard, it shall not apply to existing installations.

NOTE: 'Commenced', for the purpose of this Clause, means the point at which site or equipment construction has begun.

A1 | This Standard applies up to the outlet of the first regulator in the vapour supply system including any integral two stage regulator.

The relevant authority having jurisdiction may determine the extent of application of this Standard.

This Standard does not apply to the following situations:

- (a) Refrigerated storage of LP Gas.
- (b) Underground storage of LP Gas in mined caverns or geological formations.
- (c) Plant or equipment in which LP Gas is processed or produced, or vessels that form an integral part of that processing equipment (but does include post manufacturing storage).
- (d) Industrial gas-consuming equipment (see AS 3814 or AS/NZS 5601.1).
- (e) Automotive installations, as addressed in AS/NZS 1425 and AS 4983.
- A1 | (f) Refrigerating systems, as addressed in the AS/NZS 5149 series.
- (g) Land transport equipment and operations, as covered—
 - (i) in Australia, by the ADG Code (but excluding references to this Standard that appear in the ADG Code) and AS 2809, Parts 1 and 3; or
 - (ii) in New Zealand, a road tank wagon shall be constructed in accordance with the *Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004*. The *Code of Practice HSNOCOP 29, Flammable Gases and Oxygen Tank Wagons*—A code of practice for the design and construction of vehicles for bulk transport of flammable gases and oxygen by road is a means of compliance. Land transport shall be consistent with the *Land Transport Rule: Dangerous Goods 2005*, as amended.

(h) Air transport equipment and operations.

A1 | (i) LP Gas systems for caravans, catering vehicles, marine craft or aircraft (see AS/NZS 5601, Parts 1 and 2), or as covered in the relevant parts of the AS 2809 series.

(j) Refrigeration systems for vehicles.

1.2.2 Relationship to other Standards

A1 | Figures 1.1(A) to 1.1(E) illustrate the application of this Standard and its relationship with AS/NZS 5601.1 and other relevant Standards for gas storage containers connected in use. Legislation in some jurisdictions determines that the piping upstream of billing meters as per Figure 1.1(C) constitutes a distribution system and hence falls within the scope of AS/NZS 4645 series.

Where only LP Gas is stored, this Standard applies. For the storage and handling of other gases in cylinders, or where LP Gas is stored with other gases in cylinders, AS 4332 should be consulted.

1.2.3 Application of sections

Sections 3, 11, 12 and 13 set out general requirements that apply to the storage and handling of LP Gas in quantities greater than minor storage.

Section 2 sets out conditions and requirements for minor storage and usage of LP Gas in cylinders.

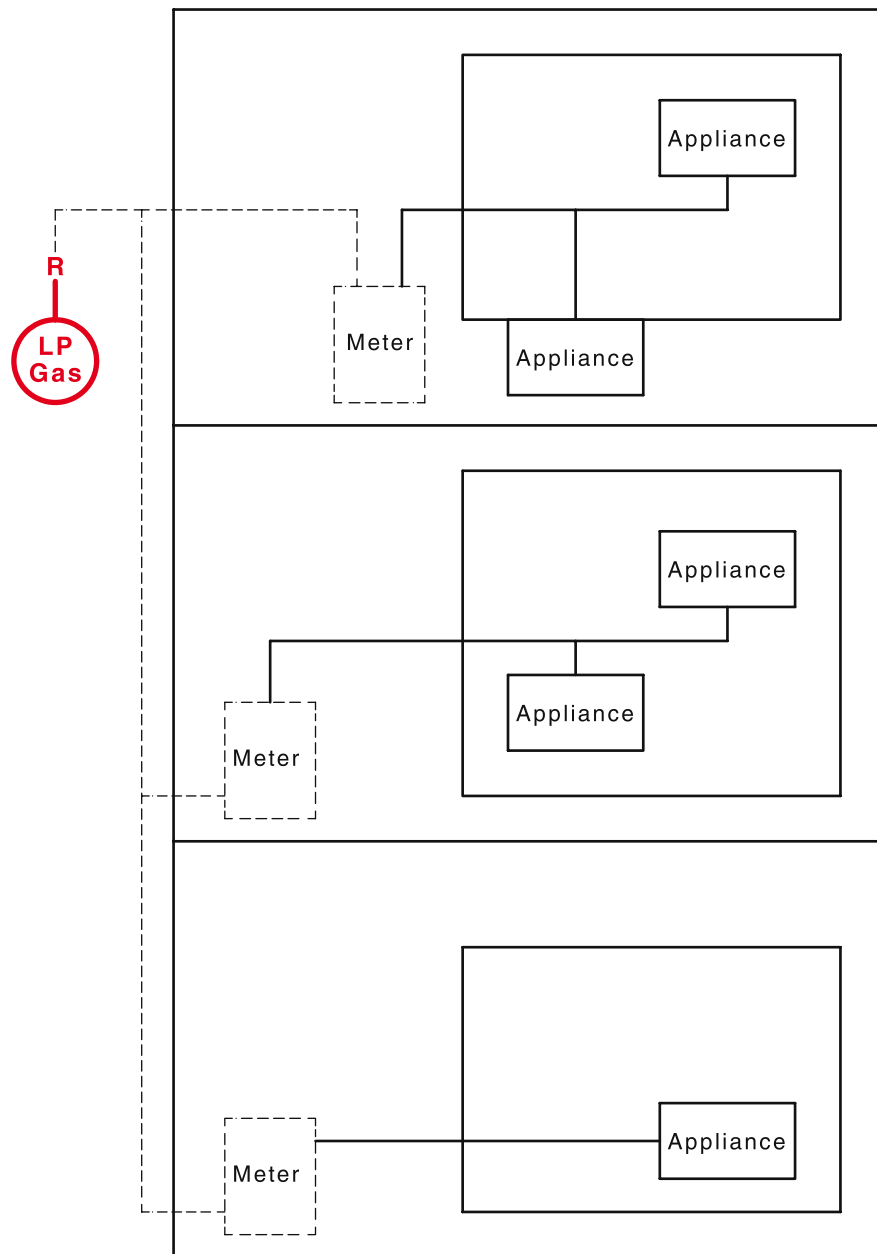
Section 4 sets out specific requirements for the storage and usage of LP Gas in cylinders, in quantities that are greater than, or do not comply with, minor storage.

Sections 5, 6 and 7 set out requirements for the storage and handling of LP Gas in tanks, in various locations.

Sections 8 and 9 set out specific requirements for cylinder filling operations in Australia and New Zealand respectively.

Section 10 sets out specific requirements for automotive filling installations, including service stations.

A1

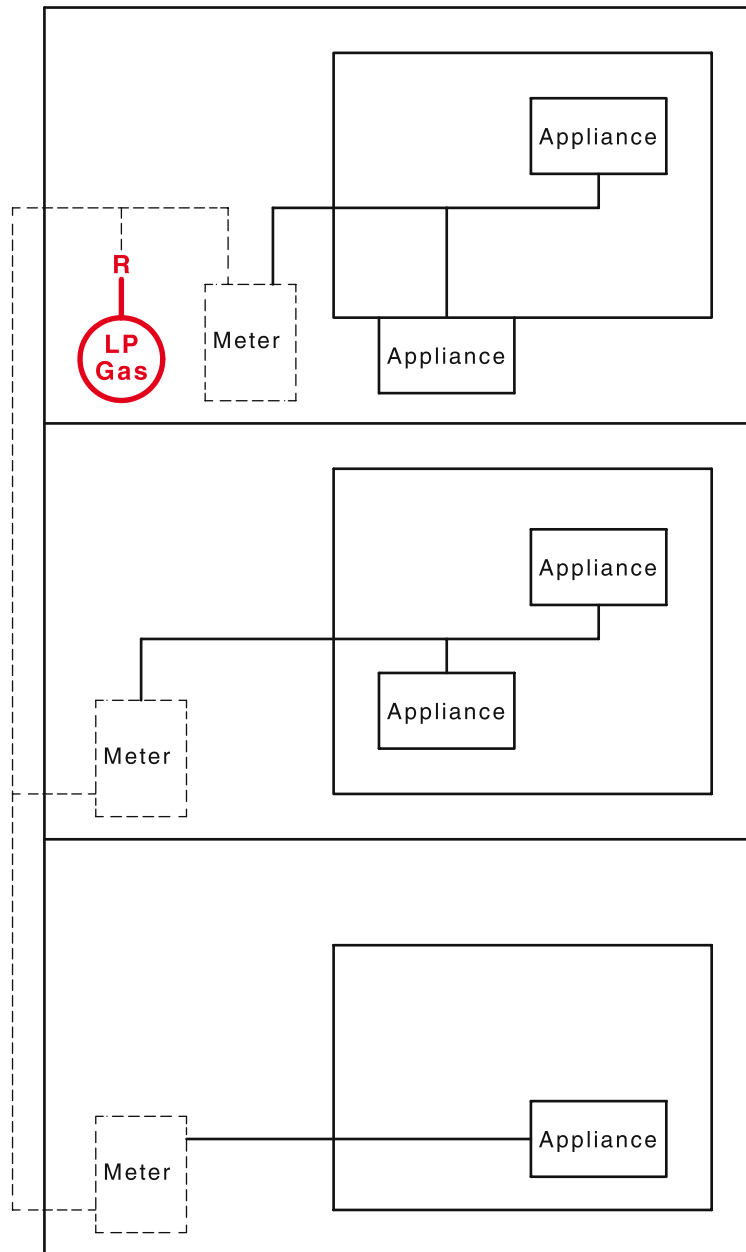


LEGEND:

- = AS/NZS 1596
- = AS/NZS 5601.1
- - - = AS/NZS 4645 series/NZS 5258
- R = Regulator

FIGURE 1.1(A) LP GAS CONTAINER SUPPLYING SEVERAL SITES BY RETICULATION FROM A SINGLE LP GAS SUPPLY

A1

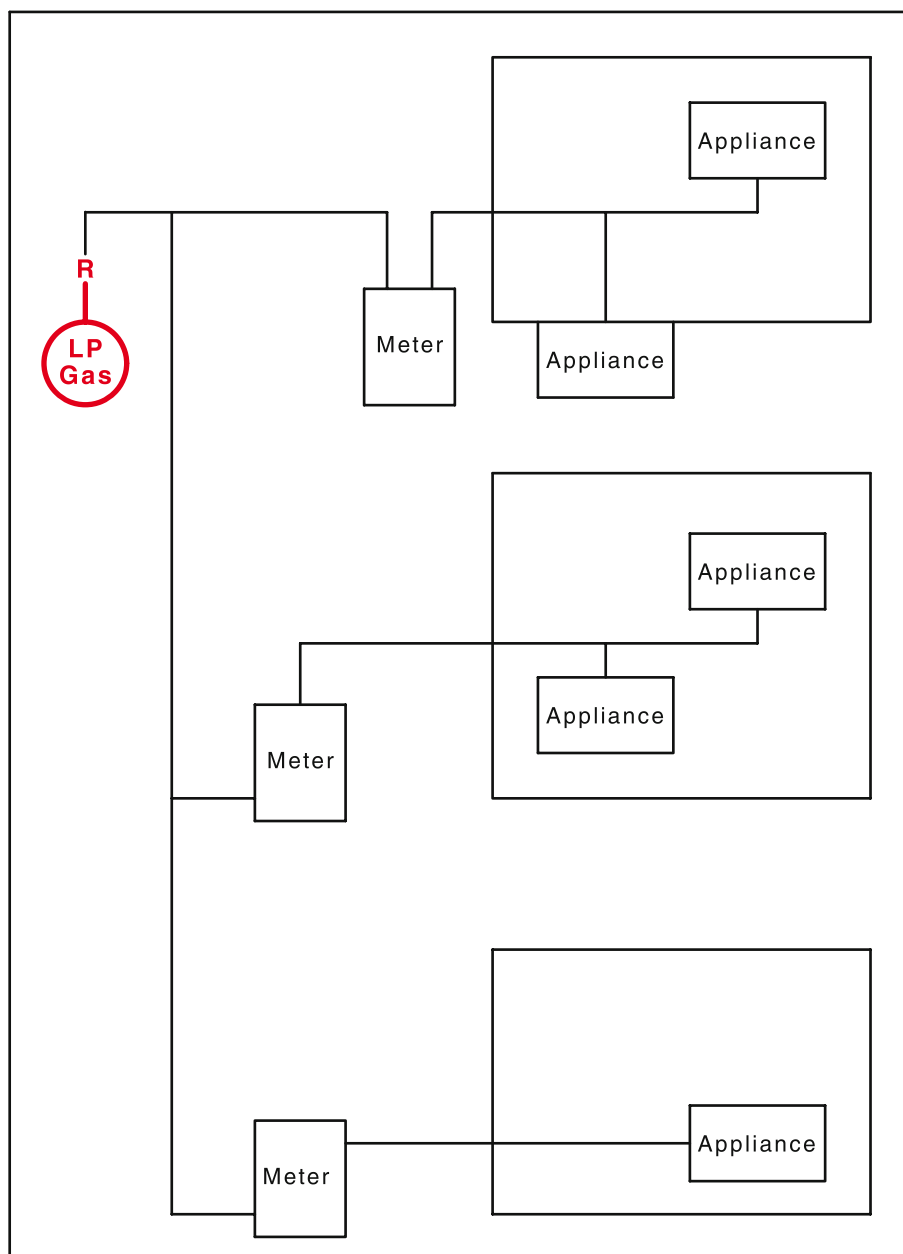


LEGEND:

- = AS/NZS 1596
- = AS/NZS 5601.1
- - - = AS/NZS 4645 series/NZS 5258
- R = Regulator

FIGURE 1.1(B) LP GAS CONTAINER SUPPLYING SEVERAL SITES BY RETICULATION FROM A SINGLE LP GAS SUPPLY ON ONE OF THE SITES

A1

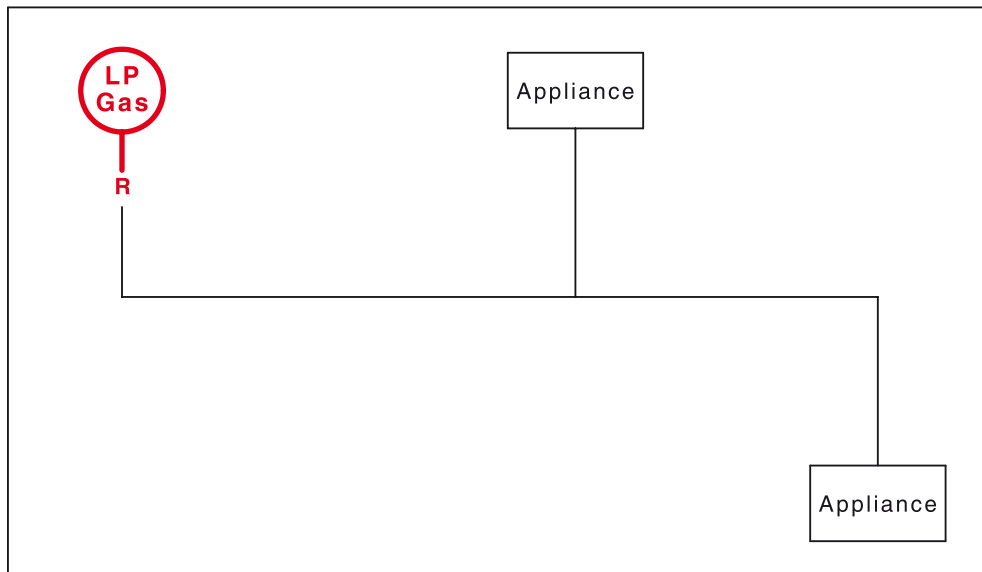


LEGEND:

- = AS/NZS 1596
- = AS/NZS 5601.1
- R = Regulator

FIGURE 1.1(C) LP GAS CONTAINER SUPPLYING SEVERAL TENNANTS ON A SINGLE SITE BY RETICULATION FROM A SINGLE LP GAS SUPPLY

A1



LEGEND:

- = AS/NZS 1596
- = AS/NZS 5601.1
- R = Regulator

FIGURE 1.1(D) LP GAS CONTAINER SUPPLYING SEVERAL APPLIANCES
ON A SINGLE SITE

A1

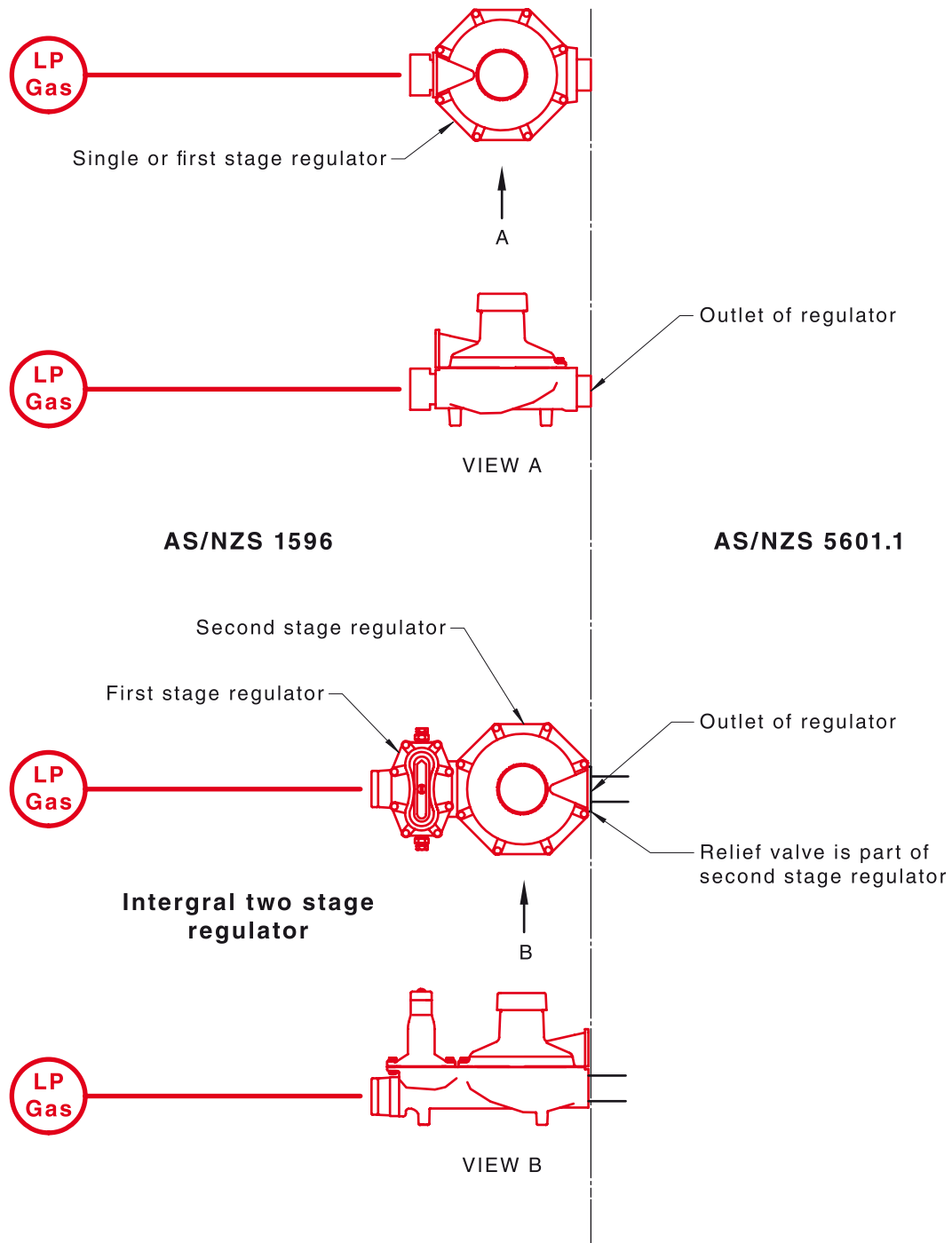


FIGURE 1.1(E) REGULATOR DETAIL

1.3 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix A.

NOTE: For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1.4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.4.1 ADG Code

The *Australian Code for the Transport of Dangerous Goods by Road and Rail* (commonly known as ADG Code) published by the National Transport Commission.

1.4.2 Aerial wiring

A power line placed above the ground and in the open air, but not including bus bars, telephone lines, or any direct current conductors used as traction trolley wires.

1.4.3 Authority

The authority having statutory (legal) control of a particular matter.

1.4.4 Automotive filling installation

A place where automotive LP Gas fuel tanks mounted on vehicles are intended to be filled from dispensers. [See also fleet refuelling installation (Clause 1.4.23) and service station (Clause 1.4.53).]

1.4.5 Boundary

The boundary of the whole of the site under the same occupancy as that on which the installation is included.

1.4.6 Capacity (of a tank or cylinder)

The total volume of the space enclosed within the cylinder or tank, expressed in litres (L) or kilolitres (kL) respectively.

NOTE: This is often referred to as 'water capacity'.

1.4.7 Combustible

A solid substance capable of undergoing combustion when tested in accordance with AS 1530.1.

1.4.8 Combustible liquid

Any liquid, other than a flammable liquid, that has a flash point, and has a fire point less than its boiling point.

NOTE: AS 1940 provides test methods of combustible liquid.

1.4.9 Compound

An area bounded by natural ground contours or by a bund, and intended to retain spillage or leakage.

NOTE: A pit or tank may be used to provide the same function.

1.4.10 Container

Anything that contains or can contain LP Gas. It does not include a vehicle or a freight container.

1.4.11 Cylinder

A container that falls within the scope of AS 2030.1 or, in New Zealand, an approved container as relevant to LP Gas.

1.4.12 Dangerous goods

(Australia) Substances and articles that—

- (a) satisfy the UN tests and criteria for determining whether they are dangerous goods; or

- (b) are listed in the ADG Code or are determined to be dangerous goods by the regulatory authority.

(New Zealand) Substances and articles that have one or more hazard Classes assigned to them in accordance with the HSNO Act, including packaging and empty containers that have not been cleaned after containing hazardous substances.

For the purposes of this Standard (for use in New Zealand) the term ‘dangerous good’ is synonymous with ‘hazardous substance’ and both are used interchangeably throughout the document.

In New Zealand, ‘dangerous goods’ is a term used by the *Land Transport Rule: Dangerous Goods 2005*, which applies during transport. For the storage and handling of substances, the HSNO Act applies, and the term ‘hazardous substances’ is used.

NOTE: UN tests and criteria are specified in the *UN Manual of Tests and Criteria and the Recommendations on the Transport of Dangerous Goods—Model Regulations*.

1.4.13 Deadman’s handle

A device that is activated by the person operating the system, to start the flow of fuel, and that requires constant actuation by the operator to maintain the flow of fuel. The flow of fuel is stopped if the device is released.

1.4.14 Decanting

A procedure in which the liquid phase of LP Gas is transferred from one container to another by utilizing the difference in pressure between the two containers.

1.4.15 Direct connection

A filling connection mounted directly at the tank and designed to spray-fill into the tank vapour space.

1.4.16 Emergency shut-down system

A control system that facilitates safe LP Gas shut-down in an emergency.

1.4.17 Excess-flow valve

A valve that is normally open, but closes automatically when a predetermined flow rate in a particular direction has been exceeded.

1.4.18 Filling connection

A loading connection that allows the transfer of LP Gas from a tanker to a tank, and vice versa.

1.4.19 Fire resistance level (FRL)/Fire resistance rating (FRR)

A measure of the fire resistance of a material or structure as determined in accordance with AS 1530.4 or NZS/ISO 834. It consists of three numerals representing, in order, the period of resistance for—

- (a) structural adequacy;
- (b) integrity; and
- (c) insulation.

For example, 60/60/30 means 60 min of resistance for each of Items (a) and (b), and 30 min for Item (c).

NOTE: In New Zealand the term ‘fire resistance rating’ (FRR) is used. It has the same meaning as FRL.

1.4.20 Firewall

A wall or other barrier constructed and placed with the object of preventing the spread of fire or the radiation of heat from any one place to some other place.

1.4.21 Fixed liquid level gauge or fixed ullage gauge

A gauge that indicates the maximum standard liquid level in the container.

1.4.22 Flammable liquid

For Australia, a flammable liquid as defined in the ADG Code.

For New Zealand, a flammable liquid as defined in New Zealand Hazardous Substances (Classification) Regulations.

1.4.23 Fleet refuelling installation

A place where only industrial or commercial vehicles are refuelled, and where the retail selling of LP Gas to the general public does not occur.

1.4.24 Fusible link

A safety device consisting of a material having a suitably low melting point, and which is intended to yield or melt at a predetermined temperature.

1.4.25 Gas distributor

A person, or persons, or company which receives LP Gas in bulk for distribution to the general public, or to agents who in turn sell the LP Gas to the general public.

1.4.26 Gas free

For flammable gases, the concentration of that gas or vapour in the atmosphere of the container being less than 5% of the lower explosive limit (LEL) for the substance when sampled at ambient temperature.

1.4.27 Hazardous area

An area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment.

NOTES:

- 1 The classification of hazardous areas due to flammable gases is specified in AS/NZS 60079.10.1.
- 2 (New Zealand) The HSNO Act uses the term 'hazardous atmosphere zones'; however, for the purposes of this Standard the term 'hazardous area' and corresponding definition should be used.

1.4.28 Hazardous substance (New Zealand)

See definition for 'dangerous goods'.

In New Zealand, for the purposes of this Standard the term 'dangerous good' is synonymous with 'hazardous substance' and both are used interchangeably throughout the document.

NOTE: In New Zealand, the term 'hazardous substance' is used in the following Act and regulations:

- (a) The HSNO Act together with the regulations.
- (b) Group Standards and Transfer Notices made under that Act.

1.4.29 Heat radiation barrier

A shield interposed between a source of radiant heat and an object, in order to reduce the amount of radiant heat received by the object to an acceptable level.

1.4.30 Hot work

Any condition that is likely to produce a source of ignition or be an ignition source.

NOTE: Examples of hot work include the following:

- (a) Welding of flame cutting equipment.
- (b) Matches, naked lights, cigarettes.
- (c) Grinding, drilling or other activities that could create heat or spark.
- (d) Electrical equipment not suitable for hazardous areas.
- (e) Spark ignition engines or compression ignition engines not suitable for hazardous areas.
- (f) Hand tools that could create a spark.

1.4.31 Ignition source

A source of energy sufficient to ignite an explosive atmosphere.

NOTE: Examples of ignition sources include naked flames, exposed incandescent material, electrical welding arcs, mechanical or static sparks, and electrical, electronic or mechanical equipment not suitable for use in hazardous locations.

1.4.32 In situ filling

A cylinder filling procedure, where a cylinder installed on a customer's premises is filled from a tanker.

1.4.33 Installation

All of the facilities on a site that are used for storing or handling LP Gas.

1.4.34 Internal component

In relation to a fitting or component, one that is constructed so that its significant working parts are within the container shell, and damage to exposed portions will not prevent effective safe seating or closure.

1.4.35 Internal safety control valve (ISC)

A quick-closing internal valve incorporating an internal excess-flow valve.

1.4.36 Liquefied petroleum gas (LP Gas)

A hydrocarbon fluid composed predominantly of any of the following hydrocarbons, or mixtures of all or any of them: propane (C_3H_8), propylene (C_3H_6), butane (C_4H_{10}) or butylenes (C_4H_8). Unless specifically stated otherwise, any reference to 'propane', 'butane', etc. means the commercial grade of that product.

NOTES:

- 1 The characteristics of the various LP Gases, together with methods for their determination, are given in AS 4670; for the autogas sector fuel quality is regulated federally in Australia through the *Fuel Standard (Autogas) Determination 2003*.
- 2 In New Zealand, NZS 5435 sets out the composition and other requirements for the following types of LP Gas: commercial propane, commercial butane, general product and special product.

1.4.37 Mass-filling ratio

The ratio between the greatest mass of LP Gas permitted in a container and the mass of water at 15°C which would completely fill the container.

1.4.38 Maximum filling level

The highest liquid surface level permitted in a container (see Appendix B).

1.4.39 Modular direct-fired vaporizer

Vaporizer containing, within the one case/body, multiple heat exchanger modules each having separate controls (inlet valve, outlet, temperature, pilot and burner).

1.4.40 May

Indicates the existence of an option.

1.4.41 Non-return valve (check valve)

A valve which permits flow in one direction only.

1.4.42 Outdoor

An above ground, open-air situation with natural ventilation, where any leakage and products of combustion are rapidly dispersed by wind and natural convection.

1.4.43 Pigtail

A short length of small bore pipe, or a hose assembly (to allow flexibility) used for the high pressure connection between an LP Gas cylinder and the cylinder regulator or cylinder manifold.

1.4.44 POL coupling

An LP Gas union connection having a left-hand thread, as specified for Type 21 in AS 2473.2.

1.4.45 Positive shut-off

A valve in which the actuating stem is permanently connected to the flow-blocking components, and which, when actuated to the closed position, unquestionably blocks off all flow.

1.4.46 Practicable

Practicable having regard to—

- (a) the severity of the hazard or risk in question;
- (b) the state of knowledge about that hazard or risk and about ways of removing or mitigating that hazard or risk;
- (c) the availability and suitability of ways to remove or mitigate that hazard or risk; and
- (d) the cost of removing or mitigating that hazard or risk.

1.4.47 Protected place

Any of the following:

- (a) A dwelling, place of worship, public building, school or college, hospital, theatre, building or open area in which persons are accustomed to assemble in large numbers, whether within or outside the property boundary of the installation.
- (b) A factory, office, workshop, store, warehouse, shop or building where people are employed, except a building used for the storage and handling of LP Gas.
- (c) A vessel (e.g. a ship) lying at permanent berthing facilities.
- (d) Any storage facility for dangerous goods outside the property boundary of the installation, except those defined as minor storages in other Standards or regulations.

In New Zealand, the HSNO Act does not use the term 'protected place', it uses the term 'Area of High Intensity Land Use' (HILU). However, for the purposes of this Standard, the term 'protected place' and corresponding definition should be used.

1.4.48 Public place

Any place, other than private property, open to the public and including a street or road.

Parking areas for commercial and public buildings are not considered public places.

In New Zealand, the HSNO Act does not use the term ‘public place’ it uses the term ‘Area of Low Intensity Land Use’ (LILU). However, for the purposes of this Standard the term ‘public place’ and corresponding definition should be used.

1.4.49 Quick-closing internal valve

An internal valve designed and arranged to be closed either automatically by the operation of one or more heat-sensing devices (which may be fusible links) or manually from a remote position, or both, by the release of the means of holding the valve open.

1.4.50 Regulator

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

1.4.51 Remote connection

A filling connection located remotely from the tank and which may be complemented with a vapour recovery connection for use with a tanker loading or unloading operation.

1.4.52 Safety valve

A pressure relief valve intended for the release of excessive vapour pressure, as defined in AS 1210 and AS 1271.

1.4.53 Service station

An automotive LP Gas retail outlet, where LP Gas is sold to the public as a motor fuel.

1.4.54 Shall

Indicates that a statement is mandatory.

1.4.55 Should

Indicates a recommendation.

1.4.56 Significant trafficable area

Situations/locations where there are no traffic control management procedures to minimize the risk of impact.

NOTE: Examples include service stations and commercial premises where no visual or physical barriers are installed to impede or direct traffic flow.

1.4.57 Site

The premises of an LP Gas facility, or where such a facility may be installed.

1.4.58 Site operator

A person who is responsible for the LP Gas operations.

1.4.59 Standard filling level

The highest liquid surface level permitted in a container for an LP Gas of specified density, assuming a liquid temperature of 5°C. It provides the location for the sensing point of the liquid level gauge.

NOTE: The standard filling level represents a safe but conservative filling level for any LP Gas whose density is equal to or higher than that for which the level was set, and whose temperature at the time of filling is 5°C or higher, the object being to ensure that the tank does not become liquid-full under normal operating conditions.

1.4.60 Tank

A container, other than a cylinder, that is designed for the storage or transport of LP Gas. A tank may be one of the following types:

- (a) *Static storage tank*—a tank intended to remain permanently in place once installed.

- (b) *Portable tank*—a tank intended for semi-permanent installation, but which incorporates additional features which allow it to be transported to the site, or transferred to another site, filled or partly filled with LP Gas.
- (c) *Skid tank*—a tank intended to be repeatedly transported in the full condition, and which may be moved frequently to service shifting or short-term demands. Such tanks might be used on an exchange fill basis, or might be left on-site for refilling from tankers.
- (d) *Demountable delivery tank*—a tank intended to be mounted on a vehicle to be used as an LP Gas delivery tanker, and which may be removed from the vehicle from time to time.
- (e) *Freight container tank*—a tank fitted with frames to international freight container dimensions in accordance with AS 3711.6.
- (f) *Stationary tank (New Zealand)*—a stationary container as defined in Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice and amendments.

1.4.61 Tanker

A road tank vehicle that meets the requirements of AS 2809.1 and AS 2809.3, or with earlier Standards superseded by AS 2809.3, or with the New Zealand Environmental Protection Authority (EPA) *Approved Code of Practice for 'Flammable Gases and Oxygen Tank Wagons'*.

1.4.62 Thermal screen

A wall or other screen constructed and placed to protect people and the environment from the effects of short-duration fires and heat radiation. A firewall satisfies the requirements of a thermal screen.

1.4.63 Ullage

The space above the liquid level in a container.

1.4.64 Vaporizer

A device, other than a tank or cylinder, which receives LP Gas in the liquid phase and adds sufficient heat to convert the liquid to a gaseous state.

1.4.65 Vapour barrier

A wall or other barrier constructed and placed with the objective of preventing the passage of vapour from any one place to some other place.

1.4.66 Volume filling percentage

The maximum volume of liquid permitted in the container, expressed as a percentage of its capacity (see Clause 1.4.6).

NOTE: The percentage is variable, being dependent on the LP Gas density and temperature, and is the basis for determining the maximum or the standard filling level (see Appendix B).

SECTION 2 MINOR STORAGE AND USAGE

2.1 INTRODUCTION

The underlying concept of minor storage is that quantities below a certain level are generally unlikely to play a significant part in spreading a fire from place to place. The firefighting services and facilities required under normal building regulations are expected to cope adequately, provided that—

- (a) the quantity of LP Gas does not exceed that given in Table 2.1;
- (b) the storage conditions comply with Clause 2.3; and
- (c) the use of LP Gas is in accordance with AS/NZS 5601.1, AS/NZS 5601.2 as appropriate, or other relevant Standard.

NOTES:

- 1 For greater quantities of LP Gas, Section 4 applies.
- 2 Other requirements, such as workplace safety regulations and guidelines, may also apply to quantities defined as minor storage in this Standard.
- 3 Hazardous areas are not commonly defined for storages less than 25 L but may be required to be defined in some non-domestic situations, particularly where there is restricted ventilation.

2.2 APPLICATION OF SECTION

Cylinders of LP Gas in quantities not exceeding those given in Table 2.1 and complying with this Section (Section 2) may be classified as minor storage. In such cases, the requirements of this Section shall apply.

Where greater quantities of LP Gas are stored and handled, or the conditions set out in this Section cannot be met, other relevant sections of this Standard shall apply.

NOTE: Approximate volumes (water capacities) of LP Gas cylinders and the nominal masses of LP Gas contained therein are given in Appendix C.

This Section does not apply to—

- (a) cylinders used for decanting purposes; or
- (b) in situ fill cylinders.

2.3 MINOR STORAGE AND USAGE OF LP GAS

The following requirements and recommendations apply to the minor storage and usage of LP Gas:

- (a) The use and storage of cylinders of LP Gas indoors, whether full or nominally empty, should be avoided wherever practicable. Cylinders should preferably be located outdoors or in adequately ventilated areas.

NOTE: Figure 2.1 shows examples of adequately ventilated areas allowed by this Section. These examples may be different from those in AS/NZS 60079.10.1 for the purpose of minor storage covered by this Standard.

- (b) The total quantity of LP Gas kept (both in storage and connected for use) shall not exceed that stated in Table 2.1. This quantity includes LP Gas cylinders and non-refillable containers in use, whether full or nominally empty, but not those cylinders installed outdoors in accordance with Section 4 of this Standard and AS/NZS 5601.1.
- (c) Any cylinders in use shall be connected to an approved appliance and used in accordance with AS/NZS 5601.1 or other applicable Standard.
- (d) Users of LP Gas should be aware of the hazards and risks of its storage and use.

A1

- (e) Cylinders shall be kept upright in a well-ventilated area away from any flame, heat or other ignition sources.
 - (f) Cylinders shall be protected from excessive temperature rise.
 - (g) Cylinders shall be protected from physical impact.
 - (h) Cylinders shall be located so that they are not likely to be damaged or dislodged under normal circumstances of use. Any trolley or stand in which the cylinder is housed shall be constructed such that it is stable and fit for purpose.
 - (i) Cylinders shall be kept in a location that does not hinder the escape of people, and is away from any combustible or waste materials.
 - (j) Cylinders shall be kept at least 3 m from oxidizing gases, except where the cylinders of LP Gas and oxidizing gas form part of a portable oxy-fuel system used for welding, brazing, cutting and the like.
- NOTE: Reference should be made to AS 4839 for portable and mobile oxy-fuel gas systems.
- (k) Cylinders shall be stored with all cylinder valves closed when not in use.
 - (l) Cylinders and their fittings shall be inspected for leaks when connected and prior to the first use, e.g. by using a non-corrosive soap and water, detergent solution or leakage detection fluid to detect leaks at all joints and fittings.

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. CAUTION SHOULD THEREFORE BE EXERCISED WHEN USING SOAP SOLUTIONS ON BRASS FITTINGS, AND ALL CONNECTION SHOULD BE RINSED THOROUGHLY WITH FRESH WATER AS SOON AS POSSIBLE AFTER THE APPLICATION OF THE SOAP SOLUTION.

2.4 GROUPS OF TEMPORARY STRUCTURES IN WHICH LP GAS IS USED

Where temporary structures are grouped together, e.g. a group of marquees, stalls or tents at a market or event, there shall be a maximum of 10 such structures within each group if any structure is using LP Gas.

Groups of temporary structures using LP Gas shall be separated by at least 10 m. The intervening space shall be kept clear.

NOTE: For the purpose of this Clause, each structure is considered as a separate site for the application of Table 2.1 and Figure 2.1.

TABLE 2.1
MAXIMUM QUANTITIES FOR MINOR STORAGE AND USAGE

Location	Maximum quantity of LP Gas, number of cylinders and non-refillable containers
Residential properties: — A detached house or single storey attached dwelling	In Australia, indoors (including on balconies): 10 kg per dwelling In New Zealand, indoors: 20 kg per dwelling In both Australia and New Zealand, maximum total quantity (combined indoor and outdoor storage, cylinders not connected): 50 kg Maximum cylinder size: 15 kg In New Zealand, maximum cylinder size: 10 kg
— Multi-storey attached dwellings, up to and including 3 storeys	In Australia, indoors (including on balconies): 10 kg per dwelling In New Zealand, indoors: 20 kg per dwelling In both Australia and New Zealand, maximum total (combined indoor and outdoor) quantity: 20 kg per dwelling Maximum cylinder size: 10 kg
— Multi-storey attached dwellings, over 3 storeys	Maximum total (combined indoor and outdoor) quantity: 10 kg per dwelling Maximum cylinder size: 10 kg
Protected places and public places: — Outdoors and adequately ventilated areas, including open air, temporary structures (e.g. marquees, tents, booths) and under awnings. (See examples in Figure 2.1) — Outdoor and adequately ventilated areas of hotels, restaurants, cafes and take-away food shops. (See examples in Figure 2.1)	Per site: Maximum total quantity: 60 kg (see also Clause 2.4) Maximum cylinder size: 15 kg In New Zealand, maximum cylinder size: 10 kg
Protected places and public places: — Indoors, within buildings with a roof and three or more walls, e.g. hotels, bars, restaurants, cafes, take-away food shops	Per site: 10 kg per 10 m ² floor area, up to a maximum total quantity of 30 kg Maximum cylinder size: 15 kg In New Zealand, maximum cylinder size: 10 kg
Shops, offices and laboratories, indoors	Maximum total quantity: 30 kg per occupancy Maximum cylinder size: 15 kg In New Zealand, maximum cylinder size: 10 kg
Factories and warehouses, indoors	45 kg per 50 m ² floor area, up to a maximum total quantity of 180 kg per occupancy Maximum cylinder size: 45 kg

NOTES:

- 1 Outdoor areas include footpaths, enclosed gardens and public places (as defined in Clause 1.4.48).
- 2 Vehicle fuel containers on fork lift trucks or installed in motor vehicles in accordance with AS/NZS 1425, are not included in the quantities stated above.
- 3 See Appendix C for cylinder sizes and water capacities.

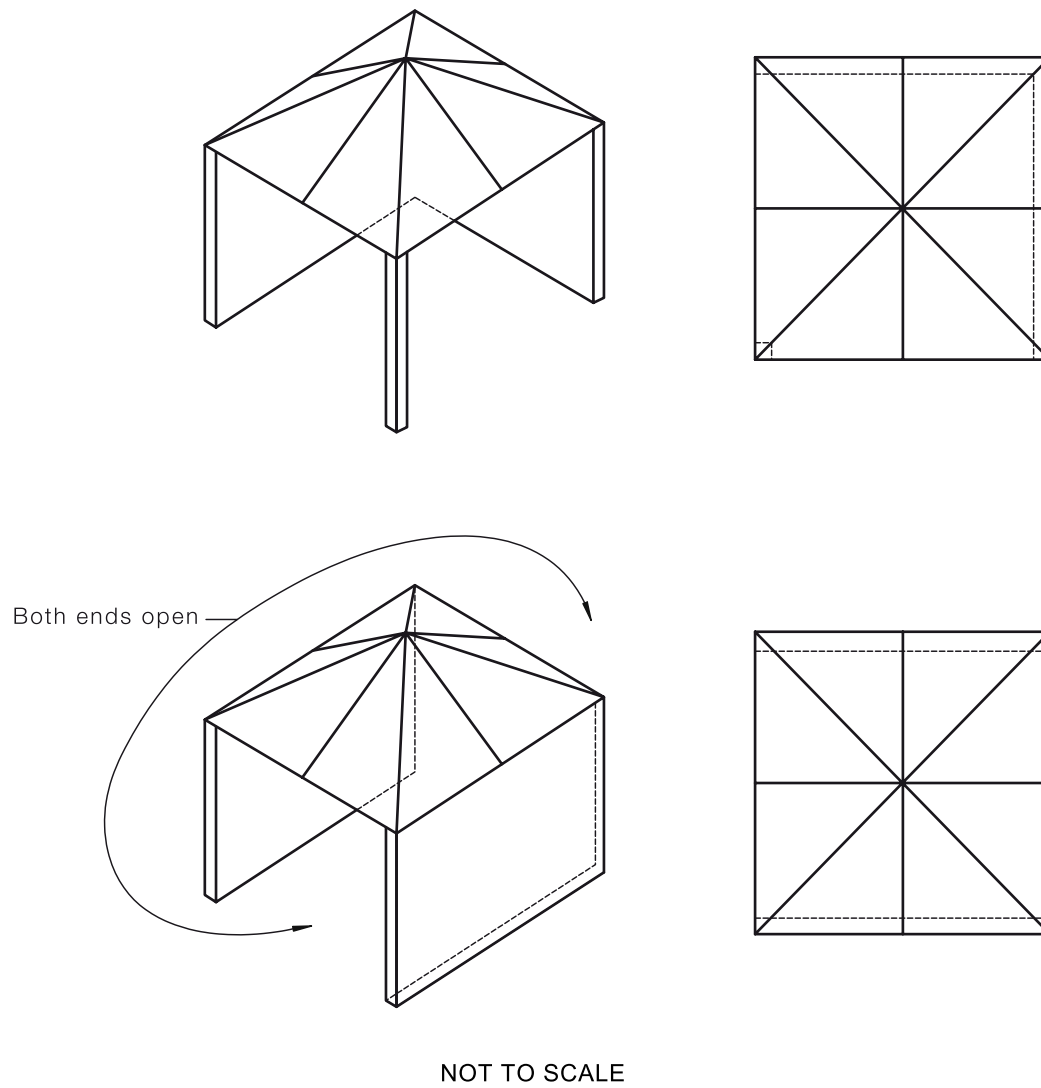
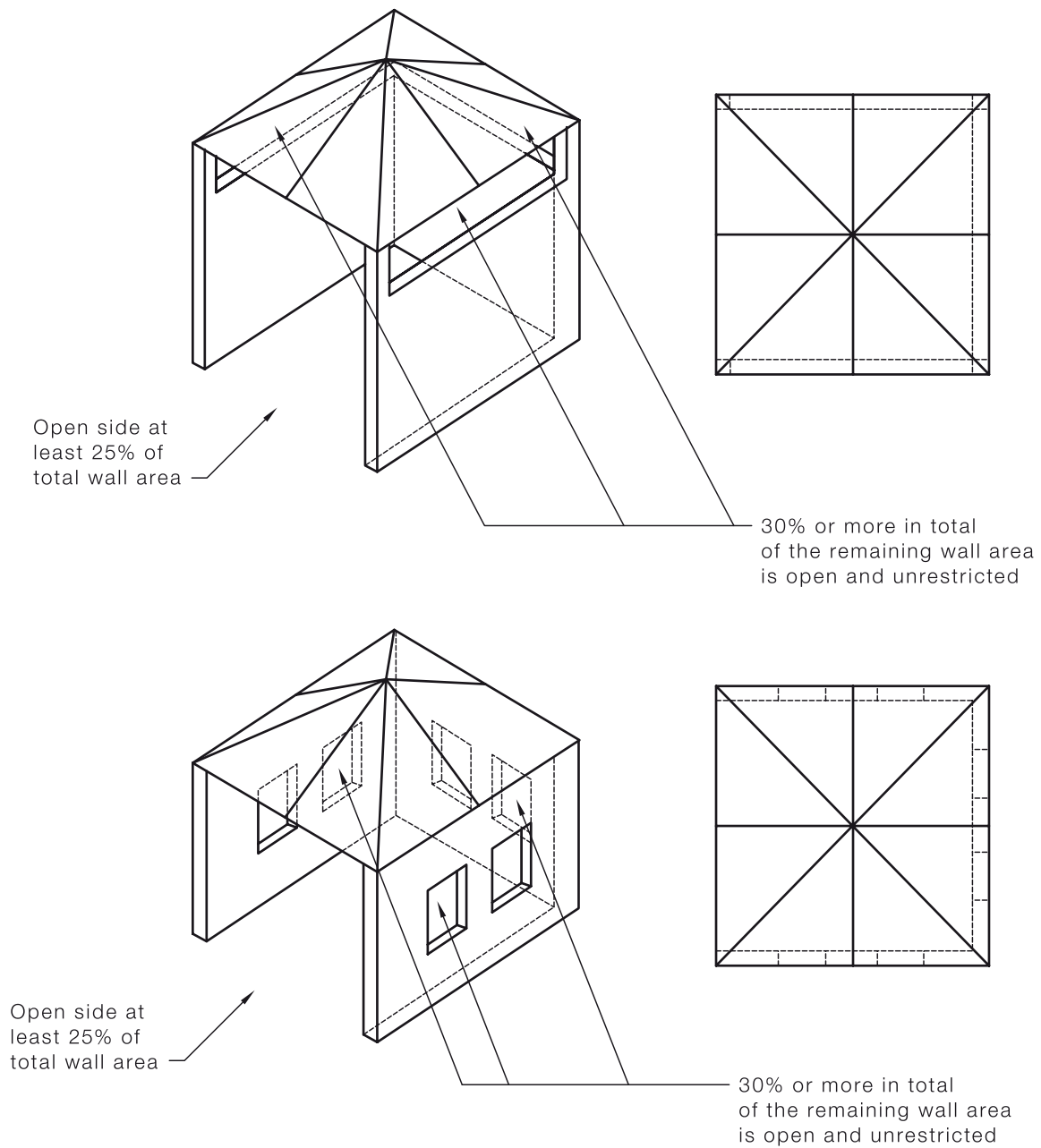


FIGURE 2.1 (in part) EXAMPLES OF ADEQUATELY VENTILATED AREAS



NOT TO SCALE

FIGURE 2.1 (in part) EXAMPLES OF ADEQUATELY VENTILATED AREAS

SECTION 3 GENERAL REQUIREMENTS

3.1 SCOPE OF SECTION

This Section sets out requirements and recommendations for the storage and handling of LP Gas that apply to both cylinders and tanks. Requirements and recommendations that are specific to certain types of storage, and to installations, piping and fittings, are given in later sections of this Standard.

3.2 RESTRICTIONS ON IGNITION SOURCES

Throughout this Standard, reference is made to hazardous areas as specified in AS/NZS 60079.10.1. Unless specifically stated otherwise, sources of ignition are not permitted within a hazardous area.

NOTE: Hazardous areas are not commonly defined for storages less than 25 L but may be required to be defined in some non-domestic situations, particularly where there is restricted ventilation.

A vehicle is not regarded as being an ignition source while it is entering or leaving a hazardous area but shall be turned off when standing or during any fuel transfers (except in the case of LP Gas road tankers).

Personal equipment, including pagers and mobile phones, shall also be considered as possible ignition sources and guidance on the requirements and use of such equipment in hazardous areas is included in AS/NZS 60079.14.

3.3 PIPES, VALVES AND FITTINGS

All pipes, valves and fittings for service with LP Gas liquid shall have a minimum design pressure rating of 2.4 MPa.

3.4 CONTROL OF ACCESS

All installations shall be appropriately secured against unauthorized access.

3.5 SEPARATION DISTANCES

3.5.1 General

Installations for LP Gas shall be separated from boundaries and protected places by the minimum distances relevant to each type of storage or use, as specified in the relevant sections of this Standard, with the additional requirements and qualifications as set out in this Clause (Clause 3.5).

3.5.2 Separation to protected places on adjoining properties

The separation distance to a protected place on another property shall be at least that given in the relevant table.

If this distance has been measured across a boundary, and alterations on the adjacent property result in a breach of the separation distance, the installation shall be modified or relocated to restore compliance, or taken out of service.

NOTES:

- 1 The use of a protected place distance measured to the boundary of the adjacent property is recommended to eliminate future problems, but such use is a commercial decision.
- 2 A formal agreement or covenant is recommended.

3.5.3 Changed site conditions

Where alterations on the installation site or an adjoining property, result in a breach of the separation distances or distances to fixed ignition sources, the affected installation (e.g. cylinders, tanks, vents, fill points, piping, etc.) shall be brought into compliance.

3.6 FIREWALLS AND VAPOUR BARRIERS

3.6.1 General

Building walls and fences shall be treated as firewalls or vapour barriers provided that they qualify as such.

For auto gas installations, see Clause 10.5.11.

Vapour barriers may be used to achieve the separation distances required to ignition sources and public places.

Separation distances shall be measured in a horizontal plane around the end of any intervening vapour barrier or firewall that complies with the following requirements as applicable:

- (a) *For ignition sources* The top of the vapour barrier or firewall shall be at least above the level of any hazardous area associated with a potential or actual LP Gas release point in normal operation. Safety valves, relief valves and drain valves are not considered release points.
- (b) *For public places* The top of the vapour barrier or firewall shall be at least 0.5 m above the level of any potential or actual LP Gas release point in normal operation. Safety valves, relief valves and drain valves are not considered release points.
- (c) The clearance between an LP Gas tank and a vapour barrier or firewall shall comply with Clause 6.3.2.

3.6.2 Vapour barriers

A vapour barrier shall comply with the following requirements:

- (a) The vapour barrier shall be impervious to LP Gas vapour over the whole of the area around which the separation distance is to be measured.
- (b) The vapour barrier shall be made of a non-combustible material. Its construction shall be sufficiently durable for the site conditions.

3.6.3 Firewalls

Where the separation distance is to a protected place, the vapour barrier shall also be a firewall. Separation distances shall be measured in a horizontal plane around the end of any intervening firewall that complies with the following requirements:

- (a) Comply with the requirements for vapour barriers; and
- (b) Have an FRL/FRR of 240/240/240 in accordance with AS 1530.4 or NZS/ISO 834.

A wall on an adjacent property shall not be used as a firewall unless by agreement between the parties concerned.

NOTES:

- 1 The use of a protected place distance measured to the boundary of the adjacent property is recommended to eliminate future problems, but such use is a commercial decision.
- 2 A formal agreement or covenant is recommended.

3.6.4 Thermal screens

Thermal screens may be provided as appropriate for the protection of facilities or personnel from heat radiation in event of a fire.

A thermal screen shall comply with the following requirements:

- (a) The thermal screen shall be constructed of non-combustible materials. It shall be firmly supported so as to be capable of withstanding short-duration LP Gas flash fires.

NOTE: Flash fires rarely exceed 20 s duration.

- (b) The thermal screen shall be of sufficient dimensions to ensure that any connections and associated pipework to the LP Gas vessel or any other operable fittings are not in line of sight from the area being protected.
- (c) For vertical tanks, the thermal screen need not be more than 0.5 m above the highest point of potential or actual release of LP Gas in normal operation. Safety valves, bleed valves and drain valves are not considered release points.
- (d) The thermal screen shall be at least 1.8 m high.
- (e) The thermal screen shall comply with the ventilation and access requirements of Clause 6.3.2.

NOTE: Blank masonry walls, or zinc-coated or pre-painted profiled steel sheeting with a minimum thickness of 0.42 mm and firmly supported on metal framework with 50 mm × 50 mm × 5.0 mm RHS uprights and rails or equivalent, are suitable.

SECTION 4 CYLINDERS AND CYLINDER SYSTEMS

4.1 SCOPE AND APPLICATION OF SECTION

This Section provides requirements and recommendations for the location, design and construction of cylinders, and for the supply of LP Gas from those cylinders, either directly from a cylinder to an individual appliance, or from single or multiple cylinders via a piping system for use away from the cylinder(s).

This Section also applies to the storage of cylinders and non-refillable containers ('cartridges') that are not connected for use.

NOTE: The design and construction of gas-burning equipment, and the installation of such equipment, is generally covered in other Standards.

4.2 CYLINDERS

4.2.1 Compliance with Standards

In Australia, cylinders shall comply with AS 2030.1.

In New Zealand, cylinders shall comply with the Hazardous Substances (Compressed Gases) Regulations.

NOTE: The New Zealand Environmental Protection Authority (EPA) Technical Guide—*Guide to Gas Cylinders* will assist in this regard.

4.2.2 Exchange-fill cylinders

A cylinder shall not be fitted with a gas release type of fixed liquid level gauge if it is—

- (a) intended to be refilled by mass (as described in Clause 8.2.1 for Australia and Clause 9.2.1 for New Zealand);
- (b) larger than 25 L capacity; or
- (c) larger than 50 L capacity automotive fuel container.

4.2.3 In situ fill cylinders

A cylinder for in situ filling applications shall be not less than 100 L capacity, and shall be provided with a filling connection that incorporates a 1¼ inch male Acme thread and one of the following:

- (a) A dual non-return valve and a fixed liquid level gauge which shall indicate a maximum liquid level equivalent to 4 L less than the standard filling level for a cylinder of that particular size.
- (b) A non-return valve and an automatic fill limiter (AFL) that stops the filling at 80% of the standard filling level. Such a device shall be appropriate for the orientation of the cylinder when being filled.

The pumping rate shall be appropriate to the cylinder size, so as to minimize the risk of overfilling.

In New Zealand, in situ fill cylinders shall conform with the New Zealand Environmental Protection Authority (EPA) Approved Code of Practice, *In-situ Filling of LPG Cylinders*, available from the Liquefied Petroleum Gas Association of New Zealand (LPGA).

4.2.4 Cylinders to be filled by decanting

Any cylinder intended to be filled by a decanting method that is monitored by means of a fixed liquid level gauge shall not exceed 25 L capacity, or 50 L capacity if used as a fuel container for a vehicle engine.

4.2.5 Liquid withdrawal cylinders

Any cylinder used for liquid withdrawal, other than an automotive fuel container, shall be marked in accordance with Appendix D.

4.2.6 Butane cylinders

Cylinders designed to contain butane exclusively shall incorporate connecting fittings that are not interchangeable with those for other LP Gas service.

4.3 REGULATORS AND PIPING FOR CYLINDER SYSTEMS

4.3.1 Regulators

A1

Regulators shall comply with the following requirements:

- (a) Regulators for cylinder-supplied systems shall comply with Clause 5.5.8.
- (b) The cylinder regulator shall be either of the following:
 - (i) Fixed rigidly to an adequate support that is independent of the cylinder and mounted with the diaphragm vertical and the vent pointing vertically downwards.
 - (ii) For cylinders exceeding 400 L and having lockable domes, connected directly to the valve outlet, or as close as the fittings will practically allow.

Gas pressure regulators shall be located to permit drainage of any liquid back into the cylinder.
- (c) Pipework connecting the regulator to the cylinder shall comply with Clauses 4.3.3 and 5.6.

The outdoor discharge from a vent terminal, gas-pressure-relief device or terminal of a vent line shall be—

- (i) arranged to minimize the risk of vapour collecting in drains, gutters, and downpipes;
- (ii) not less than 0.5 m in any direction from any opening into a building; and
- (iii) located such that there is no fixed source of ignition in the area 0.5 m above and 1 m laterally from the discharge and extending to ground level at a distance 1 m laterally (refer to Figure 4.3.1).

The vent terminal shall have provision to exclude rain and insects.

Vent discharge piping shall be treated as low-pressure vapour piping. The venting requirements of AS/NZS 5601.1 shall be met.

In New Zealand, regulators used indoors and manufactured to BS 3016, EN 12864, EN 13786 or EN 13785 are deemed to comply and further compliance with this Clause is not required.

A1

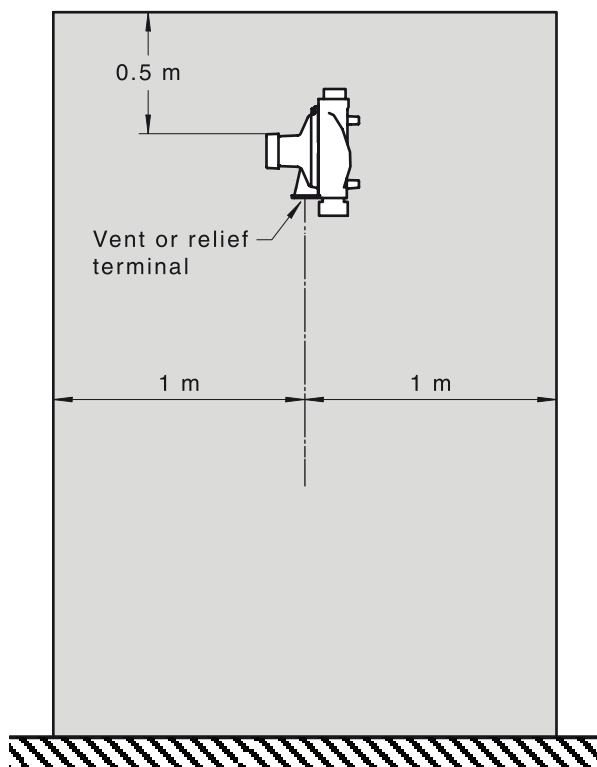


FIGURE 4.3.1 REGULATOR VENT IGNITION SOURCE EXCLUSION ZONE

4.3.2 Location of regulator

The location of a regulator shall comply with the following:

- (a) Any first stage regulator shall be outdoors, except where the regulator is attached to a cylinder that is permitted to be used indoors (see Clause 4.4).
- (b) Second stage regulators shall be installed in accordance with AS/NZS 5601.1.
- (c) A single-stage regulator or the first stage of a multi-stage regulator shall be located so that the length of the piping that is subject to cylinder pressure is as short as practicable.

4.3.3 Piping

The following requirements apply to the piping in a cylinder installation:

- (a) The piping between a cylinder and a manifold or a first-stage regulator shall be either of the following:
 - (i) Annealed copper tube—
 - (A) complying with AS 1572;
 - (B) having an alloy designation of 122 in accordance with AS 2738; and
 - (C) with a minimum wall thickness of 1.22 mm and a nominal size of 6 mm or 9 mm in industrial or commercial applications.
 - (ii) A flexible pigtail—
 - (A) complying with AS/NZS 1869;
 - (B) having a maximum length of 600 mm;
 - (C) having a nominal size of 6 mm or 9 mm in industrial or commercial applications; and

- (D) for a non-metallic lined flexible pigtail, having a maximum life of 6 years from the date of manufacture.
- (b) The piping as specified in Items (a)(i) and (a)(ii) shall be as short as practicable and not more than 1 m in length.
- (c) The cylinder and piping shall be installed such that any liquid formed in the piping will drain freely back into the cylinder. Any such liquid shall not be allowed to drain back to the regulator.
- (d) The relevant requirements of Clause 6.8 shall apply.
- (e) Manifold piping shall comply with the requirement of Clause 5.6.

4.4 CYLINDERS IN USE

4.4.1 General

This Clause (Clause 4.4) applies to the location of cylinders in use. A cylinder 'in use' is one that is connected to a system for the withdrawal of LP Gas.

4.4.2 Location of cylinders

All cylinders in use shall be located outdoors except where—

- (a) the cylinder is the fuel container for a vehicle that is used or garaged indoors; or
- (b) permitted by Section 2 or Clause 4.4.4.

4.4.3 Prohibited locations for cylinders

Any cylinder and its associated equipment shall not be installed in any of the following locations:

- (a) Within a building, except where permitted by this Standard.
- (b) Under a stairway.
- (c) In a location with restricted access, where inspection, refilling or exchange of the cylinder is restricted, obscured or hazardous to the operator.
- (d) Where nearby constructions, fences, walls or vapour barriers could prevent cross-ventilation.
- (e) Under a building, except where permitted by Clause 4.4.8.
- (f) Where the cylinder, or an incident involving the cylinder and its contents, could obstruct egress from a building.
- (g) Buried in the ground, (see Note).

NOTE: This does not limit innovative design in conjunction with appropriate authority.

4.4.4 Cylinders indoors

4.4.4.1 General

The use of LP Gas cylinders indoors is not recommended. Where an outdoor cylinder and piping system is not provided, indoor usage of cylinders shall be restricted to portable appliances and equipment as specified in Section 2 of this Standard or in Clauses 4.4.4.2 or 4.4.4.3.

The retention of reserve or exhausted cylinders indoors shall be avoided where practicable.

NOTE: In New Zealand, only the quantities set out in Table 2.1 are allowed indoors.

4.4.4.2 Volumes of LP Gas indoors—Cylinders

The following volumes and restrictions shall apply to LP Gas cylinders in use indoors in factories and warehouses:

- (a) Where the floor area is less than or equal to 200 m², Section 2 of this Standard applies.
- (b) Where the floor area is greater than 200 m², a maximum volume of 500 L (water capacity) of LP Gas per 200 m² of floor area applies.
- (c) Such groups of cylinders [as described in Item (b)] shall be separated by at least 15 m. Cylinders in such groups need not be manifolded, and may supply different consuming appliances.

4.4.4.3 Volumes of LP Gas indoors—Non-refillable containers

Where non-refillable containers of LP Gas are kept indoors, the following maximum quantities shall apply:

- (a) In buildings frequented by the public—100 L.
- (b) In warehouses—300 L in any one location. If additional storage locations are required on the same floor in the same building, they shall be separated by at least 10 m.

4.4.5 Cylinders outdoors

Cylinders that are installed outdoors shall be located in accordance with the following requirements:

- (a) Cylinders shall be separated from protected places, public places and railways lines by the distances given in Table 4.1.
- (b) Where cylinders are adjacent to a building, they may be placed next to each other in a group of up to 2500 L water capacity. Where there is more than one such group, there shall be a minimum distance of 3 m between the cylinder groups (see Figure 4.1).
- A1 | (c) Where a cylinder is adjacent to a building, and any opening into the building is below the level of the cylinder's pressure relief valve, the nearest cylinder shall be at least 1 m away, measured horizontally. Refer to Figures 4.2 and 4.3.

In New Zealand, if the quantity of LP Gas totals 100 kg or more, the separation distance to openings into buildings increases to 2 m.
- A1 | (d) Where a cylinder is installed beneath a window, the distance between the top of any cylinder valve and the bottom of the window's opening shall be at least 150 mm for exchange cylinders or 500 mm for in situ fill cylinders. Refer to Figures 4.2 and 4.3.
- A1 | (e) Where a cylinder is adjacent to a drain, the distance between the drain and the nearest cylinder shall be at least 1 m measured horizontally. Refer to Figures 4.2 and 4.3.

NOTE: Weepholes are not considered openings into the building for the purpose of this Clause.

4.4.6 Hazardous area requirements

The hazardous zone surrounding a gas cylinder, as specified in AS/NZS 60079.10.1, shall be maintained free of ignition sources.

NOTE: Appendix E illustrates hazardous areas for common cylinder situations where the aggregate exceeds 25 L. Under some circumstances, particularly in confined spaces, caution should also be taken with smaller quantities as these may also give rise to hazardous areas.

The following exceptions apply to the exclusion of ignition sources from such areas:

- (a) The presence of a door or window above a cylinder is deemed not to create a hazardous area within the building, provided that the installation complies with the requirements of Clause 4.4.5(d).
- (b) This requirement does not apply to the location of a flame or igniter of a gas appliance and its supplying cylinders where—
 - (i) the cylinder capacity does not exceed 25 L;

- (ii) in Australia, both the cylinder and the appliance are located outdoors, either as a fixed installation or as a portable or mobile appliance unit; and
- (iii) heat from the appliance will not cause the design temperature of the cylinder to be exceeded.

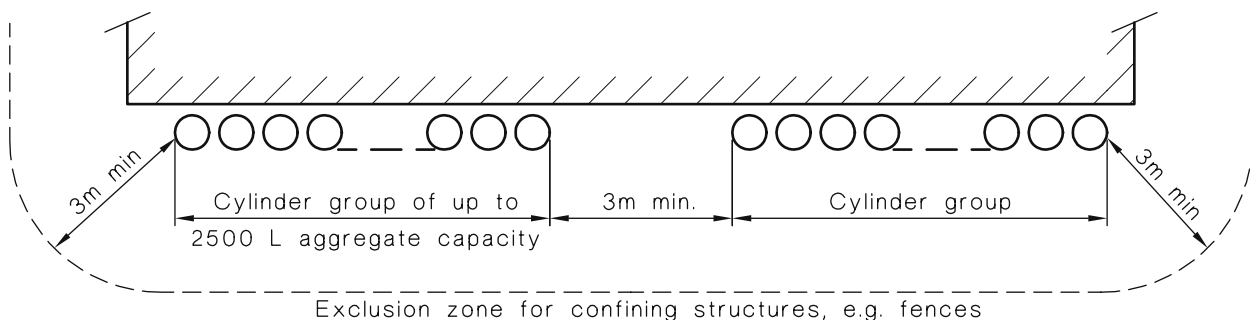
TABLE 4.1
CYLINDER LOCATIONS

1	2	3
Aggregate capacity of cylinders (water capacity)	Minimum distance from public places or railway lines	Minimum distance from a protected place
L	m	m
0 ≤1 000	0	0
>1 000 ≤2 500	1.5	3.0*
>2 500 ≤6 000	3.0	4.5
>6 000 ≤12 000	3.0	6.0
>12 000 ≤120 000	4.5	8.0
>120 000	8.0	15.0

* This distance may be reduced to zero where there are no other confining structures (other than the protected place in question), such as a solid fence or building, within 3 m.

NOTES:

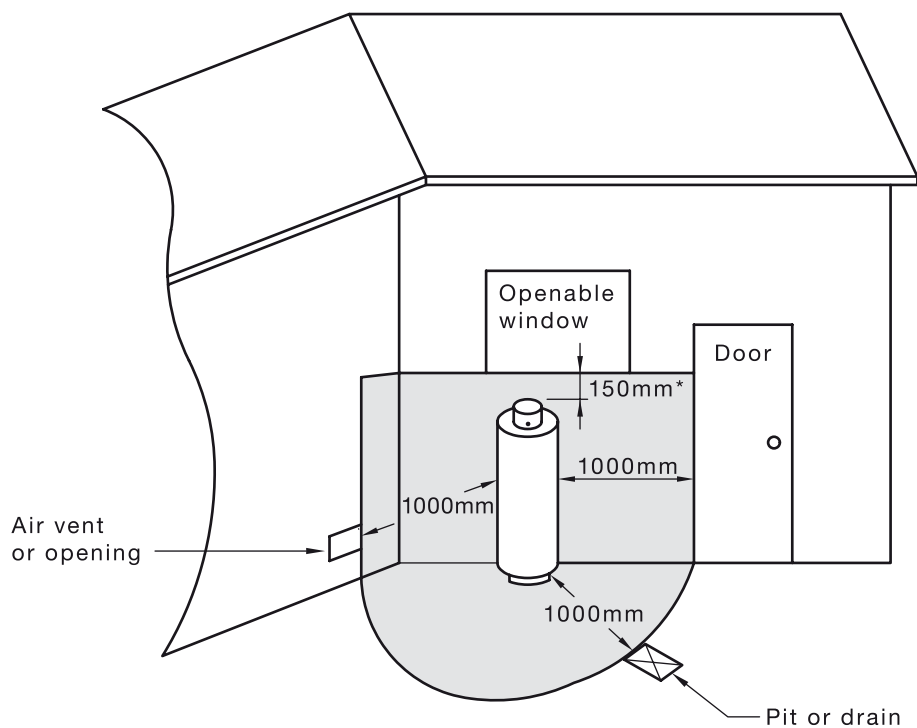
- 1 The distances are measured horizontally.
- 2 The boundary from adjacent private property is not considered to be a protected place. A separation distance may be measured across a boundary to the nearest protected place on that site, if any, but Clause 3.5.2 imposes a condition that is a potential penalty if the adjoining property is further developed.



NOTES:

- 1 Cylinders in groups need not be manifolded and may supply different installations.
- 2 Additional requirements apply if the cylinders are filled in situ. See Clause 4.4.11.
- 3 See Table 4.1 for separation distances.
- 4 Separation distances may be measured in a horizontal plane around the end of any intervening vapour barrier or firewall (see Clauses 3.5 and 3.6).

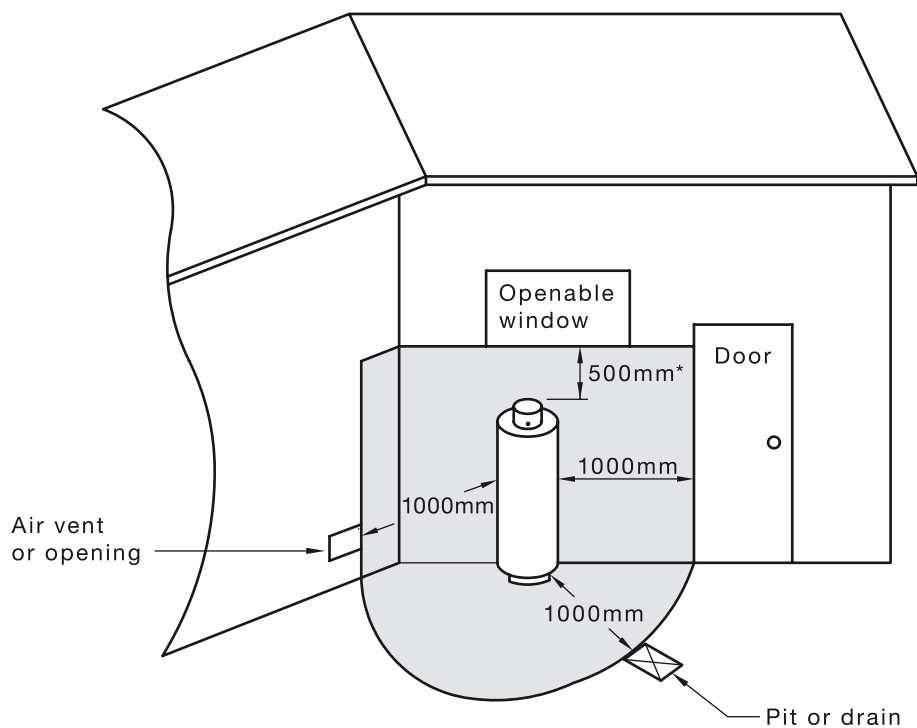
FIGURE 4.1 SEPARATION DISTANCES FOR CYLINDER GROUPS



* This distance is measured from the top of any cylinder valve

NOTE: In New Zealand, if the quantity of LP Gas totals 100 kg or more, the separation distance to openings into buildings increases to 2 m.

FIGURE 4.2 EXCHANGE CYLINDER LOCATION



* This distance is measured from the top of any cylinder valve

NOTE: In New Zealand, if the quantity of LP Gas totals 100 kg or more, the separation distance to openings into buildings increases to 2 m.

FIGURE 4.3 IN SITU FILL CYLINDER LOCATION

4.4.7 Cylinders on a verandah

Where cylinders are located on a verandah, the following requirements apply:

- (a) The location shall be nominally at ground level.
- (b) The verandah shall be open on all three sides.
- (c) The wall against which the cylinders are located shall be free of windows and doors as required by AS/NZS 5601.1.
- (d) The verandah floor shall be free of drains as required by AS/NZS 5601.1.
- (e) The hazardous area around the cylinders shall be free of fixed ignition sources, as illustrated in Appendix E.
- (f) The cylinders shall not be subject to physical damage, heat or vibration.
- (g) A maximum of 90 kg shall be kept on a verandah complying with this Clause.

The location of such cylinders is shown in Figure 4.4.

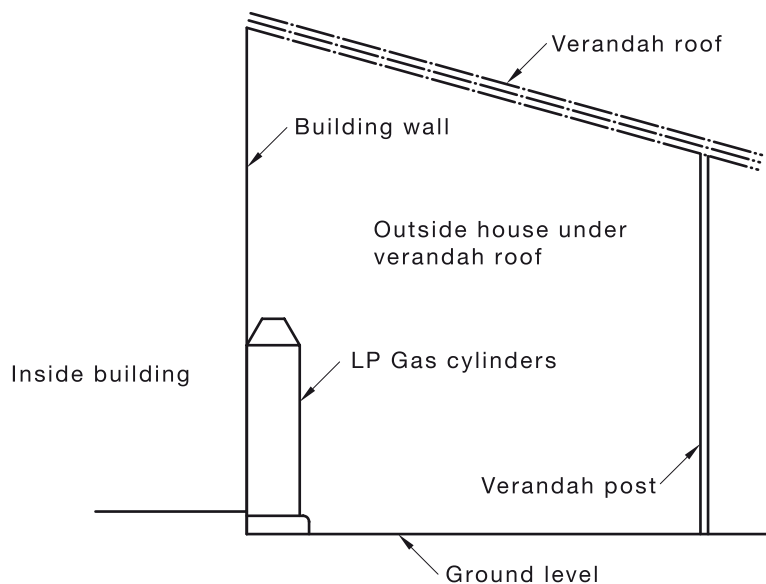


FIGURE 4.4 LOCATION OF CYLINDERS ON A VERANDAH

4.4.8 Cylinders under a building supported by piers

Where a cylinder is located under a building supported by piers, the following requirements apply:

- (a) There shall be a vertical clearance of at least 800 mm between the top of the neck ring of the cylinder and the underside of any overhanging part of the building.
- (b) No part of the cylinder shall be more than 800 mm within the perimeter of the building's walls (see Figure 4.5, side view).
- (c) The area between the piers shall be—
 - (i) open on at least three sides; or
 - (ii) enclosed by a construction through which cross-ventilation can occur (e.g. slats or battens) on at least three sides; or
 - (iii) a combination of Items (i) and (ii) above.

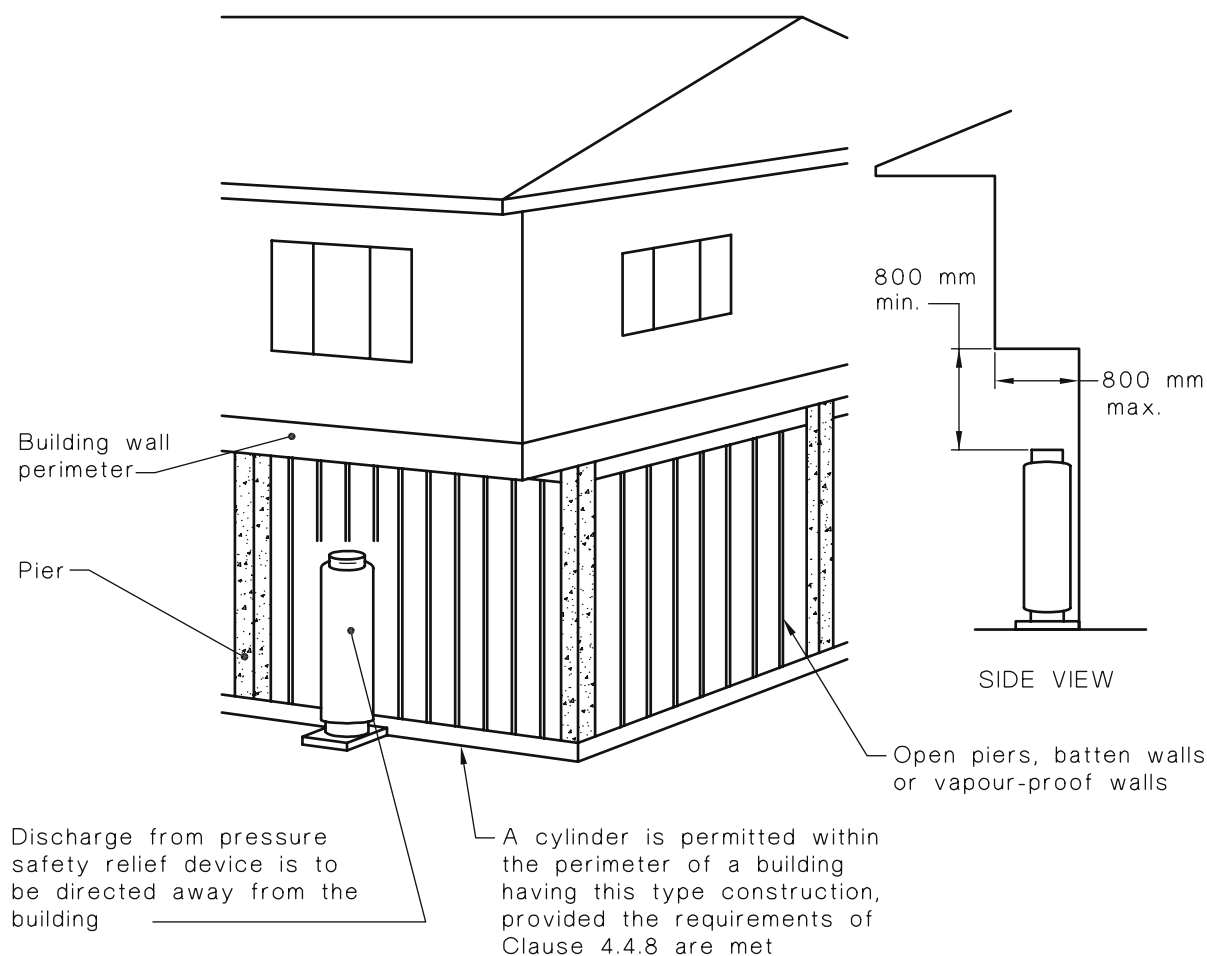


FIGURE 4.5 LOCATION OF CYLINDER UNDER A BUILDING

4.4.9 Cylinders in enclosure or recess

Where a cylinder is to be installed in an enclosure or recess, the enclosure or recess shall be designed to—

- (a) house cylinders and their associated equipment only;
- (b) allow free unimpeded discharge from each cylinder safety valve;
- (c) ensure that water will not accumulate on the base; and
- (d) ensure the cylinder and its associated equipment are clear of the surrounding soil.

Enclosures of sheet metal or similar impervious construction shall have ventilation openings at the top and bottom with each opening providing a free area of at least 0.02 m² for every cylinder enclosed.

4.4.10 Cylinders in public locations

Where a cylinder exceeding 12 L capacity is permanently installed for public use in a location having unrestricted public access, the following requirements shall apply:

- (a) Either—
 - (i) the cylinder and any associated regulator shall be enclosed in a lockable cage or cabinet ventilated at the top and bottom; or
 - (ii) the cylinder valves and regulator shall be guarded by a covering metal hood and the cylinder protected against accidental dislodgment.

- (b) The connecting piping shall be arranged so that it is not vulnerable to tampering or accidental impact.

Any lockable enclosure as described in Items (a)(i) and (a)(ii) shall be kept locked when not in use.

These requirements do not apply to cylinders on caravans or mobile homes, or to cylinders attached to any cabins for hire or domestic dwelling associated with the site.

4.4.11 Installing cylinders

NOTE: Authorities in most areas permit only specifically licensed persons to make, repair, alter, or open connections in any installation for LP Gas cylinders, except for their actual connection or disconnection.

Cylinders shall be installed in accordance with the following requirements.

- (a) Cylinders shall be installed on a firm, level, non-combustible base, not resting on soil. The floor or base shall be constructed so that water cannot accumulate within any enclosure or recess.
- (b) Cylinders shall not be stacked on top of each other.
- A1 | (c) Any cylinder greater than 25 L and less than 200 L water capacity shall be restrained from falling.
NOTE: This includes a cylinder located in an area likely to be subject to flooding or seismic activity. Cylinders greater than 200 L or less than 25 L are typically inherently stable.
- (d) In New Zealand, any cylinder larger than 25 L shall be restrained against seismic activity.
- A1 | (e) The selection of the location of cylinder installations shall consider minimization of the impact hazard by locating cylinders away from likely vehicle paths.
Commercial/industrial cylinder installations shall be protected and the impact requirements for the proposed site assessed in accordance with Appendix Q.
NOTE: A frame may be used where the cylinder is not connected to external pipework.
- (f) Cylinders shall not be installed below ground level unless there is sufficient ventilation to prevent the accumulation of any leaking gas.
- (g) A cylinder shall be installed so that the pressure-relief valve is in contact with the vapour space and any discharge from this valve is directed away from any adjacent cylinders or combustible structures.
- (h) A cylinder intended to be exchanged or removable shall be connected to a fixed piping system complying with Clause 4.3.3.
- (i) Vapour-service cylinders shall be installed so that the point of LP Gas withdrawal is in contact with the vapour space.
- (j) Where two or more exchange cylinders are connected for use, a means shall be provided to permit the cylinders to be isolated from the gas supply, to allow the cylinders to be disconnected. This shall be achieved by either of the following:
 - (i) 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 change-over regulator.
 - (ii) Isolating valves shall be installed on the manifold, to allow each cylinder to be individually disconnected from the manifold without depressurizing the manifold.

4.4.12 Additional requirements for cylinders for in situ filling

An installation of cylinders intended for in situ filling shall comply with the following requirements:

- (a) Cylinders other than those specifically fitted for the purpose shall not be used for in situ filling installations (see Clause 4.2.3).
- (b) In situ fill cylinders shall be located outdoors.
- (c) In situ cylinders shall only be filled by connection of the delivery hose directly onto the fill valve on the cylinder.
- (d) An opening into a building shall not lie within an area 0.5 m above and 1 m laterally from the cylinder or its valves and fittings (see Figure 4.3).
- (e) In situ filling shall be conducted in accordance with the requirements of Clause 11.12 and with regard to the hazardous areas defined in AS/NZS 60079.10.1 for in situ fill cylinder locations (see also Figure 4.3).
- (f) A cylinder having a capacity of 200 L or less shall be restrained and prevented from falling.
- (g) The cylinder shall be placed on a suitable base, raised at least 50 mm above the surrounding level, the top surface of which shall be such as to shed water from the base of the cylinder.

NOTE: Surfaces that are prone to indentation over time, e.g. bitumen (which could soften when exposed to heat), are not considered suitable because of the possibility of water accumulating in the depressions.

- (h) Where a cylinder installation is vulnerable to falling objects, the cylinder valves, regulator and piping shall be provided with protective guards. Particular attention shall be paid to the risks of impact or cylinder dislodgment due to ice and snow, where appropriate.

In New Zealand in situ fill cylinders shall conform to the New Zealand Environmental Protection Authority (EPA) Approved Code of Practice HSNOCOP 38, '*In-situ Filling of LPG Cylinders*' available from the LPGA.

4.5 CYLINDER STORAGE

4.5.1 General

This Clause (Clause 4.5) sets out requirements for LP Gas cylinders that are stored but not connected for use.

4.5.2 Site requirements

The following requirements and recommendations apply to the area in which cylinders are stored:

- (a) The location shall ensure that cylinders are not liable to physical damage, tampering, or excessive temperature rise. This requirement shall not be taken to preclude storage in an open area, exposed to the sun.
- (b) The standing area (other than a floor) shall be level, non-combustible and not prone to indentation such that water could accumulate or the cylinders could be dislodged. Any floor shall be concrete or other non-combustible material, hardwood or other suitable material, with or without suitable floor coverings.

Where there is a space between the floor and the ground, such a space shall be either completely filled with a non-combustible solid material or ventilated in accordance with Clause 8.3.3 (for Australia) and in accordance with Clause 6.2.3 (for New Zealand).

- (c) Buildings used for cylinder storage shall have non-combustible cladding for walls and roof and shall be ventilated by natural or mechanical means in accordance with the ventilation requirements of Clause 4.5.5.
- (d) Cylinders in a mixed cylinder storage area shall be segregated from any oxidizing gases by at least 3 m. This segregation distance may be measured horizontally around a vapour barrier complying with the requirements of Clause 3.6 and as illustrated in Figure 4.6.
- (e) Cylinders awaiting despatch may be kept on a filling platform in accordance with Clauses 8.3.2 and 8.3.3 (for Australia) and in accordance with Clauses 9.2.3 and 9.3.4 (for New Zealand).

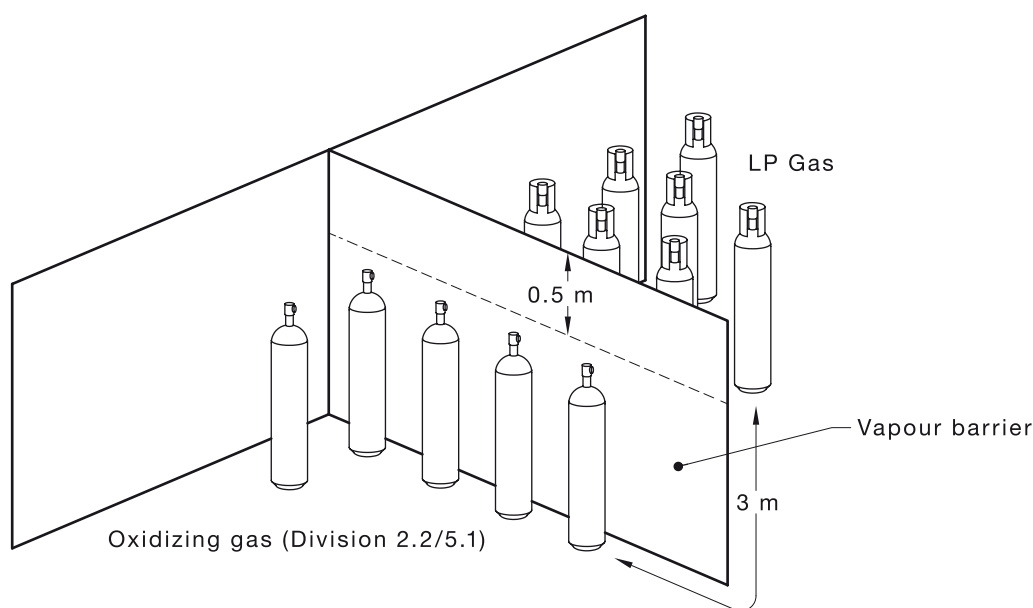


FIGURE 4.6 USE OF VAPOUR BARRIER TO ACHIEVE SEGREGATION

4.5.3 Separation distances

Cylinders stored in the open or within a building shall be located at the distances given in Table 4.1, and the following requirements shall apply:

- (a) A cylinder shall be at least 1 m horizontally away from an opening into, and shall be outside of, any building that is not used solely for storage, filling and/or handling of gas cylinders.
- (b) The distance between any cylinder and any above-ground LP Gas storage tank or flammable or combustible liquid storage that exceeds 250 L capacity shall be at least 3 m.

Cylinders shall not be stored within any compound (bundled area) for flammable liquid storages.

- (c) The distance between any two groups of cylinders shall be not less than the protected-place distance for the larger group. Otherwise, the separation distance shall be based on the aggregate volume of the two groups.
- (d) Cylinder filling locations complying with Section 8 in Australia, or Section 9 in New Zealand, shall not be treated as protected places.
- (e) Clause 3.6 shall apply.

4.5.4 Cylinder storage and handling

The following additional requirements shall apply to the storage of cylinders, including those that are empty but not gas free:

- (a) The outlet valve shall be kept closed or the cylinder opening plugged.
- (b) Where a cylinder is designed to incorporate a detachable valve cap, the cap shall be kept in place when the cylinder is not in use.
- (c) Cylinders shall be handled carefully and not allowed to fall upon one another or be otherwise subjected to undue shock.
- A1 | (d) Cylinders shall be located to prevent movement or physical damage. Valves shall be safeguarded against physical damage in accordance with AS 2473.
- (e) Cylinders shall be placed so that the safety relief device will always be able to vent the vapour space.

4.5.5 Ventilation of cylinder stores

4.5.5.1 General requirements

Cylinder stores shall be provided with adequate ventilation complying with the following requirements:

- (a) The ventilation system shall—
 - (i) be capable of diluting and removing any vapour or gas from the store, so that such levels within the store are within workplace exposure limits and below any possible explosive levels in normal situation;
 - (ii) provide sufficient fresh air from outside, to reduce any risk of asphyxiation;
 - (iii) ventilate the atmosphere in the store, at both high and low levels relative to the floor; and
 - (iv) ventilate or mechanically exhaust directly to outside the store, to a location away from building entrances, doors or windows, airconditioning intakes, sources of ignition and areas where people are likely to congregate.
- (b) The requirements of (a) shall be satisfied by either—
 - (i) a natural ventilation system, as specified in Clause 4.5.5.2; or
 - (ii) a mechanical ventilation system, as specified in Clause 4.5.5.3.

Compliance with the above may not achieve a reduction in hazardous areas as specified in AS/NZS 60079.10.1.

4.5.5.2 Natural ventilation

A naturally ventilated store shall have one of the following:

- (a) Two opposing external sides that are open from floor to ceiling [see Figure 4.7(a)].
- (b) One external side that is open, provided that the length of the open side is at least twice the distance of that wall from the opposite side [see Figure 4.7(b)].
- (c) Vents in at least one pair of opposing external sides [see Figure 4.7(c)], provided that—
 - (i) the distance between the opposing external walls does not exceed 10 m;
 - (ii) in every two-metre length of external opposing walls, there are at least two vents, one positioned immediately above the floor and the other positioned immediately below the ceiling;

- (iii) the total area of vents per meter length of wall is at least 0.1 m²; and
- (iv) vents are evenly distributed along the walls.

Care shall be taken to ensure that any nearby embankments, excavations, or retaining walls do not interfere with the operation of the natural ventilation system.

NOTE: The openings to a natural ventilation system may be covered by one of the following:

- (a) Wire mesh or grille.
- (b) Louvres.
- (c) For open, external sides only, chequered brickwork, vent bricks, slotted roller doors or equivalent.
- (d) Fire dampers, where required.

4.5.5.3 Mechanical ventilation

A mechanical ventilation system shall comprise fans, ducts, entry and exit registers and controls, and fire dampers where required. Such a system shall comply with the following:

- (a) Exhaust ventilation shall be used within the store.
- (b) The capacity of the system, in cubic metres per second for every square metre of floor space, shall be—
 - (i) for stores in which cylinders are kept but no LP Gas is decanted or filled, 0.005; or
 - (ii) for stores in which LP Gas is filled or decanted, 0.0075.
- (c) The air velocity at the register shall be at least 5 m/s.
- (d) Where localized exhaust ventilation is used, not more than 75% of its capacity shall be located at any one point. At least 25% of the capacity shall be available to ventilate the remainder of the store.
- (e) Any air intake or exhaust duct shall terminate in the open air, at distances of at least—
 - (i) 2 m from any opening to a building;
 - (ii) 4 m from the outlet of any chimney or flue; and
 - (iii) 3 m above the ground.
- (f) The ventilation system shall be designed so as to operate either—
 - (i) continuously; or
 - (ii) for sufficient time to allow two complete air changes before entry and continuously during occupation.

NOTE: Reference should be made to AS 1668.2 for requirements for mechanical ventilation systems.

4.6 EXCHANGE FACILITIES FOR PORTABLE CYLINDERS

Where portable exchange cylinders are kept in cages at service stations or other retail outlets, the requirements of Appendix F for Australia, or Appendix G, for New Zealand, respectively, shall apply.

The location of such facilities is illustrated in Figures F1 and G1 for Australia and New Zealand, respectively.

4.7 STORAGE OF LP GAS CYLINDERS ON TROLLEYS

LP Gas and oxygen cylinders may be stored together on trolleys for the purpose of LP Gas/oxygen cutting, brazing, melting, heating or similar purposes. In such situations—

- (a) the aggregate capacity of cylinders on any trolley shall not exceed 160 L; and
- (b) the aggregate capacity of LP Gas cylinders shall not exceed 110 L.

NOTE: AS 4839 should be consulted regarding the safe use of such equipment.

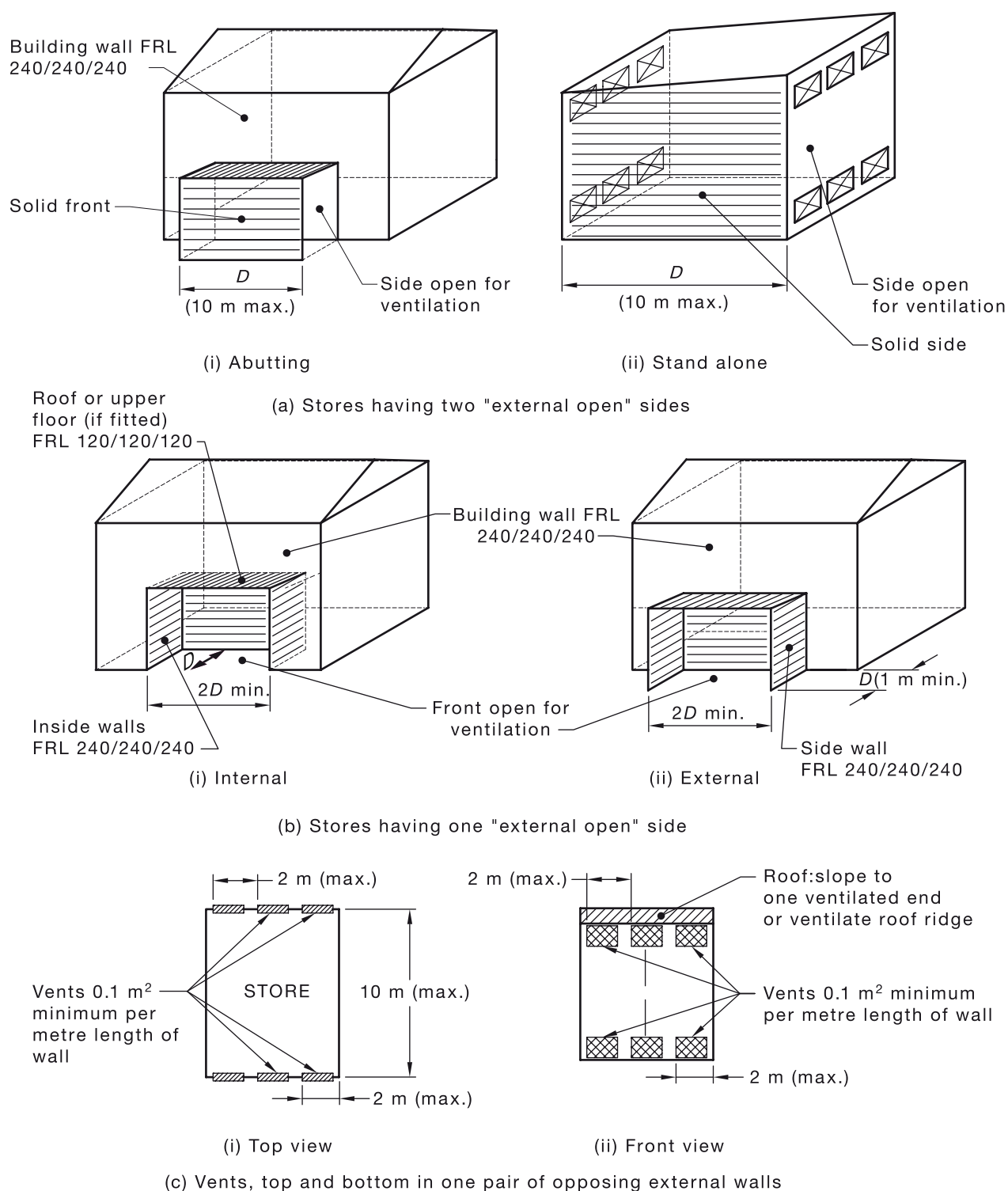


FIGURE 4.7 SCHEMATICS OF NATURALLY VENTILATED STORES

4.8 CYLINDER LOADING AND UNLOADING AREAS

4.8.1 General

An area may be established, in order to facilitate the loading and unloading of cylinders from vehicles. This area shall be outside of any hazardous area around the cylinder filling point or cylinder storage area.

Cylinders shall not remain in the loading and unloading area for longer than necessary to assemble a load for transportation or to remove them to the filling area for refilling.

The cylinder loading and unloading area shall be clearly identified by marking or signs.

4.8.2 Location of cylinders in loading and unloading areas

Cylinders shall be located in accordance with Clause 4.5.3, Items (a) and (b).

4.8.3 Ignition sources

Vehicles involved in the loading and unloading of cylinders within the area shall not be considered sources of ignition whilst engaged in loading or unloading the cylinders.

SECTION 5 COMPONENTS FOR TANK SYSTEMS

5.1 SCOPE OF SECTION

This Section specifies requirements for the design of components for LP Gas tank storage facilities.

Other Sections prescribe methods of installation for other types and locations of storages.

5.2 TANK DESIGN AND CONSTRUCTION

5.2.1 Materials of construction

An LP Gas tank shall be of steel, and shall comply with a pressure vessel design code in accordance with AS/NZS 1200.

5.2.2 New Zealand requirements

In New Zealand, if site-specific or application-specific requirements do not apply, an LP Gas vessel and its supports shall be as follows:

- (a) It shall be designed for LP Gas service with the vapour pressure being that of propane.
- (b) It shall have an above-ground service design temperature range of—
 - (i) for 1 kL to 5 kL -10°C to $+50^{\circ}\text{C}$;
 - (ii) for >5 kL to 26 kL -10°C to $+45^{\circ}\text{C}$; and
 - (iii) for above 26 kL -10°C to $+40^{\circ}\text{C}$.
- (c) It shall be designed to meet seismic loading in accordance with NZS 1170.5 (for all seismic zones).
- (d) It shall be capable of being filled with water for testing or purging purposes.

5.2.3 Australian requirements

In Australia, the following requirements apply:

- (a) Where AS 1210 is used, the design pressure shall be not less than that shown in Table 5.1, except where a design pressure for a specific condition is applied, when that condition is known. Examples are as follows:
 - (i) The service design temperature has been determined in accordance with AS 2872 and the maximum vapour pressure for the contents has been determined.
 - (ii) The tank is designed for the storage of an LP Gas for which the limits of composition and vapour pressure are known. Unless vapour pressure is calculated from the proportions of a known gas mixture, it shall be based on the use of propane.
NOTE: The more sophisticated special-purpose design techniques mentioned above are of no practical advantage for small tanks.
- (b) An underground tank shall incorporate lifting provisions, so that its protective coating is not damaged when the tank is handled.
- (c) A portable tank shall not exceed 8 kL capacity.
NOTE: Such a tank may be of Class 2A construction.

- (d) A skid tank shall not exceed 8 kL capacity. Lifting facilities shall be incorporated, and all fittings shall be internal unless a guard complying with AS 1210 is provided.
NOTE: Such a tank may be of Class 2A construction.
- (e) A demountable delivery tank shall comply with the requirements of AS 2809.3 for cargo tanks.
- (f) A freight container tank shall comply with AS 3711.6 and, if for service within Australia, the specific requirements herein for LP Gas tanks.
- (g) Any structural provisions for supporting the tank shall be designed in accordance with Clause 6.4.
- (h) Seismic loading shall be taken into account for any tank whose capacity exceeds 100 kL (see AS 1170.4). For vertical tanks, seismic and wind loading shall be taken into account for any capacity.

TABLE 5.1
DESIGN PRESSURES

Capacity-to-surface-area ratio of tank*	Design pressure, MPa	
	Propane	Butane
kL/m ²		
<0.15	1.90	0.825
≥0.15 ≤0.42	1.75	0.7
>0.42	1.55	0.525

* 'Capacity/area' as used here has the same meaning as the term 'volume/area' as used in AS 2872.

NOTE: These design pressures are valid for above-ground tanks only if the tanks are painted white. AS 1210 specifies penalties for any tank colour having a lesser heat-reflecting ability.

5.3 CONTROL OF LP GAS OUTFLOW

5.3.1 Minimization of outflow

Every opening through the tank shell shall be fitted with a means of preventing or minimizing the accidental or uncontrolled outward flow of LP Gas by the use of one of the following devices, as described in Table 5.2 and appropriate to the purpose of the opening:

- (a) A safety valve.
- (b) Primary and secondary shut-down systems of valves.
- (c) A flow-limiting orifice not greater than 1.4 mm diameter.
- (d) A plug or blank flange.
- (e) A multi-function valve (limited to openings into the vapour space of any single above-ground tank of 8 kL capacity or less). The vapour withdrawal portion shall incorporate all of the following features:
 - (i) A manual shut-off valve with attached hand-wheel or equivalent that is fitted directly to the opening, or is an integral part of or attached to a substantial fitting that is attached to the opening.
 - (ii) The opening through the multi-function valve is restricted by an orifice not exceeding 8 mm diameter, and located between the vapour space and the outlet of the shut-off valve.

- (iii) A regulator is attached directly to the multi-function valve, or is connected to it by a flexible annealed copper tube not more than 1 m long and is supported and protected on or at the tank; otherwise the vapour outlet is sealed with a metal plug.

An opening through a tank shell implies that the opening is the size of the tank nozzle as manufactured. However, reduction by means of a bush or flange is permitted, provided that no more than one such fitting is employed.

5.3.2 Safety valve

There shall be no valve or restriction of any type between a safety valve and the vapour space of the tank, except where reserve safety valves are provided under the conditions specified in Clause 5.4.3.

5.3.3 Openings for gauges

Where a gauge can be operated or serviced without opening a gas path through to the interior of the tank, the gauge may be treated as a blank flange or a plug, requiring no other protection.

Otherwise one of the following shall apply:

- (a) The opening shall be protected by—
 - (i) an orifice not greater than 1.4 mm diameter; or
 - (ii) an excess-flow valve.
- (b) The tank shall be depressurized prior to the gauge's service.

5.3.4 Shut-down system

5.3.4.1 General

Clauses 5.3.4.2 and 5.3.4.3 below should be read as specifying functions and not necessarily requiring self-contained and independent valves. The primary and the secondary functions may be incorporated in a single compound valve provided that all the functional requirements are provided.

5.3.4.2 Primary shut-down system

The primary shut-down system shall consist of a non-return valve except that, where outward flow is necessary, an excess-flow valve may be used. The design and installation of this valve shall be such that it will continue to function as a shut-down device should impact or shear-off occur to any external portion or attachment.

Where a multi-function valve complying with Clause 5.3.1(e) is used, a primary shut-down system is not required.

5.3.4.3 Secondary shut-down system

Where the primary shut-down system is a non-return valve, the secondary system shall comprise at least a manual positive shut-off valve, or, if the tank is 8 kL or less and the entry is for filling into the vapour space, another non-return valve that is gastight.

Where the primary shut-down provision is an excess-flow valve, the secondary system shall comprise—

- (a) for vapour connections, at least a manual positive shut-off valve; or
- (b) for liquid connections, an emergency shut-down system. For an opening into a tank that is not larger than 3/4 NPT and is used only for decanting into cylinders, a manual positive shut-off valve is permissible.

5.3.5 Tanks larger than 200 kL

The primary and secondary shut-down provisions may consist of a manual shut-off valve and another valve that can be shut off by remote actuation, by fire, or both. In such cases, both valves shall be located away from the tank shell and outside the horizontal outline (plan view) of the tank, provided that—

- (a) the pipe connecting to the tank is integral with the tank and designed as part of it;
- (b) the internal diameter of the attached pipe is not less than 100 mm;
- (c) the pipe is anchored and shear-protected at its outer end as for a remote connection;
- (d) the piping between the anchorage and the tank is protected from impact; and
- (e) the LP Gas installation, or the LP Gas portion of a composite installation, is continuously manned by persons able to operate the shut-off valves during that period when the tank is in service, i.e. when the valves are open.

5.4 SAFETY VALVES

5.4.1 Provision of safety valves

Safety valves shall be provided as required by the pressure vessel design code being used, with the following qualifications:

- (a) A safety valve shall communicate with the vapour space in the tank.
- (b) Safety valves shall be arranged so that the possibility of tampering is minimized. Any externally located pressure-setting adjustment shall be provided with a means of sealing or locking after setting.
- (c) Safety valves shall comply with AS 1271 or UL132 or other recognized Standard.

For Australia, the aggregate discharge capacity of the safety valve(s) shall not be less than that determined in accordance with Appendix H.

NOTES:

- 1 Care is necessary in determining the setting and capacity of safety valves for tanks with provisions for controlling the service temperature [see Clause 5.2.3(a)(i)] if the temperature of the LP Gas delivered is likely to be higher than the controlled design temperature.
- 2 Appendix H has been derived from the general formula of AS 1210, simplified to suit the particular case of LP Gas.

Where a stack pipe is fitted, a shear point shall be fitted downstream of the safety valve to ensure that impact or high wind loads cause failure at the shear point, the safety valve remains in the tank and containment is maintained.

5.4.2 Discharge provisions

Where installed, a safety valve and any discharge piping shall comply with the following requirements:

- (a) The size of any discharge piping shall be sufficient to ensure that the required discharge capacity of a safety valve is achieved. The effect of backpressure shall be taken into account in the case of changes of direction or excessive length.
- (b) The direction of discharge shall be vertically upwards.
- (c) Except for measures necessary to prevent ingress of rainwater or blockage, venting shall be direct to atmosphere.
- (d) The direction of discharge shall be such that escaping vapour will not impinge on any tank, fitting, structure or piping.

- (e) A safety valve shall not be made inoperative except under the conditions permitted in Clause 5.4.3.
- (f) For a tank of more than 8 kL capacity, the discharge shall terminate at least 2 m above the tank, except where Clause 7.5.2 applies.
- (g) Where a lockable dome or cage is provided, the arrangement shall comply with the requirements relating to free dispersal or impingement of discharge.
- (h) The discharge outlet shall be protected as far as practicable from physical damage.
- (i) A cap shall be provided to prevent the accumulation of rain, dew or foreign matter within the safety valve. Where a discharge pipe is fitted, the cap shall be fitted at the point of discharge. The cap shall not prevent the safety valve from operating effectively or prevent the safe and effective discharge of LP Gas. Where a weep hole or drain is provided in the cap, the overall design shall be such that any ignited LP Gas discharge cannot impinge on the tank, adjacent tanks, piping, or equipment.
NOTE: A deflector or a drainage discharge pipe is permissible, provided that such piping does not incorporate a valve.
- (j) The safety relief valve shall be protected from impact or high wind loading on the discharge piping that could damage the valve.

5.4.3 Reserve safety valves

Where additional safety valves are provided to permit servicing without depressurizing, the valve system used to isolate any individual safety valve shall be designed so that it is impossible to operate the system with less aggregate pressure-relief capacity than that required under Clause 5.4.1(c).

5.5 VALVES AND ACCESSORIES

5.5.1 Suitability

Any valve, fitting, or component shall be suitable for its intended purpose and service conditions.

The design pressure shall be not less than the maximum pressure of the application, e.g. tank design pressure for items subject to tank pressure, or pump outlet pressure where appropriate.

5.5.2 Metal parts

5.5.2.1 General

The melting point of pressure-containing metal parts, with the exception of the components listed in Clause 5.5.2.3 below, shall be not less than 850°C.

5.5.2.2 Additional requirements

The following additional requirements apply:

- (a) Ductile iron shall comply with ASTM A395 or equivalent.
- (b) A copper base alloy valve shall be of a material specified in AS 1271 or equivalent specification, and shall have minimum elongation of 12% in a gauge length of $5.65\sqrt{S_0}$, where S_0 = original cross-sectional area of test section.
- (c) A copper base alloy shall not be used—
 - (i) for the secondary control provision for any tank having a capacity greater than 8 kL; or
 - (ii) where the tank's capacity is 8 kL or less, and the control provision exceeds 50 mm nominal size.