

LPG Association Code of Practice
LPGA COP No 5

Installation and maintenance of LPG multi-cylinder systems

November 2019

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Foreword

The performance of LPG cylinder installations is a critical element in ensuring that gas is supplied to appliances reliably and safely. This Code of Practice (Code) has been compiled with advice and input from across the industry in New Zealand and from international authorities.

The Code captures the latest knowledge and design features gained from operating experience and investigative work conducted by the LPG Association.

The purpose of this Code of Practice is to assist with:

- Locating cylinders correctly
- The reduction of phthalates from LPG systems
- The removal of condensate at the regulator
- The selection of suitable equipment and fittings
- Recommendations on equipment maintenance.

It should be read in conjunction with the requirements of the Health and Safety at Work (Hazardous Substances) Regulations, Pressure Equipment legislation, and AS/NZS 1596.

It is intended that gas fitters will use this Code as a best practice guide for the installation and maintenance of multi-cylinder installations.

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Section 1: Scope, Definitions and General

1.1 Scope

This Code of Practice sets out the requirements for installation and servicing of multi-cylinder LPG installations for both vapour and liquid withdrawal cylinders.

1.2 Definitions

For the purposes of this Code the following definitions apply:

Accessible:

Access can be gained without hazard or undue difficulty for repairs, testing, maintenance, renewal or operational purposes.

Area of regular habitation:

Includes any dwelling, hospital, school, airport, commercial premises, office or other area where people regularly congregate.

Authority:

Means WorkSafe New Zealand.

Automatic changeover regulator:

A combination valve/first-stage gas pressure regulator fitted to an LPG multi-cylinder installation that will automatically change over from a cylinder in use to a reserve cylinder at a predetermined pressure. It may be included in a one-piece automatic changeover valve assembly comprised of automatic changeover valve, first- and second-stage regulators and may incorporate pressure relief or over pressure shut off capability.

Breather vent:

An opening designed to permit atmospheric pressure to act on the diaphragm of a regulator.

Compliance Certifier:

A person who is authorised by WorkSafe New Zealand to issue compliance certificates.

Condensate:

The liquid that separates from the gas down stream of any regulator owing to the reduction in temperature resulting from pressure reduction.

Condensate trap (also known as a drip leg or tailpipe):

A device installed in a gas line to trap the condensate liquid.

Enclosure:

A compartment, an enclosed area or a partitioned-off space primarily used for the installing of a gas cylinder meter or gas pressure regulator.

Excess flow valve:

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

Gas fitting:

Has the same meaning as in the Plumbers, Gasfitters and Drainlayers Act 2006.

Gas installation:

A combination of the following used or intended to be used in the supply and utilisation of gas, taken as separate items or as a whole: consumer piping, fittings, components, appliances, flues, sub-meters, apparatus or other devices and associated equipment.

Gas load:

The total gas consumption of all downstream appliances.

Gas pressure regulator:

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

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

HSW:

Health and Safety at Work Act 2015.

HSW HS:

Health and Safety at Work (Hazardous Substances) Regulations 2017.

Ignition source:

- (a) means any agency or agent (including any item, product, part of a facility structure or piece of equipment) capable of igniting a flammable gas, vapour or other form of combustible substance
- (b) includes a fire, flame or spark or anything capable of producing a fire, flame or spark.

LAB number:

Number allocated by WorkSafe New Zealand when a cylinder is approved.

Liquid withdrawal installation:

An installation where liquid LPG is used as the fuel supply.

Location compliance certificate:

A certificate (including a conditional compliance certificate) issued by a compliance certifier for a location.

Lock-up pressure:

The maximum pressure in an installation where the regulator has closed and when all appliances have shut down.

Multi-cylinder installation:

Means any installation greater than a twin cylinder installation.

Non return valve:

A valve designed to operate automatically to prevent reversal flow in a pipe or fitting.

Person in charge:

In relation to a place, a hazardous substance location or a place of work means a person who is the owner, lessee, sub-lessee, occupier or person in possession of the place, location or any part of it; or any other person who, at the relevant time, is in effective control or possession of the relevant part of the place or location.

Phthalates:

Plasticisers mainly DOP (Dioctyl Phthalates) predominantly found in rubber hose inner liners.

Pigtail:

A short length of flexible tube or copper pipe completed with end couplings. Used for connecting the cylinder to the manifold or the changeover valve.

POL fitting (Prest-O-Lite):

The common name given for a standard union with left hand thread, used for connection to a 45 kg cylinder.

Pressure:

As measured above atmospheric pressure, also called gauge pressure.

Protected Place:

(a) Includes:

- (i) a dwelling, residential building, place of worship, public building, school or college, hospital, child care facility or theatre or any building or open area in which persons are accustomed to assemble in large numbers, whether within or outside the property boundary of a place where a hazardous substance is situated;
- (ii) any factory, workshop, office, store, warehouse, shop or building where persons are regularly employed, whether within or outside the property boundary of a place where a hazardous substance location is situated;
- (iii) a ship lying at a permanent berthing facility; and
- (iv) a public railway.

(b) Does not include:

- (i) a small office or other building associated with a place where storage, handling, use manufacture or disposal of a class 2, 3, 4, 5, 6 or 8 substances is a major function.

Public Place:

- (a) Means a place (other than private property or a protected place) that is open to, and frequented by, the public; and
- (b) Includes a public road.

Relaxation Time:

A period of low or no LPG draw-off which allows a cylinder to recover vapour pressure and reach temperature equilibrium.

Residue:

A term given to multiple items that can build up in an LPG installation, this can include specks of rust from the LPG cylinders, installation equipment or extractible phthalates, which is the plasticiser found in some pigtails that use a particular rubber inner liner.

Twin cylinder installation:

A cylinder installation where the cylinders are connected separately to the system. Each cylinder is connected to a changeover valve that can be operated manually or automatically, to change over the cylinder supplying LPG to the installation. Connection may be made using flexible rubber or copper pigtails or pipe fittings.

Vapour withdrawal installation:

An installation where LPG vapour is used as the fuel supply.

WorkSafe:

WorkSafe New Zealand established by section 5 of the WorkSafe New Zealand Act 2013.

REFERENCED DOCUMENTS

| | |
|---------------|---|
| HSW HS Regs | Health and Safety at Work (Hazardous Substances) Regulations 2017 |
| PECPR | Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999 |
| AS/NZS 5601.1 | Gas Installations |
| AS/NZS 1596 | The storage and handling of LP Gas |
| AS/NZS 1869 | Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and towns gas |
| AS/NZS 60079 | Classification of hazardous areas (series) |
| UL 21 | LP Gas Hose |

| | |
|-------------|--|
| UL 144 | Pressure-regulating valves for LP Gas |
| UL 252 | Compressed gas regulators |
| AG 205 | Regulators |
| NF M 88-769 | 1977 Commercial propane installations in movable containers coupling and Automatic changeover device - construction - operation – tests. |

WEBSITES

| | |
|----------|--|
| LPGA | www.lpga.org.nz |
| Worksafe | www.worksafe.govt.nz |

Section 2: Selection and Location Criteria Connections, Manifolds, Changeover Valves and Regulators

This section contains general guidelines that refer to all installations and where relevant each section will have specific requirements that apply to either vapour or liquid installations. Both the general and specific requirements must be used when selecting and building the installation.

Multi-cylinder installations shall be installed using a manifold to which all the cylinders are connected and using a single regulator (being either a single or dual-stage regulator), sized for the installation throughput.

2.1 Cylinders

- (a) All cylinders must comply with the requirements of Part 15 (Gases under pressure) of the Health and Safety at Work (Hazardous Substances) Regulations 2017.
- (b) Cylinders filled for use in LPG installations must be stamped with an LAB or LABSP number and a current test date.
- (c) Consideration should be given to ensure that the demand of the appliances to be connected to the system can be supplied by the cylinder installation.

As a guide on NZ LPG mix, a single 45 kg cylinder is capable of supplying a continuous duty cycle of 1 kg/hr or 50 MJ/hr for the duration of the LPG supply.

A single 90 kg cylinder is capable of a continuous supply of 1.6 kg/hr or 80 MJ/hr.

A single 222 kg cylinder is capable of a continuous supply of 2.4 kg/hr or 120 MJ/hr.

A larger instantaneous demand can be supplied for short periods, up to approximately 15 minutes, provided sufficient relaxation time is allowed following each high draw event so that the accumulated flow does not exceed the continuous draw-off rates over time.

2.2 Pigtails

Clause 4.3.3 of AS/NZS 1596

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 class F;
- (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) a non-metallic lined flexible pigtail, having a maximum life of 6 years from the date of manufacture.

- (b) The piping as specified in (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.

Notes:

1. An excess flow valve may be an integral part of the POL fitting
2. For joining methods and materials, see Table 4.1 AS/NZS 5601.1.

Liquid specific

- (a) Liquid withdrawal systems shall be designed by a suitably competent person in consultation with the LPG supplier.
- (b) An AS 2473 type 26 CGA555 valve system shall be used.
- (c) For exchange cylinder installations a valve should be fitted at the cylinder end of each cylinder hose and a hydrostatic relief valve installed in any section of the pipe where liquid could be trapped between valves.
- (d) Liquid installations should have manufacturer approved liquid hoses.
- (e) All valves and hoses must be suitably rated for liquid, ie, typically 2.4 MPa.

2.3 Changeover valves

Changeover valves can be manual or automatic and may include a non-return valve on each pigtail connection. The valve must comply with the requirements of WorkSafe New Zealand.

Changeover valves may be comprised of a first- and second-stage regulator system in a single body or as a combination of separate components.

2.4 Regulators

- (a) Regulators and automatic changeover devices must comply with either:
 - (i) ASA621-2004
 - (ii) UL 144:2002
 - (iii) UL 252
 - (iv) BS EN 16129: 2013
 - (v) A relevant safe work instrument that specifies standards for LPG regulators or automatic changeover devices.
- (b) Only those regulators that are listed on Worksafe New Zealand's register of gas fittings can be used.
- (c) Consideration must be given to the total expected gas load when sizing the regulator.
- (d) A single-stage regulator or the first stage of a multi-stage regulator shall be located so that the length of the piping subject to cylinder pressure is as short as practicable.

2.5 Condensate trap

- (a) Condensate traps remove condensate and prevent transfer down stream of most condensates present in the LPG.
- (b) A condensate trap should be installed between the first- and second-stage regulator if they are separate items.
- (c) If the regulator is the combined type, then a condensate trap should be installed immediately after the regulator.
- (d) Condensate traps must have a vertical limb in a direct line to the first-stage regulator and be of a minimum volume of $V=N \times 5.5$
 - (i) where: V = The volume of the vertical limb in Millilitres (ml)
 - (ii) N = The number of 45 kg cylinders.
- (e) The trap must have a plug or other means of removing the condensate.

Examples of length of condensate trap tube for 10 and 13 mm pipe and various numbers of cylinders.

| Number of 45 kg cylinders | Length 10 mm pipe | Length 13 mm pipe |
|---------------------------|-------------------|-------------------|
| Two | 140 mm | 88 mm |
| Four | 280 mm | 180 mm |
| Six | 370 mm | 240 mm |
| Eight | 560 mm | 350 mm |

2.6 Non-return valves – vapour withdrawal system only

- (a) A non-return valve shall be fitted either in each pigtail connection of the changeover valve or as part of each pigtail.
- (b) The non-return valve is to ensure that LPG cannot flow across the changeover system.

2.7 Excess flow valves

- (a) An appropriately sized excess flow valve must be fitted to ensure that in the event of a pipe or hose failure the flow is restricted.
- (b) The excess flow valve can be an integral part of the pigtail assembly or immediately after the outlet of each cylinder valve or be internal to the cylinder.

2.8 Manifolds

- (a) Proprietary manifold systems must be approved by WorkSafe New Zealand.
- (b) One-off systems using the POL tee system instead of a manifold shall be restricted to connecting a maximum of four cylinders per side.
- (c) One-off manifold systems require a producer statement confirming compliance with the requirements of the PECPR regulations.
- (d) Manifolds shall be installed so 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.
- (e) For Liquid withdrawal systems A pressure relief valve shall be installed on the manifold between any valves that can isolate sections of pipework.

Note: For liquid withdrawal systems the gas supplier should be consulted as it may have additional requirements for the installation.

2.9 Materials of construction

The following is taken from clause 5.6 of AS/NZS 1596:

2.9.1 Design for pressure

Piping that operates at a pressure of less than 200 kPa shall comply with AS/NZS 5601.1 or AS/NZS 4645.1.

Piping for use at a pressure exceeding 200 kPa shall comply with AS 4041, or other equivalent design Standard, with the following qualifications:

- (a) The design pressure shall be not less than that of the cylinder, the tank or the pump delivery pressure, or hydrostatic relief valve pressure, whichever is the greater
- (b) The design shall allow for expansion and contraction, both of the piping itself and of any equipment to which it is connected
- (c) Screwed pipe shall be at least ASME B31.3 Schedule 80
Welded pipe shall be at least ASME B31.3 Schedule 40
- (d) Copper pipe or tube shall not be used where the temperature is expected to exceed 120°C, or for liquid lines exceeding 10 mm in diameter or 2 m in length.

2.9.2 Joints

A joint in rigid pipework that is subject to tank pressure shall be welded, screwed taper-to-taper, flanged, or made with a ground-face union, provided that the following apply:

- (a) Where the nominal bore of the pipe exceeds 50 mm, screwed joints shall not be used unless unavoidable, eg, for the mounting of essential auxiliary equipment having screwed connections
- (b) Pipe jointing compounds and gaskets shall be suitable for use with LP Gas
- (c) Spiral wound metal gaskets with a minimum temperature rating of 550°C shall be used for flanged connections on liquid phase piping
- (d) Compressed fibrous gaskets or O-rings shall only be used on encapsulated flanges where it is impracticable to use spiral-wound gaskets
- (e) Multiple gaskets shall not be used at any flanged joint
- (f) Joints intended to be buried shall be welded.

In New Zealand, welders shall be qualified to ANSI/API 1104 or ASME Boiler and Pressure Vessel Code, Part IX.

2.9.2.1 Joints in copper pipe

A joint in copper piping shall be made:

- (a) with a flare compression fitting; or

- (b) with a capillary fitting using a brazing metal with a melting point not less than 540°C; or
- (c) by a spigot joint formed from the pipe itself and brazed as above.

Flare fittings having mismatching cone angles, or olive or similar compression-sleeve type fittings, shall not be used.

2.9.2.2 Flexible pipe connections

A flexible pipe connection may be used where necessary to absorb vibration, or where a rigid connection is impracticable. Such a connection shall comply with the following requirements:

- (a) Individual or combined lengths shall be as short as practicable
- (b) A flexible connection shall be of metal construction, designed for a bursting pressure not less than 12 MPa and tested to not less than 3.6 MPa.

2.10 Certification for pressure pipework

Pipework that has an internal diameter 40 mm or less is not required to have a certificate of inspection under the PECPR regulations. However, records must be held to demonstrate compliance with the PECPR requirements. Pipe work that has an internal diameter of greater than 40 mm must have a certificate of inspection under the PECPR Regulations.

2.11 Identification

Piping shall be identified according to its contents.

2.12 Corrosion protection

Steel pipe and fittings shall be painted to protect against corrosion.

2.13 Sizing the installation

Piping shall be sufficient size that the operation of appliances shall not be affected by the pressure drop in any pipe.

The volume of gas accounted for shall be determined from either, the manufacturer's input rating, gas supplier or equipment manufacturer.

The total connected hourly load shall be the basis for storage and pipe sizing for all equipment that may be operating at full capacity simultaneously.

2.14 Commissioning/pressure testing of the manifold

The installation should be pressure tested up to the first-stage regulator by the gasfitter prior to delivery of the cylinders. Following delivery, purging and commissioning should take place.

Section 3: Location of Cylinders

3.1 General

Cylinders and associated equipment should not be installed indoors unless specifically permitted in table 10 of schedule 12 of the HSW HS Regulations.

3.2 Prohibited locations

Clause 4.4.3 of AS/NZS 1596.

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

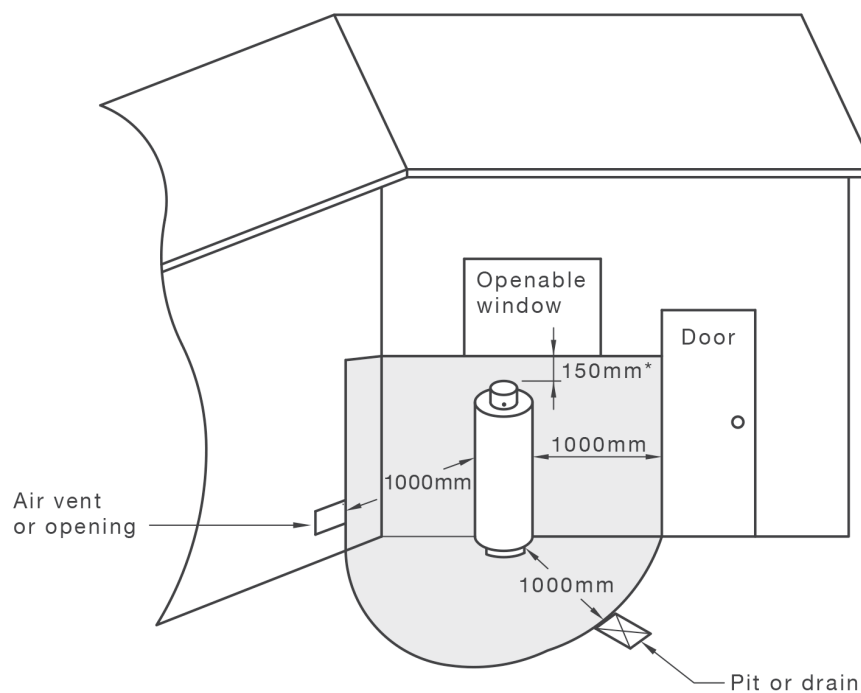
- (a) Within a building, except where permitted. Under table 10. Of schedule 12 of the HSWA HS Regulations.
- (b) Under a stairway.
- (c) In a location with restricted access, where inspection, refilling or exchange of the cylinder is restricted, obscured or hazardous to the operator.
- (d) Where nearby constructions, fences, walls or vapour barriers could prevent cross ventilation.
- (e) Under a building, except where permitted by this Code.
- (f) Where the cylinder, or an incident involving the cylinder and its contents, could obstruct egress from a building.
- (g) Buried in the ground, unless the cylinder and gas installation have been specifically designed for such a location.
- (h) Any cylinder and its associated equipment should not be installed where damage is likely to occur, unless adequate protection is provided.

3.3 Clearances around cylinders

Separation distances for LPG cylinders shall comply with the relevant HS Regulations and:

- (a) Up to 100 kg can be installed within one metre of a building (up against the wall) provided there are no openings in the building below the top of the cylinders and within one metre of the cylinders.
- (b) Cylinders should not be located within 1 metre of an opening to a drain, this is to prevent any gas leakage from entering the drain.
- (c) Where the cylinders are located within 1 metre of a building, there must be no openings into the building below the top of any cylinder or within 1 metre of any cylinder. NOTE: Weep holes are not considered openings into the building for the purposes of this Clause.

- (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 and 500 mm for on-site filled cylinders.
- (e) Between 100 to 300 kg can be installed within 2 metres of a building (up against the wall) provided the walls of the building behind the cylinders and 2 metres either side of the cylinders are vapour tight and constructed of fire-resisting material. There must be no openings in the building below the top of the cylinders or within two metres from the sides of the cylinders.
- (f) Between 300 to 1,000 kg can be installed within two metres of a building (up against the wall) provided the walls of the building behind the cylinders and 2 metres either side of the cylinders are vapour tight and are constructed of 60/60/60 fire-resisting material. There must be no openings in the building below the top of the cylinders or within two metres from the sides of the cylinders.
- (g) There is a minimum vertical clearance from openings into buildings of 150 mm above the top of any cylinder. This clearance increases to 500 mm for in-situ filled cylinders.
- (h) If the fire-resisting material or fire-rated wall cannot be provided or if the quantity is in excess of those above the separation distances from Table 1 must be used.

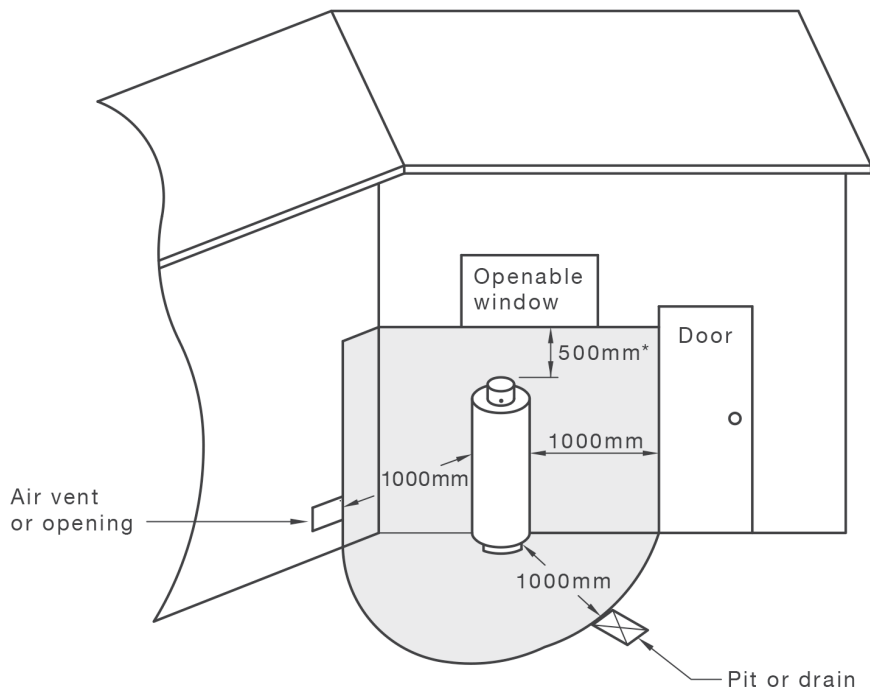


* This distance is measured from the top of any cylinder valve

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

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* 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

| Quantity (kg) | Protected place (m) | Public place (m) |
|---------------|---------------------|------------------|
| Up to 100 | 0 | 0 |
| 300 | 2 | 0 |
| 500 | 2 | 2 |
| 1,000 | 2.5 | 2 |
| 2,000 | 3 | 2 |
| 5,000 | 5 | 3 |

3.4 Cylinders on a verandah

Clause 4.4.7 of AS/NZS 1596.

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

- (a) The location should be nominally at ground level
- (b) The verandah should be open on all three sides
- (c) The hazardous area around the cylinders should be free of fixed ignition sources

- (d) The cylinders should not be subject to physical damage, heat or vibration
- (e) A maximum of 90 kg should be kept on a verandah.

3.5 Cylinders in an enclosure or recess

Clause 4.4.10 of AS/NZS 1596

Where a cylinder is to be installed in an *enclosure* or *recess*, the enclosure or recess should 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 should have ventilation openings at the top and bottom, with each opening providing a free area of at least 20 000 mm² for every cylinder enclosed.

3.6 Cylinders under buildings

Clause 4.4.8 of AS/NZS 1596

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

- (a) There should 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 should be more than 800 mm within the perimeter of the building's walls.
- (c) The area between the piers should be
 - (i) open on at least three sides; or
 - (ii) enclosed by a construction through which cross ventilation can occur (eg, slats or battens) on at least three sides; or
 - (iii) a combination of Items (i) and (ii) above.

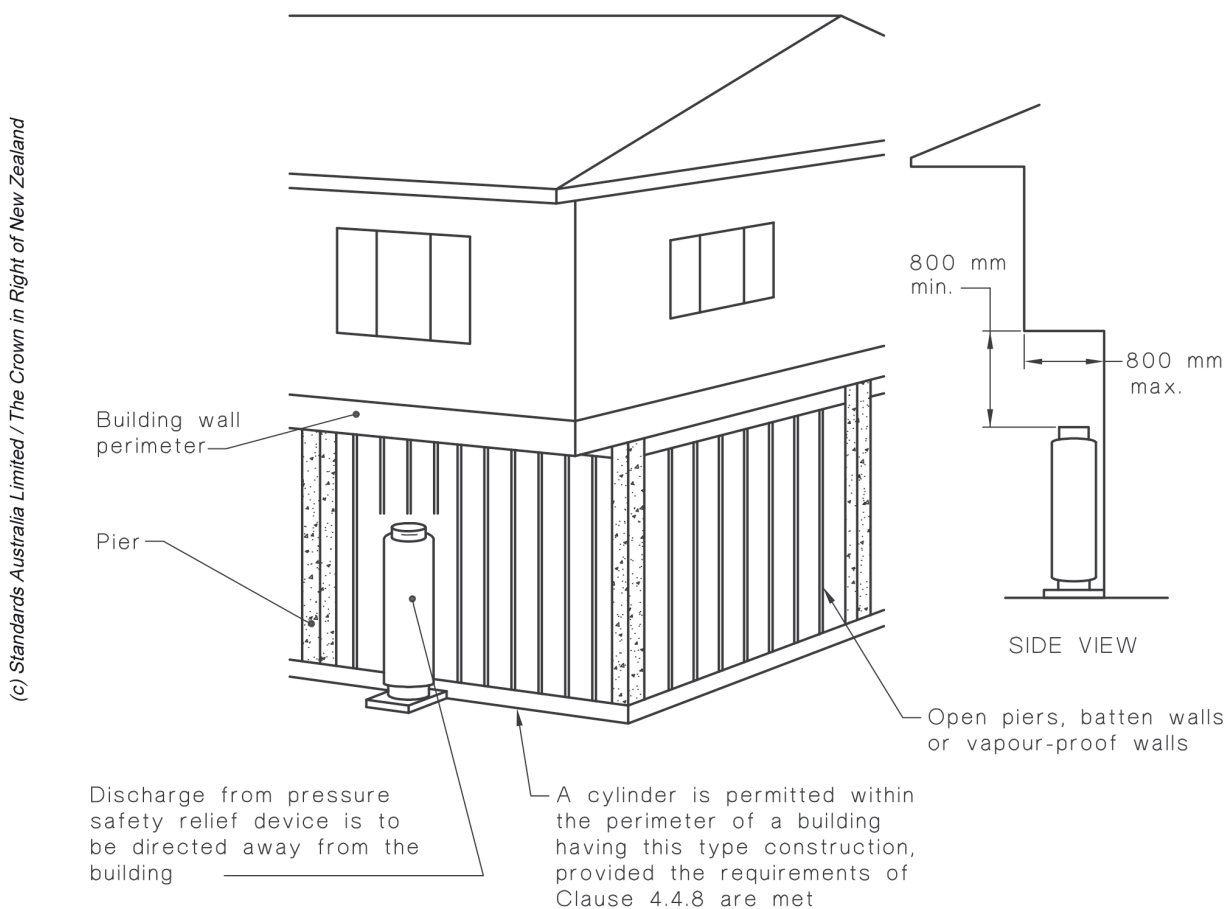


FIGURE 4.5 LOCATION OF CYLINDER UNDER A BUILDING

3.7 Requirements for cylinder deliveries

Cylinder installations should be located such that the delivery of gas can be made safely by one person without excessive manual handling or risk to a customer's property. In situations where the following conditions cannot be satisfied, other options such as locating the cylinders remotely and piping to the installation should be considered.

- (a) Cylinder installation must be designed to be capable of accommodating the size of cylinder intended for use, for either exchange or insitu fill applications.
- (b) A minimum distance of 600 mm should be provided between the front of the cylinder installation and other structures to allow adequate access for the cylinder delivery to be made.
- (c) The cylinder compound should be accessible by cylinder trolley.
- (d) Paths should have a minimum width of 600 mm.
- (e) Steps should have a minimum of 2:1 tread depth to tread rise. Maximum tread rise should be 125 mm.
- (f) Steps should not exceed 1.5 m total rise.

- (g) Paths should not exceed 20 degree gradients.
- (h) Total distance from cylinder delivery truck parking area and cylinder installation should not exceed 75 m.
- (i) It must be possible to legally and safely park the truck while making the delivery.
- (j) Access route should be firm and compact with adequate grip even in wet conditions.
- (k) The access route should not be over delicate or decorative surfaces, such as terracotta.

Section 4: Cylinder Installation

4.1 Installing cylinders

From clause 4.4.11 of AS/NZS 1596

Cylinders should be installed in accordance with the following recommendations:

- (a) Cylinders should be installed on a firm, level, non-combustible base and not resting on soil. The floor or base should be constructed so that water cannot accumulate within any enclosure or recess.
- (b) Cylinders should not be stacked on top of each other.
- (c) Any cylinder that is liable to accidental dislodgment should be prevented from falling.
- (d) Except for domestic installations, where there are maneuvering vehicles, cylinders should be afforded suitable protection, eg, by the use of bollards, or a fully contained, free-moving frame that encapsulates all cylinder components.
- (e) Cylinders should not be installed below ground level unless there is sufficient ventilation to prevent the accumulation of any leaking gas.
- (f) A cylinder intended to be exchanged or removable should be connected to a fixed piping system.
- (g) Vapour-service cylinders should be installed so that the point of LPG withdrawal is in contact with the vapour space.
- (h) Where two or more exchange cylinders are connected for use, a means should be provided to permit the cylinders to be isolated from the gas supply, to allow the cylinders to be disconnected. This should be achieved by either of the following:
 - (i) A manual or automatic changeover valve installed immediately upstream of the regulator serving the system; and

Note: Such a valve may be an integral part of an automatic changeover regulator.

- (i) Isolation valves should be installed on the manifold, to allow each cylinder to be individually disconnected from the manifold without depressurising the manifold.

4.2 Cylinder safety valve discharge

A cylinder should be installed so that the pressure-relief valve is in contact with the vapour space and, where practicable, any discharge from this valve is directed away from any adjacent cylinders or combustible structures.

4.3 Regulators

Clauses 4.3.1 and 4.3.2 of AS/NZS 1596

Regulators shall comply with the following requirements:

- (a) The cylinder regulator shall be fixed rigidly to an adequate support that is independent of the cylinder and mounted with the diaphragm vertical and the vent pointing vertically downwards.
- (b) For cylinders exceeding 400 L that are fitted with lockable domes, the regulator should be connected directly (or as close as fittings will practically allow) to the cylinder valve outlet.
- (c) Gas pressure regulators shall be located to permit drainage of any liquid back into the cylinder.
- (d) Any first stage regulator shall be outdoors, except where the regulator is attached to a cylinder that is permitted to be used indoors.
- (e) Second stage regulators shall be installed in accordance with AS/NZS 5601.1
- (f) 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.
- (g) The outdoor discharge from a vent terminal, gas-pressure-relief device or terminal of a vent line shall be:
 - (i) arranged to minimise 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) not less than 0.5 m below and 1 m laterally from any fixed source of ignition.
- (h) The vent terminal shall have provision to exclude rain and insects.

4.4 Piping

Clause 4.3.3 of AS/NZS 1596

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 class F;
 - (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.

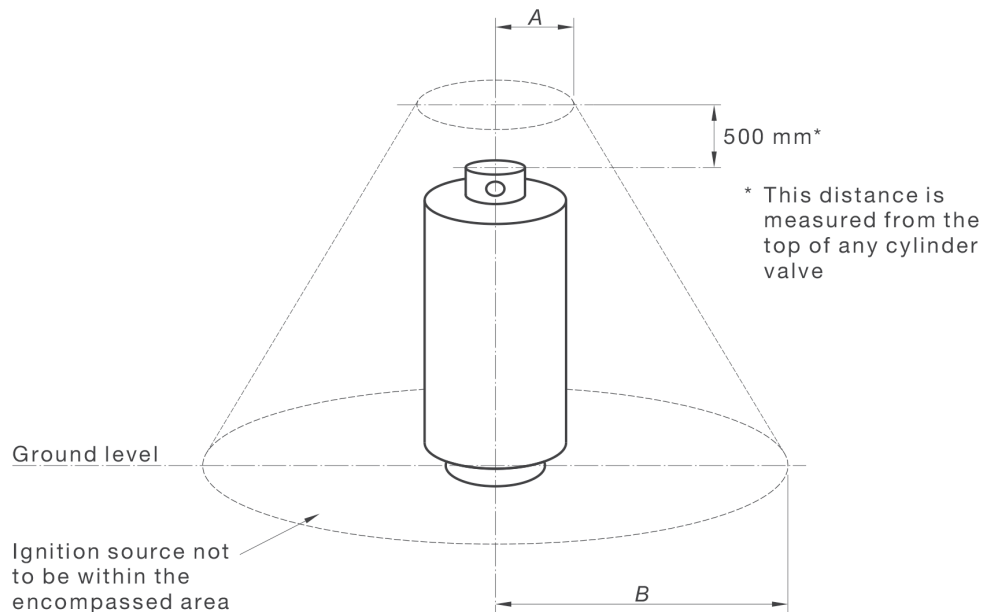
4.5 Meters

- (a) Meters shall be installed in readily accessible locations where they are protected from damage and which permit ease of replacement, maintenance and reading, and shall be clearly identified with the gas installation they supply.
- (b) Possible causes of damage include impact, corrosion, thermal extremes, excessive vibration, steam and dampness.
- (c) A recess or box in a cavity wall for housing a meter shall be:
 - (i) constructed of non-combustible material;
 - (ii) completely sealed from any adjoining recess or cavity;
 - (ii) adequately sized to permit ease of replacement or maintenance of the meter; and
 - (iv) ventilated to the outside atmosphere.

4.6 Hazardous area requirements

Clause 4.4.6 of AS/NZS 1596

- (a) The hazardous zone surrounding a gas cylinder, as specified in AS/NZS 60079.10.1, shall be maintained free of ignition sources, this includes heat pumps, earthing rods and any communication wiring.
- (b) For exchange cylinders there is a zone 2 area within the space 0.5 m above and 0.5 m laterally from any cylinder valve, extending to a distance of 1.5 m laterally at the base of the cylinder.
- (c) For on-site filled cylinders there is a zone 2 area within the space 0.5 m above and 1.5 m laterally from any cylinder valve, extending to a distance of 3.5 m laterally at the base of the cylinder.



| Radius | Exchange cylinder mm | In-situ fill cylinder mm |
|--------|-------------------------|-----------------------------|
| A | 500 | 1500 |
| B | 1500 | 3500 |

FIGURE J3 MINIMUM CLEARANCE TO IGNITION SOURCES

4.7 Restraint

- (a) All cylinders larger than 25 litres (9 kg) shall be secured against seismic activity by using chains and brackets or similar. Cylinders greater than 200 litres (90 kg) are typically inherently stable.
- (b) The brackets shall be fastened to a wall or similar robust anchorage.

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4.8 Security of cylinders in public locations

From Clause 4.4.10 of AS/NZS 1596

Where a cylinder exceeding 12 litres capacity is permanently installed for public use in a location having unrestricted public access, the following recommendations should apply:

- (a) Either:
 - (i) The cylinder and any associated regulator should be enclosed in a lockable cage or cabinet ventilated at the top and bottom; or
 - (ii) The cylinder valves and regulator should be guarded by a covering metal hood and the cylinder protected against accidental dislodgement.
- (b) The connecting piping should be arranged so that it is not vulnerable to tampering or accidental impact.

Any lockable enclosure as described in items (a)(i) and (ii) should 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.

4.9 On-site filled cylinders

- (a) The cylinders must be located outside of any building.
- (b) The cylinders should be located where there will be direct line of sight between the road tanker and cylinders.
- (c) The cylinders should be located so that any delivery hose does not pass through any buildings or cross any carriageways, unless the building is an open carport or verandah.
- (d) The cylinders are installed on a stable non-combustible base that is raised above the surrounding area and sheds water.
- (e) The cylinders are restrained (for example, chained) against seismic movement.
- (f) Any opening into a building is not located within 500 mm above the cylinders.
- (g) Any opening into a building or pit is not located:
 - (i) within 1 m measured horizontally from the cylinders holding 100 kg or less of LPG; and
 - (ii) within 2 m measured horizontally from the cylinders holding more than 100 kg of LPG
- (h) Any opening into a drain is not located within 1 m measured horizontally from the cylinder.

4.10 Vapourisers

- (a) This is a specialist field and the gas supplier shall be consulted.
- (b) Direct fired vapourisers, ie, those with a source of ignition, must be separated from the cylinder storage as required by the HSW HS legislation. Specialist advice must be obtained from the gas supplier for these requirements.
- (c) Non-direct fired vapourisers can be installed in the cylinder storage area following advice from the gas supplier.

4.11 Test points

Sufficient test points must be provided to carry out the following tests on the installation:

- (a) A pipework test on the newly installed pipework before any gas appliances are connected
- (b) An installation test, including all gas appliances, prior to connection of the gas supply
- (c) A final connection test.

4.12 Location compliance certificates

- (a) A location compliance certificate is required for all sites where 100 kg or more LPG is present for more than 24 hours.
- (b) It is usually the responsibility of the PCBU in charge of the site where the cylinders are to be installed to obtain the location compliance certificate. These are renewed annually although there is provision for a certificate to be issued for up to a three-year period (where up to 300 kg is being stored). This is dependent on the compliance certifier.
- (c) For non-workplace sites with up to 300 kg, a plaque must be installed on the installation by the gas supplier to indicate that the installation is compliant.
- (d) A location test certificate can only be obtained from a compliance certifier. A list of compliance certifiers is available of the Worksafe New Zealand website: <http://www.worksafe.govt.nz>.

4.13 Signage

HS signage is required on all installations storing 250 kg or more.

Signage details can be obtained from the gas supplier.

4.14 Emergency response

1. A 2 kg dry chemical fire extinguisher is required to be available for all installations over 50 kg. The location of the extinguisher must be clearly visible and readily accessible in an emergency.

Note: Fire extinguishers are not a requirement for residential property.

2. Emergency response plans are required for all sites with 300 kg in one location. The gas supplier or a compliance certifier should be contacted for this information. A generic emergency plan is available from Worksafe New Zealand's website.

4.15 Modifications

1. All modifications must comply with the requirements of this Code.

Section 5: Maintenance LPG Cylinder Installations

5.1 Cylinders

Cylinders should not be filled unless they have been tested and certified within the last 10 years.

5.2 Flexible pigtails manufactured to AS/NZS 1869

- (a) Pigtails should be inspected visually for cracks and deterioration every time the cylinder is exchanged or filled.
- (b) Pigtail connections should be checked with a soapy solution every time the cylinder is changed or filled.
- (c) Pigtails should be replaced six years from the date of manufacture.

5.3 Changeover valves

Changeover valves should be checked for correct operation in accordance with manufacturer's recommendations or in the absence of any recommendations, at least every 10 years.

5.4 First-stage regulators

- (a) The first-stage regulator to be checked for correct operation in accordance with the manufacturer's recommendations or in the absence of any recommendations at least every 10 years.
- (b) The condensate trap to be drained by removing the drain plug provided at intervals not exceeding two years and at every visit of the gas fitter.

5.5 Second-stage regulators

The second-stage regulator to be checked for correct operation in accordance with the manufacturer's recommendations or in the absence of any recommendations, at least every 10 years. The rubber diaphragm and rubber seal must be inspected for deterioration and replaced if necessary.

5.6 Condensate traps

Condensate traps should be emptied whenever any work is carried out on the installation and at least every 2 years.

Note: For the quantities of residue expected to be found in the condensate traps, between 2 to 3 ml maximum, use disposable gloves when emptying the residue into absorbent material. This absorbent material and the gloves can then be disposed of in general waste.