

LPG Association Code of Practice  
LPGA COP No 5

# Installation and maintenance of LPG multi-cylinder systems

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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 has been compiled with advice and input from across the industry in New Zealand and from international authorities.

The Code of Practice 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:

1. Assist with locating cylinders correctly.
2. Assist with the reduction of phthalates from LPG systems.
3. Assist with the removal of condensate at the regulator.
4. Assist with the selection of suitable equipment and fittings.
5. Assist with recommendations on equipment maintenance.

It should be read in conjunction with the requirements of the HSNO legislation, Pressure Equipment legislation, AS/NZS 5601.1 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 shall apply:

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

**Area of high Intensity land use** includes:

- (a) An area of regular habitation,
- (b) Any other hazardous substance location,
- (c) A high density traffic route,
- (d) A structure made of combustible material, does not include an onsite non-combustible office.

**Area of low intensity land use** includes:

- (a) An area where a person may legally be present occasionally
- (b) A public park or reserve,
- (c) A traffic route of low or medium traffic density, does not include an area of regular habitation.

**Area of regular habitation:**

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

**Authority:**

Means the Environmental Protection Authority (EPA) until 1 September 2014 when it passes to WorkSafe New Zealand.

**Automatic change-over regulator:**

Combination valve / first stage gas pressure regulator, fitted to a LPG multiple-cylinder installation which will automatically change over from a cylinder in use to a reserve cylinder at a predetermined pressure. 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 orifice or opening designed to permit atmospheric pressure to act on the diaphragm of a regulator.

**Condensate:**

The liquid that separates from the gas down stream of any regulator due 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.

**Controlled zone:**

Means an area abutting a hazardous substance location that is regulated so that:

- (a) Within the zone, the adverse effects of a hazardous substance are reduced or prevented;
- and
- (b) Beyond the zone, members of the public are provided with reasonable protection from the adverse effect.

**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.

**EPA:** Meaning the Environmental Protection Authority.

**Excess flow valve:**

A normally open valve which 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 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.

**HSNO:**

Means the Hazardous Substances and New Organisms Act 1996.

**High density:**

In relation to a public traffic route, means greater than medium density.

**LAB number:**

Number allocated by ERMA when a cylinder is approved.

**Liquid withdrawal installation:**

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

**Location test certificate:**

A certificate issued by a test certifier stating that the HSNO Control requirements for a hazardous substance in that location have been met.

**Lock-up pressure:**

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

**Low density** public traffic route means up to an average per 24 hours of:

- (a) 1,000-vehicles on a road; or
- (b) 50 rail wagons on a railway; or
- (c) 400 people on a waterway; or
- (d) 200 people along a public right of way.

**Medium density** public traffic route means up to an average per 24 hours of:

- (a) 5,000 vehicles on a road; or
- (b) 250 rail wagons on a railway; or
- (c) 1,800 people on a waterway; or
- (d) 900 people along a public right of way.

**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, sublessee, 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.

**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.

**Pigtail:**

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

**Pressure:**

Pressure as measured above atmospheric pressure, also called gauge pressure.

**Test Certifier:**

A person who has current approval from ERMA to issue test certificates.

**Twin cylinder installation:**

A cylinder installation where the cylinders are connected separately to the system. Each cylinder is connected to a change over valve that can be operated manually or automatically, to change over the cylinder which is 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.

**REFERENCED DOCUMENTS**

PECPR	Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999
AS/NZS 5601.1	Gas Installtions
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	Installations d'hydrocarbures liquéfies en recipients



## Section 2: Location of Cylinders

### 2.1 Cylinders

1. All cylinder locations must comply with the requirements of appendix J of AS/NZS 5601.1
2. Consideration should be given to ensure that the demand of the appliances to be connected to the system can be supplied by the cylinders, see 3.13 for details on sizing the installation.

### 2.2 Location

1. Cylinders and associated equipment should be installed in accordance with section J3 of AS/NZS 5601.1

### 2.3 Separation Distances

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

1. 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. They can be installed against a building
2. 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.
3. 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.
4. 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.

5. If the fire resisting material or fire rated wall cannot be provided or if the quantity is in excess of those above the following separation distance table must be used.

Quantity (kg)	High intensity (m)	Low intensity (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

## 2.4 Prohibited Locations

Refer to section J3.2 of AS/NZS 5601.1

## 2.5 Location Test Certificates

1. A location test certificate is required for all sites where 100 kg or more LPG is present for more than 18 hours. If there is less than 300kg of LPG the location can be subject to the Code of Practice HSNOCOP 50 LPG Compliance 100kg to 300kg.
2. It is the responsibility of the person in charge of the installation (usually the person who uses the gas) to obtain the location test certificate. These are renewed annually although there is provision for a certificate to be issued for up to a three year period. This is dependant on the test certifier.
3. A location test certificate can only be obtained from a test certifier. A list of test certifiers is available of the EPA website: <http://www.epa.govt.nz>.

## 2.6 Hazardous Area Zone

1. Any LPG cylinder has a hazardous zone around it refer to section J5 of AS/NZS 5601.1 for guidance. Or the calculations detailed in AS/NZS 60079.10.1 can be used to establish the extent of the hazardous zone.
2. The hazardous area zone surrounding a cylinder shall be maintained free of ignition sources. Any electrical equipment that might be installed in the hazardous zone must be rated for the relevant zone.
3. A vehicle is not regarded as being an ignition source while it is entering or leaving a hazardous zone.

## 2.7 Restraint

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

## 2.8 Security of Cylinders in Public Locations

Refer to section J3.6 of AS/NZS 5601.1

## 2.9 Signage

1. HSNO signage is required on all installations storing 250 kg or more.
2. Signage details can be obtained from the gas supplier.

## 2.10 Emergency Response

1. A 2kg dry chemical fire extinguisher is required to be available for all installations over 50kg. The location of the extinguisher must be clearly identified and be placed within 30 metres of the installation.

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 test certifier should be contacted for this information.

## 2.11 Modifications

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

## 2.12 Requirements for cylinder deliveries

1. 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 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 600mm should be provided between 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 600mm.
- (e) Steps should have a minimum of 2:1 tread depth to tread rise. Maximum tread rise should be 125mm.
- (f) Steps should not exceed 1.5m total rise.
- (g) Paths should not exceed 20 deg gradients.
- (h) Total distance from cylinder delivery truck parking area and cylinder installation should not exceed 75m.
- (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.

## 2.13 Vaporisers

1. This is a specialist field and the gas supplier shall be consulted.
2. Direct fired vaporisers, i.e. those with a source of ignition, must be separated from the cylinder storage as required by the HSNO legislation. Specialist advice must be obtained from the gas supplier for these requirements.
3. Non-direct fired vaporisers can be installed in the cylinder storage area following advice from the gas supplier.

### **In-situ filling**

Refer to Code of Practice HSNOCOP 38 Insitu filling of LPG Cylinders.

## Section 3: Selection and Location Criteria Connections, Manifolds, Change-over 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.

### 3.1 Cylinder connections

Refer to section 4.6 of AS/NZS 5601.1

#### **Liquid specific**

Liquid withdrawal systems shall be designed by a suitably competent person in consultation with the LPG supplier.

An AS 2473 type 26 CGA555 valve system shall be used.

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.

Liquid installations should have manufacturer approved liquid hoses.

All valves and hoses must be suitably rated for liquid i.e. typically 2.4 MPa.

### 3.2 Changeover valves – vapour installations only

1. 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 the Authority.
2. Changeover valves may be comprised of a first & second stage regulator system in a single body, or as a combination of separate component items.

### 3.3 Regulators

- (a) Regulators shall comply with the requirements of the EPA “Guide to Gas Cylinders”.
- (b) Regulators shall comply with the requirements of section J6 of AS/NZS 5601.
- (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 that is subject to cylinder pressure is as short as practicable.

### 3.4 Condensate trap

1. Condensate traps remove condensate and prevent transfer downstream of most condensates present in the LPG.
2. A condensate trap should be installed between the first and second stage regulator if they are separate items.
3. If the regulator is the combined type then a condensate trap should be installed immediately after the regulator.
4. Condensate traps must have a vertical limb in a direct line to the first stage regulator and be of a minimum volume of  $V=N \times 5.5$  where:

V – The volume of the vertical limb in millilitres (ml)

N – The number of 45kg cylinders.

NOTE: Larger traps may be required for liquid installations using a vapouriser.

5. 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

### 3.5 Non-return valves – vapour withdrawal systems only

1. A non-return valve must be fitted in each pigtail connection at the manifold system, or as part of each pigtail.
2. The non-return valve is to ensure that LPG cannot flow across the changeover system.

### 3.6 Excess flow valves

1. 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.
2. 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.

### 3.7 Manifolds

1. Proprietary manifold systems must be approved by the EPA.
2. One-off systems using the POL tee system instead of a manifold shall be restricted to connecting a maximum of four cylinders.
3. One off manifold systems require a producer statement confirming compliance with the requirements of the PECPR regulations.
4. 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.

#### **Liquid withdrawal systems**

1. A pressure relief valve shall be installed on the manifold between any valves that can isolate sections of pipework.

**(The gas supplier should be consulted as they may have additional requirements for the installation).**

### 3.8 Materials of construction

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

#### 5.6.1 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.

#### 5.6.2 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, e.g. 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.

NOTE: Statutory regulations in some States permit only those welders who have certification in accordance with AS 1796 to weld pressure piping.

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



### 5.6.3 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 spigoted 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.

### 5.6.4 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.

## 3.9 Jointing methods

1. A joint subject to cylinder pressure, shall be welded to schedule 40 or 80, or screwed taper to taper, to Schedule 80 or flanged. The welder should be qualified to ASME 9, API 1104.

## 3.10 Certification for pressure pipework

1. 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 which has an internal diameter of greater than 40 mm must have a certificate of inspection under the PECPR Regulations.

## 3.11 Identification

1. Piping shall be identified according to its contents.

## 3.12 Corrosion protection

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

### 3.13 Sizing the Installation

1. Piping shall be sufficient size that the operation of appliances shall not be affected by the pressure drop in any pipe.
2. The volume of gas accounted for shall be determined from either, the manufacturer's input rating, gas supplier or equipment manufacturer.
3. 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.

### 3.14 Draw off rates for general product LPG

1. As a guide a 45kg vapour withdrawal cylinder is capable of a continuous supply of 1kg/50MJ over the period of 1 hour. A 90kg cylinder is capable of a continuous supply of 100MJ over the period of one hour and a 210kg cylinder is capable of 160MJ.
2. The instantaneous demand can exceed this rate for short periods provided the cylinder is subject to only low or no draw off for a time (called relaxation period).

### 3.15 Commissioning/Pressure Testing of the manifold

1. 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.

### 3.16 First Delivery of LPG

For first time cylinder deliveries the LPG delivery personnel will not connect cylinders but will leave them plugged with a suitable label attached. Only the gasfitter should connect the cylinders to the gas installation.

## Section 4: Maintenance of Multi Cylinder Installations

### 4.1 Cylinders

1. Cylinders shall not be filled unless they have been tested, certified and stamped within the last ten years.

### 4.2 Pigtails

1. Pigtails should be inspected visually for cracks and deterioration every time the cylinder is exchanged or filled.
2. Pigtail connections should be checked with a soapy solution every time the cylinder is changed or filled.
3. Flexible pigtails manufactured to AS/NZS 1869 should be replaced every six years from the date of manufacture.

### 4.3 Change-over Valves

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

### 4.4 First Stage Regulators

1. The first stage regulator to be checked for correct operation in accordance with the manufacturer's recommendations, or in the absence of any recommendation at least every ten years.

### 4.5 Second Stage Regulators

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

## 4.6 Condensate Traps

1. 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. The used absorbent material and the gloves can then be disposed of in general waste.
2. The condensate trap to be drained by removing the drain plug or test pressure nipple provided at intervals not exceeding two years, and at every visit of the Gas fitter.

NOTE: Before venting any trap check that there are no sources of ignition in the area and stay upwind of any vented gas.