



Environmental  
Protection Authority  
*Te Mana Rauhi Taiao*

# Guide to Gas Cylinders

SEPTEMBER 2011



## TECHNICAL GUIDE

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# 1. Scope

## 1.1. Introduction

This Guide is intended to assist and guide any person, group or organisation that is involved in, or intends being involved in, the importation, manufacture, supply, filling, storage, handling or periodic testing of gas cylinders and fittings. It provides a guide to the Hazardous Substances (Compressed Gases) Regulations 2004 for these activities but does not exempt persons from the obligation to become familiar with and comply with these regulations.

The regulations nominated in this Guide have applications to many circumstances in addition to cylinders, but this Guide is limited to their application to cylinders. This Guide is not intended as an explanation of these wider applications.

Every effort has been made to retain the historical information contained in the second (last) reprint of the Guide to Gas Cylinders published in 1991 by the Dept of Labour wherever this has been considered still relevant, whilst at the same time ensuring both accuracy and currency for the purposes of this Guide.

It is assumed that readers of this Guide are familiar with the industry, the Hazardous Substances (Compressed Gases) Regulations 2004 and the other relevant regulations.

This Guide must be read in conjunction with the following regulations, transfer notices and Group Standards:

- The Hazardous Substances and New Organisms Act 1996
- The Hazardous Substances (Classification) Regulations 2001
- The Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001 and amendments
- The Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations 2001
- The Hazardous Substances (Identification) Regulations 2001 and amendments
- The Hazardous Substances (Emergency Management) Regulations 2001 and amendments
- The Hazardous Substances (Compressed Gases) Regulations 2004 and amendments
- The Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended)
- The Hazardous Substances (Pesticides) Transfer Notice 2004
- The Aerosols Group Standards 2006
- The Compressed Gas Mixtures Group Standards 2006

## 1.2. Scope

Improper handling of hazardous substances may cause injury, death or ill health to a person and cause damage to property or the environment. Hazardous substances may pose a risk to drivers, cargo handlers, emergency services and the general public during their transportation and storage. These risks are compounded when they are compressed under pressure.

The aim of this Guide is to ensure that cylinders containing hazardous substances in gaseous form are securely constructed and maintained, thereby reducing the risks and helping to prevent accidental damage or injury to people, property and the environment.

The cylinders and fittings shall be designed, manufactured and maintained in accordance with this Guide.

This Guide does not detail the requirements of other legislation. Compliance with this Guide does not obviate the requirement to comply with the HSNO act or regulations made under that act, or other legislation such as the Health and Safety in Employment Act 1992.

This Guide applies to the design, manufacture and approval of the following gas cylinders and fittings as defined in the Hazardous Substances (Compressed Gases) Regulations 2004:

- Compressed Gas Containers
- Fire Extinguishers
- Fittings
- Aerosols

This Guide is also applicable to the filling of cylinders and tanks used for the motive power of a vehicle. With the exception of portable cylinders that are capable of being removed from a vehicle for filling (these are fully included under this Guide and under the above regulations) the approval and design of automotive cylinders and tanks rests with the New Zealand Transport Agency.

In addition to the above, this Guide includes:

- Periodic testing of cylinders
- Filling of cylinders
- Handling and storage of cylinders
- Marking and identification of cylinders, valves and fittings

### 1.3. The Hazardous Substances and New Organisms Act 1996

The HSNO Act 1996 provides a streamlined, up-to-date system for managing the risks associated with hazardous substances and new organisms in New Zealand. The HSNO Act repealed the Dangerous Goods Act 1974 and the Toxic Substances Act 1979 as well as other statutes related to hazardous substances.

The HSNO Act delegated responsibility for the approval of hazardous substances and new organisms and for the implementation of the HSNO Act and regulations made under that act to the Environmental Risk Management Authority (ERMA New Zealand).

Responsibility for inspection and enforcement under the HSNO Act is managed by:

- Inspection and/or testing, including periodic testing of cylinders, is conducted by independent test certifiers approved by ERMA New Zealand. A register of these test certifiers is on the ERMA New Zealand website at: [www.ermanz.govt.nz/search/~tc.html](http://www.ermanz.govt.nz/search/~tc.html)
- Enforcement is delegated to a variety of government or local government agencies as follows:
- Department of Labour Workplace

- Ministry of Health
- Land Transport NZ
- NZ Police
- Maritime NZ
- Civil Aviation Authority
- Energy Safety Service of the Ministry of Consumer Affairs
- Local Authorities
- Regional Councils

## 1.4. Regulations, Transfer Notices and Group Standards

The approval mechanism for individual substances was by regulation for explosives and by notice in the New Zealand Gazette for other substances. These notices in the Gazette are referred to as transfer notices.

The approval mechanism for groups of hazardous substances was by group standards under Part 6A of the Hazardous Substances and New Organisms Act 1996.

## 1.5. The Hazardous Substances (Compressed Gases) Regulations 2004

These regulations came into force on 1 October 2004. They set out the requirements for cylinders, aerosols, non-refillable containers and cylinder fittings as well as the labelling, marking, testing, filling and emergency management.

## 1.6. The Hazardous Substances (Identification) Regulations 2001

These regulations came into force on 1 April 2004. They set out the informational and performance requirements for the identification of hazardous substances including primary and secondary identifiers, documentation, labelling, signage and advertising.

The requirements in this Guide for the identification of cylinders i.e. permanent markings, and the labelling of the contents of cylinders, should also be read in conjunction with the Hazardous Substances (Identification) Regulations 2001 and the HSNO Approved Code of Practice for Labelling of Hazardous Substances (HSNOCOP 10-1:2007).

## 1.7. The Hazardous Substances (Classification) Regulations 2001

These regulations came into force on 1 April 2004. They set out the classifications for hazardous substances according to the Globally Harmonised System (GHS). This includes the level of hazard (e.g. very high, high, medium, low) and the performance scale according to how the hazard is determined (e.g., flash point, boiling point, scale of reactivity, physiological effect, etc).

## 1.8. The Hazardous Substances (Emergency Management) Regulations 2001

These regulations came into force on 26th March 2004. They set out the requirements covering the provision of information, documentation, fire fighting equipment, emergency response plan, secondary containment and signage.

## 1.9. The Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001

These regulations came into force on 1 April 2004. They set out the knowledge and prior experience requirements for test certifiers, approved handlers and enforcement officers.

## 1.10. The Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001

These regulations came into force on 1 April 2004. They set out the storage and handling requirements for Class 1 explosives, Class 2 flammable gases, Class 3 flammable liquids, Class 4 flammable solids and class 5 oxidising substances. They also include the requirements for location test certificates and approved handler test certificates.

## 1.11. The Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations 2001

These regulations came into force on 1 April 2004. They set out the handling requirements for Class 6 toxic substances, Class 8 corrosives and Class 9 ecotoxic substances. They also include the requirements for approved handler test certificates.

## 1.12. The Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004

This transfer notice, which is NZ Gazette Notice number 35, 2004, includes the following items that relate to cylinders:

- Schedule 1: List of Substances (Dangerous Goods) to be transferred
- Table 1: Flammable gases that are not otherwise hazardous
- Table 2: Oxidising gases that are not toxic
- Table 3: Oxidising and/or toxic gases

- Table 4: Gases that are not hazardous but are controlled by the Hazardous Substances (Compressed Gases) Regulations 2004
- Schedule 4 Changes to controls relating to gases that are not hazardous substances.

### 1.13. The Hazardous Substances (Pesticides) Transfer Notice 2004

This transfer notice, which is NZ Gazette Notice number 72, 2004 sets out the classifications for pesticides which include certain pesticide gases.

### 1.14. The Aerosols Group Standards 2006

Six group standards set out the requirements for classification, storage and handling of aerosols having the following combinations of hazardous properties:

- Corrosive
- Flammable
- Flammable, corrosive
- Flammable, Toxic
- Non-hazardous
- Subsidiary hazard

### 1.15. The Compressed Gas Mixtures Group Standards 2006

Ten group standards set out the requirements for classification, storage and handling of compressed gas mixtures having the following combinations of hazardous properties:

- Flammable
- Non-hazardous
- Oxidising
- Subsidiary hazard
- Toxic [6.1]
- Toxic [6.1], corrosive
- Toxic [6.1], flammable
- Toxic [6.1], flammable, corrosive
- Toxic [6.1], oxidising [5.1.1]
- Toxic [6.1], oxidising [5.1.1], corrosive

### 1.16. Sources of Information

- The acts and regulations referred to in this Guide are available at: [www.legislation.govt.nz](http://www.legislation.govt.nz)

- The transfer notices are available on the ERMA New Zealand web site at:
- The Hazardous Substances (Pesticides) Transfer Notice 2004:  
<http://www.ermanz.govt.nz/Publications/Transfer-Notice-72-2004.pdf>
- The Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004: <http://www.ermanz.govt.nz/Publications/Transfer-Notice-35-2004.pdf>
- The group standards referred to in this Guide are available on the ERMA New Zealand web site at:  
<http://www.ermanz.govt.nz/hazardous-substances/about/approvals/group-standards/Pages/default.aspx>
- The registers referred to in this publication (other than the registers of hazardous substances) are available on the ERMA New Zealand web site at: <http://www.ermanz.govt.nz/search-databases/Pages/default.aspx>
- A register of test certifiers can be found on the ERMA New Zealand website at:  
<http://www.ermanz.govt.nz/search-databases/Pages/testcertifiers-search.aspx>
- Fire extinguishers that have been issued a registered licence by SAI Global Australia are available at:  
<http://register.saiglobal.com/>

Further Information on hazardous substance compliance is available at:

- call the Hazardous Substances Compliance Line: 0800 376 234; or
- contact ERMA New Zealand at:  
PO Box 131, Wellington  
Tel: 04 916 2426  
Email: [hsinfo@ermanz.govt.nz](mailto:hsinfo@ermanz.govt.nz)  
Website: <http://www.ermanz.govt.nz>  
Call the Hazardous Substances Compliance Line: 0800 376 234
- You may also contact the Department of Labour at:  
Tel: 0800 20 90 20  
Email: <http://www.dol.govt.nz/contact/index.asp>

## 2. Compressed Gases

### 2.1. How are compressed gases classified?

The Hazardous Substances (Classification) Regulations 2001 follow the Globally Harmonised System<sup>1</sup> of substance classification. There are some differences in this system of classification to that adopted by the United Nations Recommendations for Transport of Dangerous Goods. Certain gases will consequently have a classification other than Class 2. Furthermore, the Class 2 classification is defined as flammable gases only.

With the exception of compressed non-hazardous gases, all gases have hazard classifications, e.g., Class 2, Class 5, and Class 6. These hazard classifications are subdivided according to the level of hazard, e.g., high, medium or low hazard and are sub-classified according to the criteria by which the hazard is measured, e.g., the flammability or combustibility range of the gas mixture with air or the level of acute (toxic) exposure by inhalation.

For example:

Class 2.1.1A	2 = Gas .1 = Flammable .1A = High Hazard
Class 2.1.1B	2 = Gas .1 = Flammable .1B = Medium Hazard
Class 2.1.2A	2 = Gas .1 = Flammable .2A = Aerosol
Class 5.1.2A	5.1 = Oxidising substance .2A = Gas
Class 6.1B	6 = Toxic .1 = Acutely toxic B = LC <sub>50</sub> 100 – 500 ppm as a gas in air as a result of acute exposure by animals, and by the inhalation route.

<sup>1</sup> The Globally Harmonised System of Classification and Labelling of Chemicals (GHS). This is an internationally harmonized approach to classification and labelling that is progressively being introduced by UN member countries.

## 2.2. Common gas classifications

Table 2.2: Common gas classifications

Classification	Properties	Examples
2. 1. 1A	Flammable Gas - High Hazard	LPG, Propane, Butane, CNG, Acetylene, (Ethyne), Hydrogen, Methane, Fluoromethane R4 1, Hydrogen Sulphide, Ethylene Oxide, Carbon Monoxide.
2. 1. 1B	Flammable Gas - Medium Hazard	Methyl Bromide, Anhydrous Ammonia
2. 1. 2A	Flammable Aerosols	Aerosols comprising 45% or more by mass of flammable ingredients
5. 1. 2A	Oxidising Substance	Oxygen, Liquid Oxygen, Chlorine, Nitrous Oxide
6. 1A	Toxic Gas	Chlorine, Phosgene
6. 1B	Toxic Gas	Dichlorovos, Insectigas, Hexafluoroacetone
6. 1C	Toxic Gas	Sulphur Dioxide, Carbon Monoxide, Anhydrous Ammonia
Not classified	Compressed non-hazardous gases, but controlled by the CG Regulations)	Compressed Air, Argon, Carbon Dioxide, Helium, Nitrogen, Neon, Refrigerant Gases

### Notes:

1. The gases used as examples in this table may have more than one hazard classification. They are only listed against one classification to provide an example.
2. A full description of each hazard classification may be found in the Hazardous Substances (Classification) Regulations 2001.
3. A summary of the classifications and controls for each approved substance is available from the hazardous substance register at: [www.ermanz.govt.nz](http://www.ermanz.govt.nz).

## 2.3. What is a Permanent Gas?

A permanent gas means a gas with a critical temperature not exceeding -50°C.

The filling criterion for a permanent gas is the cylinder pressure when both the cylinder and the gas are at 15°C. Filling a cylinder with a permanent gas is covered in Part 7 of this Guide. Permanent gases are so called because they liquefy only under extreme conditions of temperature and pressure. Once a cylinder has been charged, the pressure will increase if the temperature of the gas increases.

In normal service in New Zealand the gas temperature may reach 65°C, and it is expected that this temperature will only be exceeded under abnormal conditions. Most cylinder specifications provide for a range of conditions, and therefore the temperature used for determining the developed pressure for permanent gases in New Zealand is 65°C. The temperature of a permanent gas in a cylinder will be

approximately the same as the cylinder walls because the thermal mass of the gas is low. There is good heat transfer from the walls to the gas, and there is convection within the gas.

The pressure in a cylinder containing a permanent gas depends on the gas composition, the temperature and pressure at which it is charged, and the temperature which it reaches.

It is possible to liquefy permanent gases, a process frequently used in order to transport or store the gas in a bulk pressure vessel. However, the gas will need to be maintained in a cryogenic or refrigerated state to obtain liquefaction.

## 2.4. What is a Dry Gas?

A dry gas means a gas having a dew point of less than  $-40^{\circ}\text{C}$  at a pressure of 101.3 kPa absolute.

Dew point, in the case of a dry gas, means the temperature at which 100% saturation is reached. Certain permanent gases are also naturally dry gases. However, compressed air cannot under normal compression conditions be considered a dry gas unless extra measures are taken during the compression process (and before charging a cylinder) to 'dry' the air by artificial means, for example by passing the compressed air through additional mechanical driers.

## 2.5. What is a Liquefiable Gas?

### 2.5.1. General

Liquefiable gases are gases that have a critical temperature exceeding  $-50^{\circ}\text{C}$  and a boiling point not exceeding  $20^{\circ}\text{C}$  at 101.3 kPa absolute.

Liquefiable gases are so called because they can be economically liquefied under pressure at normal temperatures. This reduces the volume of the gas considerably and makes it economical to transport or store in cylinders.

All containers of liquefiable gases in their liquid state must have sufficient ullage (vapour space) to ensure the liquid will not expand to fill the container.

A liquefiable gas in its liquid state has a higher thermal mass than a permanent gas, and its mean bulk temperature will therefore rise more slowly for the same heat input. However, the liquid stratifies, and the temperature at the surface of the liquid is higher than the mean bulk temperature. It is the liquid surface temperature therefore that determines the vapour pressure, which is the pressure in the cylinder, provided that the cylinder has not been over-filled - this is discussed in more detail in Part 7 of this Guide.

### 2.5.2. High Pressure Liquefiable Gases.

Carbon Dioxide, nitrous oxide and ethylene (ethene) are the main commercial gases in this category. Filling ratios and test pressures will be discussed in Part 3.

Although acetylene (ethyne), in a scientific sense, is a high pressure liquefiable gas, its special properties require it to be considered separately, refer section 2.6.1 of this Guide.

### 2.5.3. Low Pressure Liquefiable Gases

LPG and its components, principally propane and butane, are the most important and frequently encountered members of this category. The actual composition of LPG in New Zealand is determined by commercial interests, although for the most part it will be made up of 60 -100 % Propane, 40 – 0 % Butane. Most imported LPG is propane. The composition of LPG available for use in New Zealand has varied in the past and may vary again in the future. Therefore, the filling ratio for propane must be used.

Although Chlorine and Anhydrous Ammonia, in a scientific sense, are low pressure liquefiable gases, their special properties require them to be considered separately, refer sections 2.6.2 and 2.6.3 of this Guide.

Filling of low pressure liquefiable gases is controlled by the filling ratio – refer to Part 7 of this Guide.

## 2.6. Other Gases

### 2.6.1. Acetylene (ethyne)

Acetylene under pressure may decompose with explosive force under certain conditions. It is 'shock sensitive' and has a flammable range of between 2.5% and 80% in air by volume. The decomposition characteristics of the gas are avoided by filling the cylinder with a porous mass which has minute cellular spaces so that no pockets of appreciable size remain where 'free' Acetylene in gaseous form can collect. The porous mass is saturated with Acetone or other suitably authorised solvent in which the Acetylene dissolves. The combination of these features allows Acetylene to be safely contained in cylinders at moderate pressures.

### 2.6.2. Chlorine

Chlorine is a non-flammable, low pressure liquefiable gas and is greenish - yellow in colour. Although non-flammable it is capable of supporting combustion by way of an oxygen-enriched atmosphere. It has a Class 5.1.2A oxidising gas hazard classification. Chlorine is also classified according to the following hazards:

- acutely toxic (Class 6. 1A)
- toxic to human target organs (Class 6. 9A)
- corrosive to metals (Class 8. 1A)
- corrosive to skin tissue (Class 8. 2A)
- • corrosive to eye tissue (Class 8. 3A)
- very eco-toxic to aquatic and soil environments (Classes 9. 1A, 9. 2A)

Great care must therefore be taken when transporting, storing, handling, filling or testing Chlorine cylinders.

Filling of Chlorine cylinders is controlled by filling ratio (refer Part 7).

### 2.6.3. Anhydrous Ammonia

Anhydrous means without water, i.e., gas or liquid phase as opposed to aqueous ammonia which is a solution of varying dilutions. Anhydrous Ammonia is primarily used as a refrigerant.

Anhydrous Ammonia is a low pressure liquefiable gas and at atmospheric temperature and pressure it is a colourless gas, but is easily compressed to a colourless liquid.

It has a 2.1.1B medium hazard, flammable gas classification and will burn in air between the flammable limits of 16% and 25% by volume.

Anhydrous Ammonia is also classified according to the following hazards:

- acutely toxic (Class 6. 1C)
- corrosive to skin tissue (Class 8. 2B)
- corrosive to eye tissue (Class 8. 3A)
- very eco-toxic to aquatic environments (Class 9. 1A)

Great care must therefore be taken when transporting, storing, handling, filling or testing Anhydrous Ammonia cylinders.

### 2.6.4. Liquid Oxygen

Oxygen has a critical temperature of  $-118^{\circ}\text{C}$  and must therefore be kept below this temperature to remain in its liquid form. This is achieved by using vacuum insulated containers or in insulated bulk tanks.

### 2.6.5. Fumigant Gases

Fumigant gases such as Dichlorovos, 'Pestigas'<sup>2</sup>, 'Insectigas', Methyl Bromide, etc., are low pressure liquefiable gases. They are typically classified as toxic and ecotoxic in varying concentrations. Methyl Bromide is also classified as a medium hazard, flammable gas. Gases that are classified as 6.1A, 6.1B or 9.1A are also tracked substances in any quantity, and are furthermore required to be under the control of an Approved Handler unless secured under lock and key. Refer to Part 6.5 of this Guide.

### 2.6.6. Cryogenic Gases

Cryogenic gases are substances that are gases at atmospheric conditions but which are held as liquids at very low temperatures. Different cryogens become liquids under different conditions of temperature and pressure. The most common cryogens are argon, helium, nitrogen, and oxygen. Adequate venting or pressure relief devices on cryogenic containers are essential.

### 2.6.7. Compressed Gas Mixtures

1. Compressed gas mixtures are frequently encountered in engineering-gas welding industries where mixed properties of gases are desired, in order to provide shielding properties when welding various metals.  
E.g., Argon + CO<sub>2</sub>, Nitrogen + Hydrogen,  
Argon + CO<sub>2</sub> + Helium

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<sup>2</sup> Pestigas and Insectigas are trademarks of BOC Gases New Zealand Limited

2. Compressed gas mixtures are also encountered in SCUBA diving where for different dive operations the standard Nitrogen – Oxygen components of air are in some cases adjusted, e.g., Nitrox, Heliox. Refer also Part 7 of this Guide.
3. Where cylinder designs have been approved for a specific gas or group of gases, it may be possible to introduce a gas mixture that will affect or change either;
  - a. the developed pressure for which the cylinder is designed and is approved; or
  - b. the identification markings and/or the labelling for the cylinder; or
  - c. the specified inspection or test period for the cylinder.

It is therefore essential that prior to charging a cylinder with a compressed gas mixture, that the suitability of the design of the cylinder for the intended fill has been checked. This is further discussed in Part 3.

## 3. Approval of Cylinders

### 3.1. What cylinders require approval?

All cylinders require approval prior to being charged in New Zealand.

### 3.2. What does an approval consist of?

Approval of a gas cylinder consists of the following steps:

- a. Approval by ERMA New Zealand of the design standard e.g. AS 2469:2005, and
- b. Verification of the cylinder design by a Design Verifier (test certifier) and the issue of a design verification test certificate; and
- c. The allocation of a register number (LAB number) for the verified design by ERMA New Zealand; and
- d. Pre-commissioning of the first shipment by a pre-commissioning tester (test certifier) including type testing of sample cylinders (where required) selected by the test certifier from the shipment, at a cylinder testing laboratory and the issue of a cylinder pre-commissioning test certificate; and
- e. Inspection and clearance of each shipment and issue of an imported cylinder test certificate by a test certifier prior to distribution.

### 3.3. What are approved design standards?

#### 3.3.1. Approved design standards

Cylinders for use in New Zealand must be designed to standards approved by ERMA New Zealand or to standards previously approved under the Dangerous Goods (Class 2- Gases) Regulations 1980, and which have not been revoked.

A considerable number of international standards for the design of cylinders are approved. These can be found in the register on the ERMA New Zealand website

Applications for further standards to be included in the register must be submitted to ERMA New Zealand together with the reasons why the applicant considers the addition would be justified. This application is to be made in accordance with regulation 10(c) of the CG Regulations.

Standards will only be considered for assessment if they are in the English language, either originally or as an official translation published by the originating body.

#### 3.3.2. When may ASME Code VIII be used?

The ASME VIII pressure vessel code may be accepted by the Authority as an approved standard under the following circumstances:

- a. the cylinder design is not covered by another standard on the register of approved cylinder standards, e.g., cryogenic; or

- b. the cylinder design in respect to its intended installation or use, is not or cannot be manufactured to another approved standard, e.g. fixed installation vapour withdrawal cylinders; and
- c. the manufacturer supplies full supporting information, including calculations and ASME certification when seeking design verification approval, and.
- d. the cylinders are marked with the ASME inspection stamp.

### 3.3.3. What are the non-approved design standards?

A number of previously approved standards have been withdrawn and no longer appear in the register of approved cylinder standards for reasons such as:

- a. the standard has been superseded; or
- b. the standard has been revised and re-issued; or
- c. the standard has been consolidated in another standard.

Cylinders that were designed and imported to standards and that were previously approved and which were subsequently withdrawn, are deemed to be still approved provided they were imported whilst the standard was current.

Cylinders that are/were designed or imported after the withdrawal of the standard, are not approved for filling and use in New Zealand.

Similarly, a number of cylinder standards have never been approved or considered suitable as cylinder designs in this country, or alternatively the application for approval was declined.

In these cases, the non-approved standards are listed on the register of non-approved cylinder specifications by ERMA New Zealand.

## 3.4. What are the design requirements?

### 3.4.1. General

It should be noted that the listing of a standard on the register of approved cylinder standards does not guarantee the issue of a design verification test certificate for a particular cylinder design.

Most design standards provide for a range of conditions, and these must include allowance for the reference temperature and the developed pressure as described below.

### 3.4.2. What is reference temperature?

The reference temperature for liquefiable gases means the temperature at which the liquid density must be evaluated for calculating the filling ratio.

The reference temperature for permanent gases means the temperature at which the developed pressure must be determined.

The British Home Office Gas Cylinders and Containers Committee used experimental data to derive relationships between maximum shade temperatures and the effective temperature of the compressed gas

container when it was subject to solar radiation. These relationships were set out in Table 18 of BS 5355:1976.

Various modifications were made to this table including to allow for trans-Tasman traffic.

The reference temperatures for cylinders in New Zealand are as follows:

- for low pressure liquefiable gases (not exceeding 250 litres capacity) 57.5°C
- for high pressure liquefiable gases (not exceeding 500 litres capacity) 5°C
- for permanent gases (any size) 65°C

### 3.4.3. What is developed pressure?

Developed pressure for permanent gases means the pressure developed in a cylinder at the reference temperature.

The pressure in a cylinder of a liquefiable gas is the pressure of the vapour phase. This is dependent only on the gas composition and the temperature of the vapour and of the liquid surface, provided the cylinder has not been over-filled (see section 7.7.5).

The pressure in a cylinder of a permanent gas depends on the gas composition, the temperature and the pressure at which it is filled, and on the temperature that it reaches. Tables from BS 5355:1976 are used to establish the developed pressure for cylinder design verification test certification.

### 3.4.4. Test Pressures and Filling Ratios for certain gases.

Table 3.4.4 Test Pressures and Filling Ratios for certain gases

Gas	Design Pressure (MPa)	Minimum Test Pressure (MPa)	Maximum Filling Ratio
Carbon Dioxide		20.7	0.667
		22	0.75
Nitrous Oxide		20	0.75
Ethylene		18	0.325
LPG	2.34	3.3	0.444
Acetylene	1.55		

Note: The minimum test pressure for cylinders imported before 1980 is 19 MPa.

### 3.4.5. Filling ratios low pressure liquefiable gases.

Table 3.4.5 Filling ratios low pressure liquefiable gases

<b>Gas</b>	<b>For Cylinders Not Exceeding 250 L Water Capacity</b>	<b>For Cylinders - Exceeding 250 L But Not Exceeding 500 L Water Capacity</b>
Ammonia	0.553	0.558
Baron Trichloride	1.202	1.206
Butadiene (1-3)	0.569	0.573
n-Butane	0.528	0.533
iso-Butane	0.508	0.512
Carbonyl chloride	1.268	1.275
Chlorine	1.287	1.295
Chlorine trifluoride	1.689	1.698
Cyanogen chloride	1.071	1.077
Dimethyl ether	0.601	0.605
Ethylamine	0.630	0.633
Ethyl chloride	0.824	0.828
Ethylene oxide	0.806	0.810
Hydrogen cyanide	0.614	0.617
Hydrogen fluoride	0.886	0.891
Hydrogen sulphide	0.688	0.695
Methylamine	0.600	0.604
Dimethylamine	0.597	0.601
Trimethylamine	0.577	0.580
Methyl bromide	1.545	1.550
Methyl chloride	0.841	0.847
Nitrogen tetroxide	1.333	1.340
Nitrosyl chloride	1.173	1.179
Propane	0.444	0.449
Cyclo propane	0.552	0.555
Propylene	0.453	0.458
Sulphur Dioxide	1.269	1.277

Gas	For Cylinders Not Exceeding 250 L Water Capacity	For Cylinders - Exceeding 250 L But Not Exceeding 500 L Water Capacity
Vinyl chloride	0.830	0.835
R12	1.193	1.203
R21	1.275	1.281
R22	1.075	1.087
R12B1	1.688	1.678
R133a	1.220	1.228
C.318	1.369	1.380
R114	1.346	1.355

### 3.5. What are the steps for obtaining cylinder design verification?

These steps include:

- a. Check the Gas Cylinder Register to ensure that the proposed cylinder design has not previously been approved.

Note: It may be possible that an existing approved cylinder design may be suitable for the customer's intended purpose.

- b. Ensure that the proposed cylinder is designed to an approved standard.
- c. Obtain a design verification test certificate from a Design Verifier for cylinder design verification.
- d. Obtain confirmation of the allocation of a cylinder register number by ERMA New Zealand

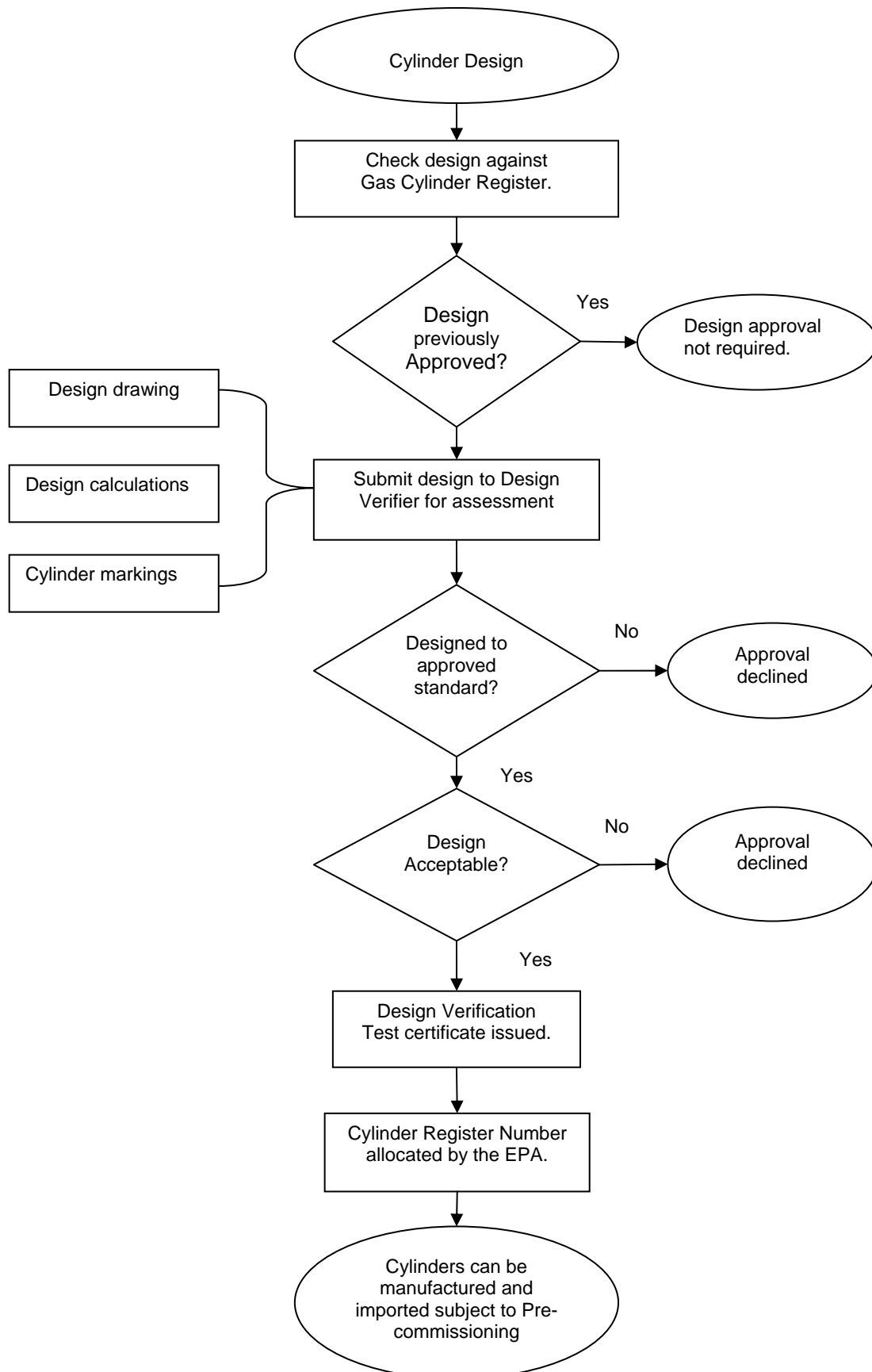
In order to obtain a design verification test certificate it is necessary to forward to the test certifier:

- a copy of the design drawing, and
- the design calculations, and
- the cylinder markings layout
- Where a standard specifies that there are a range of design factors permissible, the design factor used must be provided, including the reasoning for its use

It is prudent at this stage to ensure that the cylinder manufacturer will engage/has engaged a recognized inspection agency e.g., SGS, Lloyds, TUV, TISTR, Arrowhead Industrial, Cochrane Laboratories.

Flow chart 3.5 sets out the steps for obtaining a Cylinder Design Verification test certificate.

Flow chart 3.5 Steps for obtaining a Cylinder Design Verification test certificate:



### 3.5.1. Recognised inspection agencies

Recognised inspection agencies (Independent third parties) must inspect, at the point of manufacture, all batches of cylinders destined for filling and use in New Zealand. A register of recognised inspection agencies can be found on the ERMA New Zealand website

Recognised inspection agencies are contracted by the cylinder manufacturer. They must be present at the point of manufacture and must witness all steps of manufacture of a particular production run (lot, batch, shipment or order) of cylinders intended for use in New Zealand. When the recognised inspection agency is satisfied that a particular production run of cylinders has been:

- a. manufactured at the approved manufacturing facility; and
- b. manufactured in accordance with the approved design specification; and
- c. tested upon completion of manufacture in accordance with the approved design specification and successfully passed all tests,

the recognised inspection agency will permit their approved mark to be stamped or permanently marked on each cylinder.

Inspection certificates are issued by the recognised inspection agency and must precede or accompany each shipment of cylinders into New Zealand. Copies of the inspection certificates must be:

- a. retained by the importer; and
- b. provided to the test certifier issuing the pre-commissioning test certificate;
- c. provided to the test certifier issuing the import clearance test certificate.

## 3.6. What are the steps for obtaining a Cylinder Pre-Commissioning test certificate?

This section should be read in conjunction with regulations 22 and 23 of the CG Regulations.

Once a design verification test certificate has been obtained and a cylinder register (LAB) number allocated, the first shipment of the cylinders may be brought into New Zealand.

The cylinder register (LAB) number must be stamped on all cylinders by the manufacturer prior to consignment. If for any reason this is not carried out prior to arrival of the cylinders in New Zealand, this matter will need to be addressed during the Pre-commissioning process. In this case the cylinders must be stamped with their allocated LAB number by a cylinder testing station approved for this purpose.

- a. Upon arrival of the first shipment a pre-commissioning tester must inspect the shipment. A copy of the manufacturers test report and a list of all lots and cylinder serial numbers comprising the shipment must be provided to the test certifier.
- b. Where type testing of sample cylinders has been required (e.g. by the Design Verifier), the required number of samples must be taken from the shipment and delivered to an accredited cylinder testing laboratory for type testing. Type testing is carried out in accordance with the design specification for the cylinders and may include any or all of the following tests:

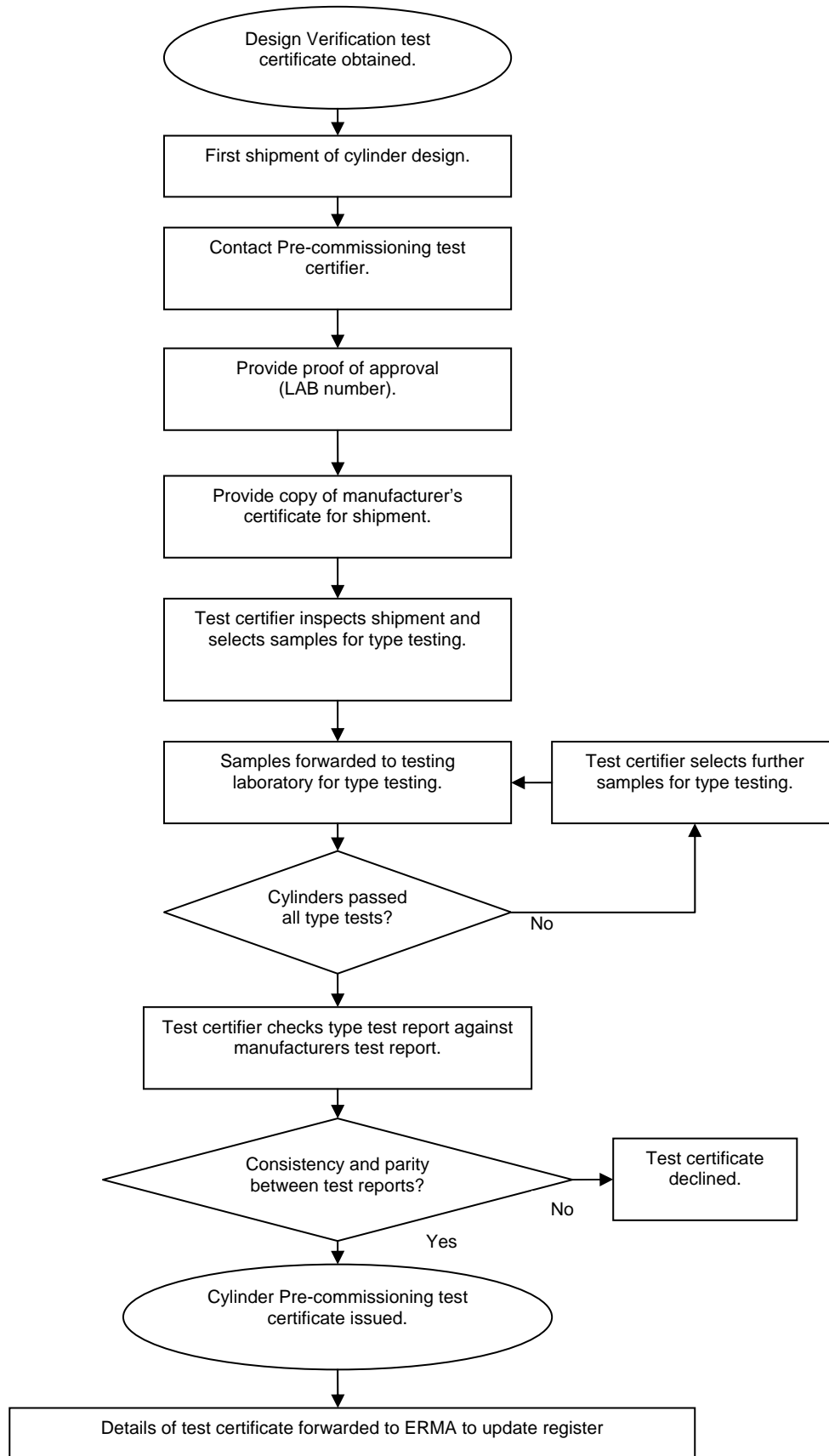
- Visual inspection.
- Mechanical testing – yield strength, ultimate tensile strength and percentage elongation.
- Flattening testing.
- Hydrostatic testing.
- Cyclic testing.
- Burst testing

Cylinders may not be filled in New Zealand unless they have undergone the approval process set out in this section 3.6 of this Guide (or have had a waiver of pre-commissioning approved).

Flow chart 3.6 sets out the steps for obtaining a cylinder pre-commissioning test certificate:

An exception to this requirement for pre-commissioning is cylinder designs that were approved prior to the introduction of the CG regulations.

Flow chart 3.6 Steps for obtaining a cylinder pre-commissioning test certificate:



## 3.7. What are the steps for obtaining a waiver of a Cylinder Pre-Commissioning test certificate?

### 3.7.1. What is a waiver of pre-commissioning?

A waiver of pre-commissioning is an approval by ERMA New Zealand to waive the requirement for pre-commissioning.

### 3.7.2. When may a waiver be required?

There are a variety of circumstances in which a waiver of pre-commissioning certificate may be granted. Such examples include the following:

- a. A cylinder design that has already received a Design Verification test certificate but owing to the small quantity of cylinders intended to be imported (present and future) and/or the specialised nature of their intended use, e.g., some medical gas cylinders, waste gas recovery cylinders, etc., it is considered appropriate to allocate a waiver of pre-commissioning certificate requirement;  
or
- b. Cylinders that are of a design similar to that which is already approved (on the Gas Cylinder Register) and which has previously undergone a pre-commissioning test. This is generally applicable only to one off cylinders e.g. a cylinder that has entered New Zealand by an immigrants possession or visiting yacht.

### 3.7.3. How to apply for a Waiver of Pre-commissioning

An application for a Waiver of Pre-commissioning Certificate Requirement must be made to ERMA New Zealand.

Regulation 21 of the CG Regulations stipulates that ERMA New Zealand may approve a Waiver of Pre-commissioning Certificate Requirement provided that specific requirements have been considered. The criteria in Table 3.7.3 are used by ERMA New Zealand when making an assessment. Sufficient information must therefore accompany the application to enable ERMA New Zealand to make a complete assessment. An application fee (incl. GST) must accompany the application. The quantum of this fee is posted on the ERMA New Zealand website at: <http://www.ermanz.govt.nz/about/fees.html>.

The application must be by way of a completed copy of the form 'Application for Waiver of Pre-commissioning Certificate' and be accompanied by the application fee of \$112.50 (incl. GST). The template for the application form can be found at: [http://www.ermanz.govt.nz/resources/hs-pubs\\_other2.html](http://www.ermanz.govt.nz/resources/hs-pubs_other2.html)

Cylinders are approved individually and where ERMA New Zealand considers that an application meets the criteria they may approve the waiver, allocate a LAB SP number for the cylinder and add the cylinder details to the Special Register.

Where ERMA New Zealand declines an application the applicant will be advised of the reasons for declining the application. Any cylinder that is the subject of a declined application may not be tested or filled in New Zealand.

Any cylinder that has been allocated a LAB SP number but subsequently fails a periodic inspection or test must be reported to ERMA New Zealand.

Table 3.7 Criteria for waiver of pre-commissioning

Criteria	Yes/No/Not applicable
Have the reasons for the application been provided?	
Has the manufacturer of the cylinder been provided?	
Has the quantity of the cylinders been provided?	
Has the third party inspection agency been provided?	
Has the third party inspection agency been recognised previously for the approval of cylinders?	
Have the cylinder details been provided? <ul style="list-style-type: none"> <li>• Cylinder Manufacturer</li> <li>• Manufacturing Specification</li> <li>• Test pressure/working pressure</li> <li>• Third party inspection agency</li> </ul>	
Has the third party inspection agency been recognised previously for the approval of cylinders?	
Are the cylinders of a design that has not previously been imported into or manufactured in NZ?	
Have cylinders of this manufacturer been approved previously?	
Has the manufacturing specification been provided?	
Have cylinders manufactured to this specification been approved previously?	
Has the type of gas to be contained in the cylinder been provided?	
Has the test pressure/working pressure been provided?	
Has experience proven the compliance history of the manufacturer to be acceptable?	
Has experience proven the quality control history of the manufacturer to be acceptable?	
Is the design similar to the design of other cylinders of the same manufacturer which have been previously approved?	
Is the manufacture of the cylinder similar to the manufacture that of other cylinders of from the same manufacturer which have been previously approved?	

### 3.8. What are the steps for obtaining an Import Clearance test certificate?

All shipments of cylinders must be inspected and cleared by a test certifier approved for this activity.

Each shipment of cylinders must be withheld from distribution until such time as the importer or their agent has contacted a test certifier and that certifier has inspected and cleared the shipment, followed by the issue of an Imported Cylinder test certificate. A copy of the manufacturer's certificate(s) covering all lots and serial number ranges of cylinders in the shipment must be provided to the test certifier.

Note: a manufacturer's test certificate is an attestation by the manufacturer detailing the standard and design that the cylinders are manufactured to and also the tests performed.

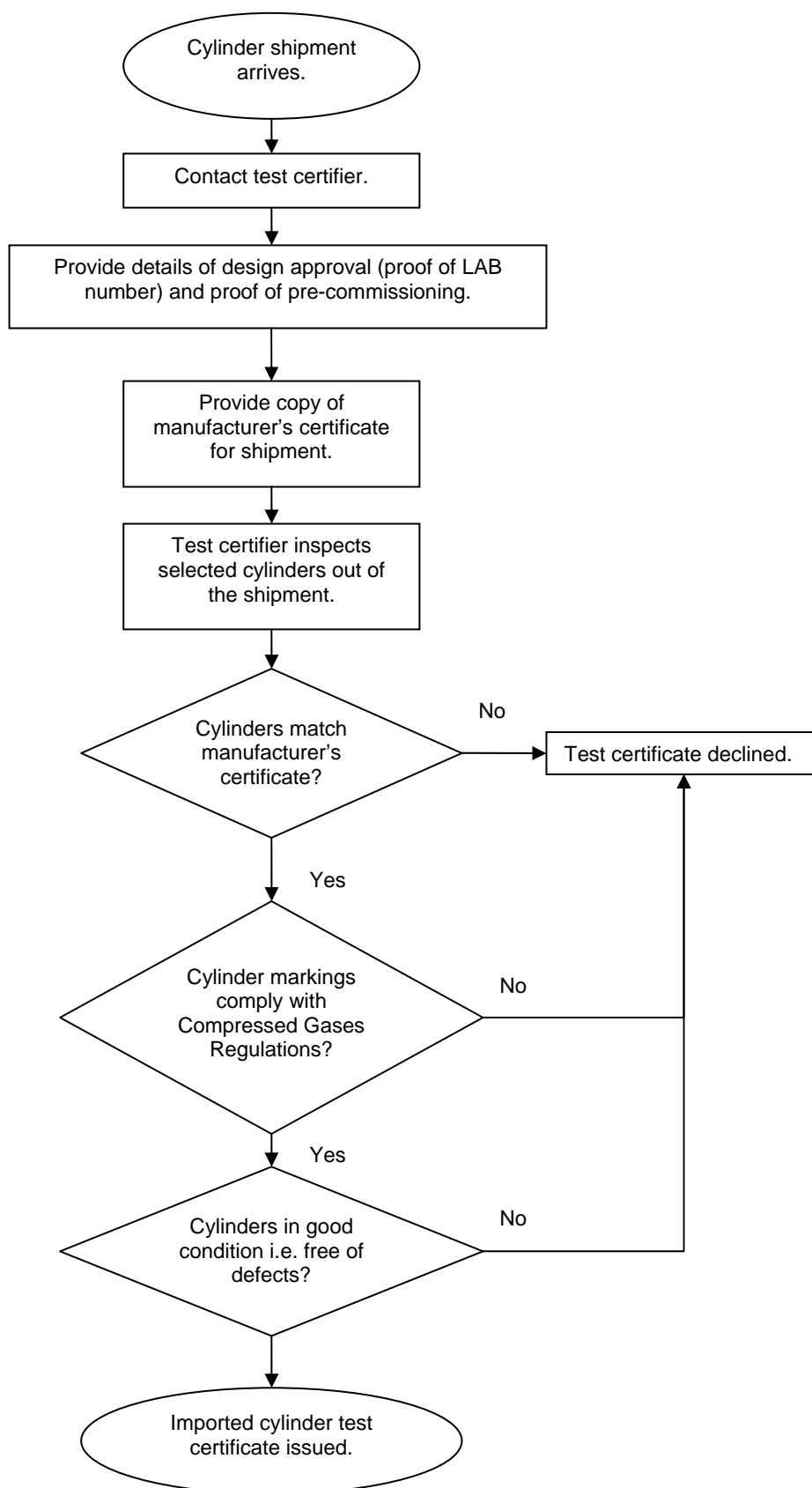
The rate of cylinders inspected will be determined by the formal sampling plan established by the test certifier. The following rates provide a guide:

- a. Where the shipment comprises a single job-lot or series of serial numbers: 1 in 200; or
- b. Where the shipment comprises multiple job-lots or series of serial numbers: 2 in each job-lot or series.

NOTE: Where a shipment comprises different designs or sizes of cylinders, the above rates should apply to each design or size of cylinder.

Examination of imported cylinders by the test certifier should follow the Schedule A examination in section 3.6 of this Guide.

Flow-chart 3.8 Obtaining an Import Clearance test certificate:



### 3.9. One off Cylinders – LAB SP Numbers

A cylinder filling station must not fill any cylinder manufactured after March 1980 that is not listed on the Gas Cylinder Register, i.e., that is not marked with a LAB number or a LAB SP number.

The cylinder owner will be referred to a cylinder testing station for an initial determination as to whether or not the cylinder design may be of an approved design.

Where the periodic tester identifies the cylinder as a previously approved design, the correct LAB may be stamped on the cylinder provided that:

- the periodic tester is specifically approved as a test certifier for the purpose by ERMA New Zealand to undertake this action (only specific periodic testers are approved to undertake this), and
- the correct LAB number is suffixed by the mark of the periodic tester's testing station.

Where the periodic tester cannot identify the cylinder as a previously approved design and considers that the cylinder may meet the criteria for a Waiver, the periodic tester may, subject to the cylinder owner's consent, apply to ERMA NZ for a LAB SP number. The application must be by way of a completed copy of the form 'Application for Waiver of Pre-commissioning Certificate' and be accompanied by the application fee (refer to section 3.7.3 of this Guide). This application form is at:

[www.ermanz.govt.nz/resources/publications/word/ER-AF-HSC-01-03.coc](http://www.ermanz.govt.nz/resources/publications/word/ER-AF-HSC-01-03.coc)

Where ERMA considers that an application meets the criteria for a LAB SP number and approves the application, ERMA will allocate a LAB SP number for the cylinder and add the cylinder details to the Special Register. The LAB SP number is to be stamped on the cylinder by the Periodic tester.

Where ERMA declines an application they will advise the applicant of the reasons for declining the application. Any cylinder that is the subject of a declined application may not be tested or filled in New Zealand.

Any cylinder that has been allocated a LAB SP number but subsequently fails a periodic inspection or test must be reported to ERMA NZ.

### 3.10. Change of Gas Traffic

Where a person intends using a cylinder for a different type of gas traffic to that specified in the Cylinder Design Verification test certificate or specified in the Gas Cylinder Register for that cylinder, that person must re-submit the details of the cylinder design (including where possible, a copy of the manufacturer's drawings, specifications and certificate) to a Design Verifier for re-assessment and re-approval in the different gas traffic (refer to section 3.5 of this Guide). The change is not approved until a new test certificate is issued. A copy of this test certificate must be forwarded to the ERMA New Zealand.

Developed pressures and reference temperatures affecting the cylinder design in the changed gas traffic will be of particular consideration in the verifier's re-assessment.

Where the filling pressure/filling ratio remains unchanged for the new gas traffic, a new Cylinder Register (LAB) number will not be issued and the entry in the Cylinder Register will be amended to include the additional gas traffic.

Where the filling pressure/filling ratio will change for the new gas traffic, a new Cylinder Register (LAB) number will be allocated, and the cylinder will essentially become a separate design. However, for Liquefied gases, a new gas with a new filling ratio may be added to the approval with the agreement of ERMA and with the stamping of the filling ratio onto any cylinders that are to be used for that gas traffic. This is then not considered a new approval but an addition to an existing approval.

Note: If one design is initially approved for use with more than one type of gas, e.g. Permanent and Liquefiable gas (P & L); the respective filling pressures must be marked and suffixed with the name of the gas to which each applies. Refer section 4.8 for suffix abbreviations.

For a cylinder that is already in use, the cylinder will also require re-inspection and re-testing by a periodic tester, including purging and cleaning where required, in accordance with section 7 (Gas Traffic Change) of AS 2030.1 and AS 2337.1

## 3.11. Approval of Fire Extinguishers

### 3.11.1. General

Re-chargeable fire extinguishers, whether they are high pressure types (CO<sub>2</sub>, Nitrogen) or low pressure types (dry chemical, wet chemical, foam water), are required to be of approved designs for charging and use in New Zealand if their water capacity exceeds 500 ml.

The approval requirements are irrespective of whether the extinguisher is initially charged in New Zealand or whether it is imported in a pre-charged condition.

### 3.11.2. What is the approval procedure for a high pressure fire extinguisher?

The approval procedure for a high pressure fire extinguisher is exactly the same as for any other type of high pressure cylinder. Refer section 3.5.

### 3.11.3. What is the approval procedure for a low pressure fire extinguisher?

The approval procedure for a low pressure extinguisher differs from the standard cylinder approval procedure.

Regulation 19 of the CG Regulations requires Low Pressure Fire Extinguishers to have a fire extinguisher registration number before they can be imported into New Zealand. The registration number provider must be accredited. The provider must put the fire extinguisher through systems that include requirements that are equivalent to the design verification and manufacturing certificates that are required by the CG Regulations.

Hence Low Pressure Fire Extinguishers must have been approved by a product certification body e.g., SAI Global Ltd and BSI Group. The product certification body will audit the extinguisher manufacturer on a scheduled basis, test each extinguisher design at a fire ground test facility, and upon successful completion of both audit and testing will allocate a fire extinguisher registration number which must be permanently marked on each fire extinguisher. Refer to section 4.1 note 2.

ERMA New Zealand will not keep or maintain a register of fire extinguisher registrations numbers. Any enquiry in this regard should be directed to the issuing product certification body.

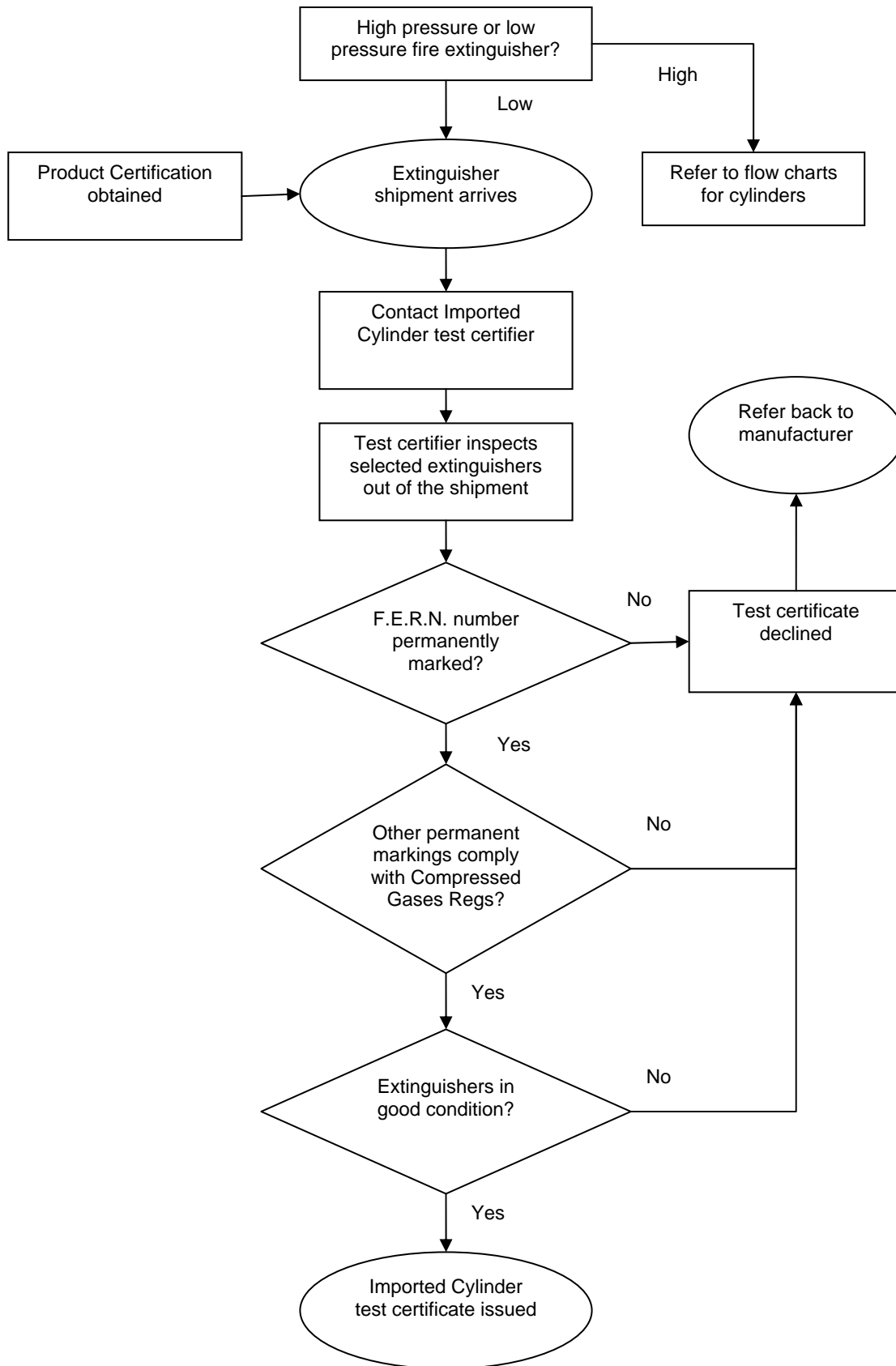
Hence the following is applicable:

- Design verification (regulation 15):
  - The fire extinguisher registration number is the equivalent of a design verification certificate.
  - The fire extinguisher registration number is the equivalent of the HSNO register number for the cylinder design.
  - The fire extinguisher registration number will not be kept on the HSNO register as there is a separate register of fire extinguisher registration numbers.
- Manufacturing Certificate (regulation 16):
  - A fire extinguisher registration number is the equivalent of a manufacturing certificate.
  - The product certification body (for fire extinguisher registration number) is the equivalent of a recognised inspection agency for the purposes of regulation 16.
- Pre-commissioning certificate (regulation 22):
  - at the time an extinguisher is first imported, the fire extinguisher registration number will provide evidence that regulation 22(2)(b) has been met (but proof of the fire extinguisher registration number will be required). Hence, the pre-commissioning process is not required for fire extinguishers with a fire extinguisher registration number.
- Test Certificate for Imported Fire Extinguishers (regulation 19):
  - A test certifier is required to examine each batch of fire extinguishers imported into New Zealand.
  - All of the information required in regulation 19(2)(b) to 19(2)(g) inclusive is required for each batch of imported fire extinguishers.
- Periodic Testing (regulation 52):
  - Is only required when a fire extinguisher needs to be recharged and is older than 5 years since manufacture or last test.

#### **3.11.4. Low Pressure Fire Extinguishers imported prior to 1 October 2004.**

These extinguishers were exempt most cylinder approval requirements under the Dangerous Goods (Class 2 –Gases) Regulations 1980. From March 2002 until 1 October 2004 manufacturers and importers of low pressure extinguishers were requested to begin ensuring that their design had obtained product certification. Low pressure fire extinguishers imported prior to 1 October 2004 may remain in service subject to complying with all other labelling and marking requirements per regulation 39 of the CG Regulations.

Flow Chart 3.11 Procedure for obtaining an Imported Cylinder test certificate for low pressure fire extinguishers:



## 4. Marking and Labelling

### 4.1. What are the identification requirements?

Every cylinder and their contents must be identified for the clear benefit of all users, fillers, periodic testers, transporters, emergency responders as well as any other persons coming into contact with the cylinder and/or its contents. These requirements are shown in table 4.1.

Table 4.1: Identification of cylinders and their contents

Cylinder identification (manufacture, standards, test dates, approval number, etc).	Stamped or permanently marked <sup>1,2,3</sup>
Valves and fitting identification.	Stamped or permanently marked.
Gas identification User warning identification Filling station identification	Adhesive or attached labels.

#### Note

1. For all high pressure cylinders and low pressure LPG cylinders the markings are stamped or engraved on either the cylinder shoulder, valve protection ring or, in certain cases with small cylinders, the foot ring, e.g., Primus LPG cylinders.
2. For low pressure fire extinguishers, it is not considered appropriate to stamp the cylinder shell owing to the thin wall construction, and markings must appear on an indelible, permanent label affixed to the extinguisher. The exception to this rule is where the markings have been roll-pressed during the cylinder shell manufacturing process, i.e., before complete fabrication as a pressurised container.
3. For fibre wrapped or full composite cylinders all markings must appear on a label(s) implanted under the transparent resin during manufacture. Any markings subsequently added by a periodic tester in the course of testing or authorised composite repair, must be by way of a paper label sealed over using a suitable resin repair product.

### 4.2. Permanent markings for cylinders and fire extinguishers

This section should be read in conjunction with regulations 39 through 42 of the CG Regulations and regulation 35(l) of the Hazardous Substances (Identification) Regulations 2001.

The following markings must be permanently and clearly marked either on a thickened portion of the cylinder, e.g., the shoulder or on a suitably attached metal plate, e.g., valve protection ring, foot ring or other permanently attached identification plate, with characters not less than 6 mm high, or if space does not permit this, not less than 3 mm high:

Refer to section 4.7 for acceptable units

- a. the standard to which the cylinder is designed; and
- b. the cylinder manufacturer's name or mark; and

- c. the unique identifying serial number of the cylinder, or in the case of a low pressure fire extinguisher the batch number may be marked; and
- d. the test pressure; and
- e. in the case of a permanent gas, the charging pressure; and
- f. the water capacity; and
- g. the tare weight; and
- h. in the case of a liquefiable gas, the empty weight; and
- i. the month and year (mmyy) of the date of manufacture of the cylinder; and
- j. the cylinder register (LAB) approval number of the design or the Special Register (LAB SP) number<sup>3</sup>; and
- k. the mark of the recognised inspection agency (third party); and
- l. the month and year of each periodic test conducted in accordance with regulation 52 and amendments; and
- m. the mark of the periodic testing station at which the periodic tester conducted the inspection and/or test.

### 4.3. Alternative marking locations for empty weight.

A cylinder's empty weight may be marked on a loose metallic collar retained by the valve. This alternative is particularly suitable for certain designs of cylinder where for reasons of their shape, size or design it is impractical to stamp the empty weight on the cylinder.

The collar and its markings must be:

- durable;
- legible;
- protected from accidental damage; and
- must not impede or restrict operation of the valve hand wheel.

In the case of carbon dioxide fire extinguishers, AS/NZS1841.6: 1997 allows the empty weight to be marked on the operating head instead of the cylinder shell. This is an acceptable additional marking location as long as the empty weight also appears on the cylinder shell.

### 4.4. Markings for low pressure fire extinguishers.

Unless a low pressure fire extinguisher has been marked during manufacture and prior to its fabrication as a pressurised container, the extinguisher should not be stamped with the permanent markings specified in section 4.2 owing to their thin wall type of construction. In such cases the markings specified in a) to i) of section 4.2 must be displayed on an indelible, permanent label on the extinguisher. For the markings specified in l) and m) of section 4.2 a suitable design of void label must be used. Refer section 4.9.1.

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<sup>3</sup> Note that if the cylinder was imported up to and including 1980, the cylinder may not have been issued with a register (LAB) approval number

Instead of i) and j) of section 4.2 a low pressure fire extinguisher must be marked with the fire extinguisher registration number. Refer sections 3.10.3 and 3.10.4 of this Guide.

## 4.5. Additional markings for certain cylinders.

Table 4.5 sets out additional permanent markings that are required for cylinders containing certain gases:

Table 4.5: Additional permanent markings

Gas Traffic	Marking
Dry gas	5 pointed star
Toxic gas class 6.1A or 6.1B	skull mark

## 4.6. Markings on cylinders manufactured prior to March 1980.

The markings of many cylinders manufactured prior to March 1980 will not comply fully with the current marking requirements as per sections 4.2 and 4.5. Such cylinders were the subject of a general exemption issued by the Previous Approving Authority and included those cylinder designs approved under the Dangerous Goods Regulations 1958. These cylinders may continue in service subject to their passing periodic inspection and testing.

Cylinders that were not approved under either the 1958 regulations or the 1980 regulations remain non-approved cylinder designs.

## 4.7. Abbreviations and units of pressure, capacity and weight

There are preferred, permitted and non-preferred abbreviations and units for denoting pressure, capacity and weight. These are included in Table 4.7.

Table 4.7: Preferred, permitted and non-preferred abbreviations

Information	Preferred abbreviations and units		Permitted abbreviations and units (not preferred for new cylinders)		Non-preferred abbreviations and units
Test Pressure	TP	MPa or Bar	T, PH	kPa	psi, kg/cm <sup>2</sup>
Charging Pressure	WP or CP	MPa or Bar	FP, F, PW	kPa	psi, kg/cm <sup>2</sup>
Water Capacity	WC	kg	V	L	lb, oz
Tare Weight	TW	kg	T		lb, oz
Empty Weight	EW	kg	E		lb, oz

If cylinders are marked with non-preferred units then the cylinder can be stamped with the preferred units by an approved test station but care must be taken to ensure that all unit conversions are done accurately

## 4.8. Use of suffixes for identifying gas traffic

If the design of a cylinder has been approved for use with more than one type of gas, or the design has been reviewed and the approval extended to include more than one type of gas, then the respective filling pressures must be marked alongside a suffix denoting the type of gas.

Examples of suffixes used include:

- a. AIR denoting the filling pressure for atmospheric or industrial air only; or
- b. OXY denoting the filling pressure for any permanent gas other than CNG or methane; or
- c. CNG denoting the filling pressure for CNG only.
- d. No Suffix is taken to mean the filling pressure for any permanent gas other than CNG or methane.

Almost all of the high pressure cylinders currently in use do not have a suffix after the filling pressure and are approved for all permanent gas traffic.

## 4.9. Marking and labelling by periodic tester.

### 4.9.1. After inspection

Section 8.5.1 specifies that where a cylinder is inspected but not tested, for example the annual visual inspection of a SCUBA cylinder each alternative (non-hydro test) year, the cylinder should be tagged or labelled. The tag or label may be one of the following:

- a. a plastic non-removable tag such as those available from New Zealand Underwater; or
- b. a non-ferrous (preferably aluminium) loose collar retained by the valve; or
- c. a disc or label of non-ferrous metal or durable plastic fastened to the valve by a non-removable plastic fastener or other suitable method; or
- d. a non-removable adhesive label or void label.

The label or tag must:

- be durable;
- be legible (e.g., 6mm characters although 3mm characters may be used for small labels or tags);
- be corrosion and abrasion resistant;
- not be easily detached from the cylinder;
- must not impede or restrict operation of the valve hand wheel; and
- clearly signify the month and year of inspection plus the identification of the periodic testing station, viz: mmXXyy

where XX is either the unique mark of the testing station or, in the case of a NZ Underwater affiliated testing station, the station number underscored by the NZU authorised flag stamp.

#### 4.9.2. After Testing

Regulation 39(2)(i) and (j) requires a cylinder that has passed its periodic test to be stamped on the thickened portion, e.g., the shoulder, with the month and year of test plus the identification of the periodic testing station, viz:

mmXXyy

where XX is either the unique mark of the testing station or, in the case of a NZ Underwater affiliated testing station, the station number underscored by the NZU authorised flag stamp.

For cylinders that do not have a thickened shoulder the stamping may be done on one of the following (in order of preference):

- a. the valve protection ring (if it is permanently attached); or
- b. the foot ring (if it is permanently attached); or
- c. a special plate attached by the manufacturer for this purpose.
- d. For acetylene cylinders only – stamping on a neck ring fitted between the cylinder and the valve in such a manner that the ring cannot be removed without first removing the valve or by physically cutting the ring off.

The stamping must be legible, preferably using 6mm characters although 3mm characters may be used for small diameter cylinders.

#### 4.9.3. Test markings for thin walled cylinders.

Cylinders of thin wall construction, for example, low pressure fire extinguisher cylinders, must not be stamped. They must have their test information recorded on a suitable metallic adhesive label or equally durable material which is then affixed to the cylinder, e.g., 'void labels'.

The label must contain the following information:

- Month and year of test.
- Test pressure used.
- Name and mark of the periodic testing station.
- Cylinder serial number and/or periodic test certificate number.
- Fill pressure.

Previous test labels must not be removed as these provide a record of previous testing of the cylinder.

In lieu of a test label the above information may be stamped on a permanent part of the cylinder that does not come under pressure, for example on the foot ring or protective shroud.

#### 4.9.4. Additions or alterations to cylinder markings

Some periodic testing stations are authorised to make additions or alterations to cylinder markings, namely:

- new periodic test dates;
- adding pressures, capacities or weights (provided they are detailed in the cylinder register);
- metrication of imperial markings;
- correction of markings stamped in error.

Any additions or alterations made by the test station must have the identification of the periodic test station stamped after it, and must be recorded on a periodic test certificate.

Where a correction needs to be made to a marking that has been stamped in error, the erroneous marking must not be filed off, ground off or obliterated but have a single line stamped through it and the correction stamped next to it.

Where a periodic tester has reason to believe that a cylinder marking has been added, altered, removed or replicated/forged by an unauthorised person, the periodic tester should store the cylinder in a secure place and contact the relevant enforcement agency (e.g. Department of Labour).

Unauthorised additions or alterations to cylinder markings may result in the cylinder being condemned.

## 4.10. Colour code for identification of periodic re-testing.

### 4.10.1. What is the colour code system?

As an aid to identifying cylinders due for periodic testing a colour coding system can be used. Using the system is optional, but if it is used it must follow table 4.10.3.

### 4.10.2. Where can it be used?

Examples of how the colour coding system can be used are as follows:

- Paint highlighting the most current test date that is stamped on a cylinder.
- A coloured loose collar under the valve.
- Coloured labels or tags used to denote periodic inspection – refer section 4.9.1.

### 4.10.3. What are the colour codes?

Table 4.10. below sets out the year of test and the colours corresponding to each test period as appropriate to the type of cylinder.

Table 4.10 Colour Codes

Year of Test	Cylinder to be Tested	Colour of Plastic Ring or Highlight Paint			
		1 Year Cycle	2 Year Cycle	5 Year Cycle	10 Year Cycle
2001	Royal blue	Red	Light blue	Grey	Pink
2002	Red	Light blue	White	Dark green	Dark brown
2003	Light blue	White	Light brown	Mauve	Black
2004	White	Light brown	Grey	Yellow	Claret
2005	Light brown	Grey	Dark green	Lime green	Royal blue
2006	Grey	Dark green	Mauve	Pink	Red
2007	Dark green	Mauve	Yellow	Dark brown	Light blue
2008	Mauve	Yellow	Lime green	Black	White
2009	Yellow	Lime green	Pink	Claret	Light brown
2010	Lime green	Pink	Dark brown	Royal blue	Grey
2011	Pink	Dark brown	Black	Red	Dark green
2012	Dark brown	Black	Claret	Light blue	Mauve
2013	Black	Claret	Royal blue	White	Yellow
2014	Claret	Royal blue	Red	Light brown	Lime green
2015	Royal blue	Red	Light blue	Grey	Pink
2016	Red	Light blue	White	Dark green	Dark brown
2017	Light blue	White	Light brown	Mauve	Black
2018	White	Light brown	Grey	Yellow	Claret
2019	Light brown	Grey	Dark green	Lime green	Royal blue
2020	Grey	Dark green	Mauve	Pink	Red

	Visual inspection for SCUBA cylinders	Hydro test and visual inspection for SCUBA cylinders	Refer section 8.7	Refer section 8.7
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## 4.11. Cylinder contents identification/labelling.

### 4.11.1. General

Where a gas cylinder contains a hazardous substance it must be identified and labelled to the classifications of the hazardous substance, the adverse effects and the general precautions that need to be taken in order to prevent the adverse effects.

It is the approved filler's responsibility to ensure that all cylinders they fill are correctly labelled as to the cylinder's contents.

### 4.11.2. What are the priority identifiers?

Priority identifiers are information that must be available to any person handling the cylinder within two seconds. It must consist of an indication of the type of hazard that exists, normally in the form of signal words, including a description of the type of hazard and/or pictograms (which may have a description of the hazard). All priority identifiers must be visible i.e. not under a peel off label.

For gases, the priority identifiers primarily give:

- a. an indication that it is flammable/oxidizing/toxic/corrosive/ecotoxic; and
- b. an indication that it is a gas.

The standard UN pictograms should be used (refer to table in section 4.11.4).

### 4.11.3. What are the secondary identifiers?

Secondary identifiers are information that must be available within ten seconds to any person handling the cylinder, and consists of an indication of the degree of hazard and other risks associated with the gas. It must also include information on how to prevent and manage those risks. This is normally in the form of hazard/warning and precautionary statements and/or risk phrases.

For gases, the secondary identifiers give:





- a. An indication of the general degree of hazard, e.g., 'highly flammable gas', 'flammable', 'fatal/toxic', 'very ecotoxic'.
- b. An indication of the circumstances in which it may adversely behave, e.g., 'heat', 'open flames', 'if inhaled', 'aquatic environment'.
- c. An indication of the steps to be taken to prevent unintentional ignition/combustion/inhalation/release.





#### 4.11.4. Examples

The following table sets out the identification/labelling requirements for particular classifications and gases. Where a gas is not listed reference should be made to the following as appropriate in order to confirm the classification for a particular gas:

- the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004;
- the Hazardous Substances (Chemicals) Transfer Notice 2006;
- the Hazardous Substances (Pesticides) Transfer Notice 2004;
- the Compressed Gas Mixtures Group Standards 2006;
- the Aerosols Group Standards 2006

Table 4.11 Priority Identifiers

Classification	Examples	Priority Identifiers	Signal Word	Secondary Identifiers (select as appropriate)
2.1.1A	LPG, Propane, Butane, Acetylene, Hydrogen, Methane, CNG, Carbon Monoxide, Ethylene Oxide		Danger	Highly flammable gas. Keep well away from heat, sparks and open flames. No smoking. Keep valve closed when not in use.
2.1.1B	Anhydrous Ammonia, Methyl Bromide		Warning	Flammable gas. Keep well away from heat, sparks and open flames. No smoking. Keep valve closed when not in use.
2.1.2A	Flammable aerosols		Warning	Flammable aerosol. Read label before use. Keep away from heat and open flames. Do not spray on open flames or ignition source. Pressurised container. Do not pierce or burn even after use.
5.1.2A	Oxygen, Liquid Oxygen, Chlorine		Danger	May cause or intensify fire. No smoking. Keep away from heat and open flames. Do not use around grease or oil. Store away from flammable substances.

6.1A/6.1B/6.1C	Chlorine, Anhydrous Ammonia, Nitrous Oxide, Sulphur Dioxide, Insectigas, Carbon Monoxide, Dichlorovos, Phosgene		Danger	Fatal/toxic if inhaled. Keep out of reach of children. Avoid inhalation. Use in well ventilated area. Wear respiratory protection.
8.1A/8.2A/8.3A	Chlorine, Anhydrous Ammonia, Sulphur Dioxide, Phosgene		Danger	Fatal/toxic if inhaled. Keep out of reach of children. Avoid inhalation. Use in well ventilated area. Wear respiratory protection. Avoid skin contact.
9.1A/9.2A/ 9.3A/9.4A	Chlorine, Anhydrous Ammonia		Warning	Very ecotoxic to aquatic life/soil/environment/animals/insects.
Non-flammable, Non-toxic Compressed Gas	Compressed Air, Argon, Nitrogen, Helium, Carbon Dioxide, Balloon Gas, Refrigerant Gas		Warning (suggested)	Contains gas under pressure/contains refrigerant gas under pressure. Avoid eye and skin contact. (suggested.)

## 4.12. Identification/labelling of fire extinguishers

In lieu of the markings in the table in section 4.11.4 above, fire extinguishers (excluding deluge cylinders) should be clearly identified and labelled as follows:

- a. the cylinder shell is painted/powder coated a differentiating colour (normally red) that will be associated with their uses as fire extinguishers; and
- b. the following information is clearly marked on an indelible, non-removable label affixed to the extinguisher shell:
  - that it is a fire extinguisher;
  - its type e.g., CO<sub>2</sub>, Dry powder, Foam, etc.; (or colour branding),
  - its fire rating in accordance with AS/NZS 1841.1;
  - its application, e.g., wood/paper/electrical;
  - its nominal unit capacity; and
  - instructions for use; and

- c. a durable servicing tag is attached to the extinguisher head to indicate the last periodic servicing and last periodic test, in accordance with NZS 4503.

#### Notes.

1. It is accepted that in certain limited organisations, e.g., hospitals, ships, aircraft and Defence Force establishments, alternative colour codings may be used.
2. Despite the requirements for the painting of all extinguishers in accordance with AS/NZS 1841.1, fire extinguisher shells of natural stainless steel will be accepted subject to their meeting all other marking and labelling requirements as per b) and c) above.

### 4.13. Identification/labelling of SCBA and SCUBA cylinders

In lieu of table 4.11.4 above, SCBA and SCUBA cylinders must be labelled with a suitably durable UN pictogram (green) for 'non-flammable, non-toxic gas, (or 'non-flammable compressed gas), viz:



### 4.14. Identification/labelling of cylinders used for mixed gas SCUBA diving (Nitrox, EANx and DNAX)

In lieu of table 4.11.4 above, all cylinders used for 'Nitrox' mixed gas diving must be clearly labelled as follows:

- a. A 100 mm emerald green circumferential band bordered above and below by a 25mm yellow band. The green band must include in contrasting lettering the words, 'Enriched Air' or 'EANx' in the case of enriched air filled by the partial pressure blending method, or the words 'DNAX' in the case of the de-nitrogenated (i.e. nitrogen has been removed) air filling method;
- b. a label certifying that the cylinder has been oxygen cleaned (i.e. cleaned in preparation for oxygen enriched service), and the date of last clean. This is required irrespective of the Nitrox filling method used.
- c. a label certifying the Nitrogen-Oxygen-other gas percentage mix that the cylinder is charged with.

### 4.15. Identification/labelling of aerosol dispensers.

In addition to table 4.11.4 above, aerosol dispensers must be:

- a. marked with a batch number; and
- b. able to be traced (through markings or documentation) to the manufacturer of the empty aerosol dispenser.

## 4.16. Identification/labelling of non-refillable containers.

In addition to table 4.11.4 above, a non-refillable container must be:

- a. marked with a batch number; and
- b. able to be traced (through markings or documentation) to the manufacturer of the empty non-refillable container.

## 4.17. Additional markings for LPG cylinders.

### 4.17.1. LPG Cylinders over 5 litres water capacity

In addition to table 4.11.4 above, LPG cylinders over 5 litres water capacity must be finished in one of the following coatings:

- a. white paint or powder coating; or
- b. galvanised finish; or
- c. zinc powder coating; or
- d. a similar light reflecting coating.

### 4.17.2. Additional marking for liquid withdrawal cylinders

Liquefiable gas cylinders designed and used for liquid withdrawal must be marked with two black vertical strips extending the length of the cylinder shell on opposing sides.

## 4.18. Markings for valves

Valves imported prior to 1 October 2004 must be marked in accordance with the standard to which they have been designed and manufactured. They must also be marked in accordance with any approval issued for that valve design by the Previous Approving Authority – Refer to the Register of Valves and Fittings.

Valves imported after 1 October 2004 must have the following markings:

- a. the valve open and closed position;
- b. the manufacturer's mark or identifier;
- c. the design standard to which the valve was manufactured;
- d. the batch number;
- e. the operating pressure of the pressure relief device;
- f. the date of manufacture or a code in the batch number that links to a date of manufacture.

## 4.19. Markings for Regulators

Regulators imported prior to 1 October 2004 must be marked in accordance with the standard to which they have been designed and manufactured. They must also be marked in accordance with any approval issued for that regulator design by the Previous Approving Authority – refer to the Register of Valves and Fittings.

Regulators imported after 1 October 2004 must have the following markings:

- a. the manufacturer's mark or identifier;
- b. the design standard to which the regulator was manufactured;
- c. the batch number;
- d. the date of manufacture or a code in the batch number that links to a date of manufacture;
- e. information identifying the gas or gases for which the regulator is intended to be used.

## 4.20. Markings for adaptors

Adaptors imported prior to 1 October 2004 must be marked in accordance with any approval issued for that adaptor by the Previous Approving Authority – refer to the Register of Valves and Fittings.

Adaptors imported after 1 October 2004 must have the following markings:

- a. the manufacturer's mark or identifier;
- b. the date of manufacture of the adaptor;
- c. the connection compatibilities of the adaptor.

## 4.21. Markings for automatic changeover devices for LPG

Automatic changeover devices for LPG imported prior to 1 October 2004 must be marked in accordance with the standard to which the device was designed and manufactured. They must also be marked in accordance with any approval issued for that device by the Previous Approving Authority – refer to the Register of Valves and Fittings.

Devices imported after 1 October 2004 must be marked as follows:

- a. the manufacturer's mark or identifier;
- b. the design standard to which the device was manufactured;
- c. the batch number;
- d. the date of manufacture of the device or a code that links to a date of manufacture.

## 4.22. Clarity of markings on valves and fittings.

Markings on valves and fittings must comply with the clarity and legibility requirements of regulation 35 of the Hazardous Substances (Identification) Regulations 2001.

## 4.23. Cylinder contents identification by colour.

The primary means of identifying the contents of a cylinder is the labelling as per section 4.11.4. However, as a secondary means of identification cylinders may sometimes be colour coded.

Where colour coding is used it should conform to the current edition of AS4484 – ‘Gas cylinders for industrial, scientific, medical and refrigerant use – labelling and colour coding’.

This standard applies to gas cylinders having a water capacity of between 0.1 kg and 150 kg. Cylinders above this size may also follow this standard.

This standard does not apply to SCUBA, SCBA or portable fire extinguishers and should not be used for LPG cylinders irrespective of size.

## 5. Neck Threads, Valves, Safety Devices and Fittings

### 5.1. Preferred Cylinder Neck Threads.

[These sections should be read in conjunction with regulations 27 through 29 of the CG Regulations].

There are permitted and preferred neck threads for cylinders in accordance with regulations 5 and 12 of the CG Regulations. These are included in Table 5.1

Table 5.1: Neck threads

Type	Comments.
0.715", 1" or 1.25" 1 in 8 taper on diameter to BS341/AS 2473 Note: the 1" thread is equivalent to the 25T and 25E threads in the BS, EN and ISO specs.	First preference for all cylinders
3/4" -14 NGT <sup>1</sup> (NPT <sup>2</sup> , NPTF <sup>3</sup> )	LPG or acetylene cylinders
3/8" -18 NGT <sup>1</sup>	Small acetylene cylinders
3/4" -14 NPSM4 (NGS5 )	SCUBA cylinders
M14 x 1.5	Primus LPG cylinders
3/4" BSP8	

### 5.2. Non-preferred Cylinder Neck Threads.

In certain circumstances it has been - and may be – necessary to use a different neck thread to those specified in the above table. These circumstances include:

- The cylinder is normally fitted to or forms a part of a specific distribution system that requires special purpose valves, e.g., large diameter quick acting; or
- The cylinder is normally fitted to or is an integral part of a special purpose item of plant or machinery, is not used for any other purpose and is only removed for filling or testing; or
- The cylinder is used with special purpose equipment for which interchangeability is essential, and the use is well established in New Zealand or internationally.

Where a non-preferred neck thread is used, the neck thread type and size should be clearly identified on the stamped cylinder markings, or by using a metallic disc retained by the cylinder valve.

Table 5.2 Typical applications of some non-preferred neck threads

Type	Application
1" NGT <sup>1</sup>	Large LPG cylinders, CO <sub>2</sub> fire extinguishing systems.
3/4" NGT <sup>1</sup>	Ex-CNG cylinders used for helium and helium-air mixtures.
1/2" NGT <sup>1</sup>	Small resuscitation cylinders.
1/4" NGT <sup>1</sup>	Ammonia cylinder fitted to printing machine.
1.125" UNF <sup>6</sup>	Aluminium-fibre wrapped SCBA cylinders.
0.875" UNF <sup>6</sup>	Aluminium-fibre wrapped SCBA cylinders.
3/4" UNF <sup>6</sup>	Small resuscitation cylinders, small cylinders for beverage dispensers.
DIN 477 <sup>7</sup>	Oxygen cylinders for Draeger BG 174 mine rescue sets Resuscitation cylinders SCBA, SCUBA CO <sub>2</sub> explosion suppression system
1"NGT <sup>1</sup>	CO <sub>2</sub> fire extinguishing cylinders.

The neck thread is assessed at the same time the cylinder design is assessed for the purpose of the design verification test certificate.

## 5.3. Valve Specifications

### 5.3.1. Why are standardised valve connections important?

Accidentally connecting a compressed gas cylinder valve outlet with equipment that is not designed for that particular gas traffic is potentially extremely hazardous and could result in serious harm to people and/or damage to property.

Because of this, standard valve outlet connections have been established for cylinders containing different gases. These standard connections will help ensure that the valve connection for one type of gas will not fit the connections for incompatible gases.

### 5.3.2. Inlet (stem) Specifications.

Refer section 5.1.

### 5.3.3. Outlet Connections for cylinders other than LPG cylinders

These must comply with:

- section 5.3 of AS 2030.1; or

- an existing design standard

#### 5.3.4. Alternative Outlets.

Specialised designs of valve outlets have been developed for certain types of use. Such types include:

- Portable fire extinguishers; or
- Resuscitation kits and other portable medical uses; or
- Cylinders which are part of installed systems.

Right hand external threads have been accepted for small acetylene cylinders, that is, CGA Connections No.200 and No.520. Outlets for LPG cylinder valves are to be in accordance with section 5.3.5 of this Guide.

#### 5.3.5. Outlet Connections for LPG Cylinder Valves.

Outlet connections for LPG cylinder valves must be of an approved type as shown in Table 5.3.

Table 5.3: Approved outlet connections for LPG cylinder valves.

Type	Application
UL 2061	Cylinders < 25 L water capacity
M 14 x 1.5 Right-hand internal (Primus) (14mm ISO metric)	Cylinders < 25 L water capacity
3/8" BSP Right-hand internal (Cadac)	Cylinders < 25 L water capacity
3/8" BSP Left-hand external (Companion)	Cylinders < 25 L water capacity
20 mm Clip-on connector	All sizes
0.885" – 14 NGO Left-hand internal (POL)	All sizes
1 ¼" ACME Right-hand external (QCC)	Fork lift, all cylinder sizes
CGA 555 Left-hand external	Cylinders 45 kg water capacity and greater: Liquid withdrawal only

#### 5.3.6. Non-Preferred Outlet Connections for LPG Cylinder Valves.

In general, the use of non-preferred outlet thread connections is discouraged.

Non-preferred outlet thread connections have been approved on certain types of LPG cylinders less than 25 L water capacity manufactured prior to March 1980. However, this approval does not permit the installation of new valves with non-preferred outlet threads, even as a replacement for similar worn-out valves.

## 5.4. LPG Cylinder Valve Adaptors.

If a cylinder valve is fitted with an adaptor on the outlet thread, then the outlet connection of the adaptor can be considered the outlet connection of the valve, provided that:

- a. the adaptor is permanently fitted to the valve in a suitable manner and according to the manufacturer's instructions; and
- b. the adaptor outlet connection is a preferred outlet connection (refer section 5.3.5).

Note: No adaptor of any type must be fitted to a QCC valve in an LPG cylinder.

The manner of fitting an adaptor should not prevent removal of the valve from the cylinder for the purpose of periodic testing. Periodic testers should not accept liability for damage to valves fitted with adaptors when the valve is removed for internal inspection of the cylinder.

## 5.5. How Should Valves be Protected?

It is important that all users of cylinders take appropriate steps to ensure that cylinder valves are protected against damage.

Examples of appropriate steps include:

- Valve protection rings, where these form part of the cylinder design; or
- Vented valve caps, where threaded provision for these has been provided; or
- Protecting the tops of cylinders during transport and handling; or
- Securing tall cylinders during transport and storage to prevent them from toppling.

## 5.6. How Must Valves be Removed and Refitted?

### 5.6.1. General

Valves must only be removed and re-fitted by suitably competent persons<sup>4</sup> who have appropriate equipment to undertake the work without damaging either the valve or the cylinder.

Examples of appropriate equipment include:

- Cylinder clamps.
- Crows-foot type wrenches or fittings of correct size(s) that will span parallel flats on the sides of valves.
- Tubular or box wrenches or fittings.
- Split sockets.
- Soft mallets, e.g., rubber, wooden.

Care must be taken not to use any tool or device that may mark, deform or damage any part of a valve. Lubricants should only be used if these are of a suitable type for the particular gas traffic. Refer section 8.11.

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<sup>4</sup> Persons with mechanical aptitude who have been trained to remove and install valves.

### 5.6.2. Valve Torque Values.

Upon re-fitting, valves should be torqued to the value recommended by the manufacturer. If the correct value cannot be ascertained, advice from a suitably competent<sup>5</sup> person should be sought.

Guidance torque values are included in Table 5.6.2. These are included for guidance only and should only be used when no specific information is otherwise available:

Table 5.6: Valve torque values *as guidance only*

Thread	Torque Value			
	Minimum		Maximum	
<b>Steel Cylinders: (use 2 ½ turns of PTFE tape)</b>	<b>N-m</b>	<b>Ft-lb</b>	<b>N-m</b>	<b>Ft-lb</b>
½" NGT	108	80	122	90
0.60" BS 341/AS2473	136	100	149	110
0.735" BS341/AS2473	136	100	149	110
¾" NGT	200	150	312	230
1" BS341/AS2473	325	240	380	280
27.8 DIN	352	260	380	280
27.2 SI	352	260	380	280
1" NGT	339	250	352	260
1 ¼" BS341/AS2473	488	360	515	380
<b>Aluminium Cylinders: All threads</b>	100	75	110	80

## 5.7. Over-pressure Protection Devices.

[This section should be read in conjunction with regulation 30 of the CG Regulations].

### 5.7.1. What is an over-pressure protection device?

Over-pressure protection devices are designed to protect the cylinder against any likelihood of unsafe over-pressurisation that could cause the cylinder to burst or explode.

The device releases the contents when a pre-determined pressure or temperature is reached.

These generally take the form of one of the following or a combination of them:

- Bursting Discs
- Safety Valves
- Fusible Plugs

<sup>5</sup> An engineer with experience in the cylinder industry.

### 5.7.2. When are they required?

Regulation 30 of the CG Regulations requires that most cylinder designs and types must be fitted with an over-pressure protection safety device. Refer also to AS 2030.1 section 5.

### 5.7.3. What are the exceptions to the requirement?

- a. A cylinder with a valve that was approved under the grandfather clause
- b. A cylinder designed to contain a Class 6.1 acutely toxic substance must not under any circumstances be fitted with an overpressure protection device.
- c. A fire extinguisher designed to operate at pressures not greater than 19MPa is not required to have an over-pressure device.
- d. A cylinder manufactured prior to March 1980.
- e. A cylinder manufactured between March 1980 and October 2004 where the fitment of an overpressure protection device was not a specific legal requirement or a requirement of the cylinder design approval.

### 5.7.4. How should they be fitted?

It is extremely important that over-pressure protection devices be fitted correctly, using matched components from the same manufacturer as the valve or the cylinder as appropriate, fitted in the correct order and using the correct torque value.

When fitted the device must:

- a. operate below the test pressure of the cylinder; and
- b. operate in the case of excessive heat or pressure to stop the cylinder from bursting, and
- c. not release the cylinder contents under normal atmospheric conditions.

Retro-fitting of over-pressure protection devices after valve manufacture or at a later date should only be undertaken:

- a. Where the valve manufacturer has made provision for the retro-fitting to take place, e.g., a machined part fitted with a blanking plug; and
- b. The matched components are available from the manufacturer.

Any variation to the above can result in unsafe variations from the intended operating conditions and/or void the manufacturer's warranty or the design approval.

### 5.7.5. How should they operate?

Typical examples of over-pressure protection devices are as follows:

- a. A spring-loaded, re-seatable pressure relief valve designed into the valve and having an operating pressure not greater than the cylinder test pressure (and preferably not greater than 90% of the test pressure) and not less than 1.25 x the developed pressure; or

- b. A burst disc designed into either the valve or the cylinder having an operating pressure not greater than the cylinder test pressure and not less than 1.18 x developed pressure; or
- c. an operating temperature not greater than 105°C.

**In cases not covered by the above, safety devices may be fitted in accordance with the provisions of AS 2030.1 (which refers to AS 2613).**

## 5.8. Over-filling Protection Devices (OPDs) in LPG Cylinders.

### 5.8.1. What are they?

Over-filling Protection Devices (OPDs) are devices that incorporate a float mechanism and a shut-off valve operated at a pre-calculated point when the float lifts.

When fitted to the bottom of an LPG cylinder valve they act as a back-up safety device that will prevent the cylinder from being excessively over-filled. As the liquid level of the LPG contents in a cylinder rises the float also rises and eventually shuts off the filling tube of the valve.

OPDs are a back-up safety device only. They are designed to operate at between 80 – 85% cylinder full. As it is not permitted to fill an LPG cylinder greater than 80% full OPDs must not be used to decide the gross filled weight.

### 5.8.2. When are OPDs required to be fitted?

All LPG cylinders having a nominal capacity greater than 4 kg and less than 11 kg manufactured after March 2002 are required to have an OPD fitted to the valve.

These particular valves usually have a distinctive triangular-shaped hand wheel with the letters 'OPD' embossed on them. Where valve replacement becomes necessary, any 4.5 kg or 9 kg nominal capacity LPG cylinder manufactured after March 2003 must be fitted with a valve incorporating an OPD. 4.5 kg and 9 kg nominal capacity LPG cylinders manufactured prior to March 2003 may be fitted with a replacement valve incorporating an OPD.

## 5.9. Regulators and Automatic Change over Devices.

[This section should be read in conjunction with regulations 31 and 32 of the CG Regulations].

Regulators and automatic changeover devices must comply with one of the nominated design standards included in table 5.9.

Table 5.9 Design standards for regulators and automatic changeover devices

Regulators for gases other than LPG	Regulators and automatic changeover devices for LPG
AS 3840	UL 144
AS4267	UL 252
An existing approval issued by the Previous Approving Authority (under the Dangerous Goods Act 1974)	AGA 205
	An existing approval issued by the Previous Approving Authority under the Dangerous Goods Act 1974
A Code of Practice approved by ERMA New Zealand under the HSNO Act	A Code of Practice approved by ERMA New Zealand under the HSNO Act

## 5.10. Test Certification of Fittings for LPG

[This section should be read in conjunction with regulation 36 of the CG Regulations].

Examples of LPG fittings that require test certification (whether the fittings are imported or manufactured in New Zealand) by a test certifier registered for this activity are as follows:

- Regulators
- Valves
- Adaptors
- Automatic changeover devices
- Gauges
- Gas manifolds.
- Flexible 'pigtail' hoses and their connections.
- Manual shut-off valves.
- Automatic shut-off devices.
- Pressure relief devices.

The criteria that determines whether a fitting requires test certification under the HSNO Act is whether or not that fitting is installed upstream from the regulator, i.e., it is installed between a cylinder valve and the regulator.

In order to assess a fitting for compliance a test certifier must have first received:

- a copy of the test report on the fitting from a recognised inspection agency; and
- a sample of the fitting requiring assessment.

The assessment by the test certifier may include;

- a. the information marked on the fittings
- b. whether the report from the recognised inspection agency indicates compliance with the design to which the fitting was manufactured

- c. the fittings meet the requirements of the Hazardous Substances (Compressed Gases) Regulations.

A test certificate is required for both the first and subsequent batches of fittings.

Upon completion of assessment, the test certifier may issue a test certificate and subsequently provide ERMA New Zealand with copies of both the test certificate and the test report. Following receipt of a test certificate for the first batch of fittings, ERMA New Zealand must:

- a. allocate a register number to the cylinder fittings; and
- b. enter the details on the Cylinder Fittings Register.

### 5.11. What happens if a test certifier fails to give clearance to a fitting?

[This section should be read in conjunction with regulation 37 of the CG Regulations].

If a test certifier fails to give clearance to a fitting the test certifier must either:

- a. allow the fittings in that batch to be brought in to compliance if the certifier considers this possible; or
- b. oversee the rendering unserviceable of every fitting in that batch; or
- c. be satisfied that every fitting has been returned to the country of origin; and
- d. provide a report to ERMA New Zealand setting out how the requirements have been met.

### 5.12. Waivers of clearance requirements.

Regulation 38 of the CG Regulations allows ERMA New Zealand in any particular case, to grant a waiver of the test certification requirements for a fitting, having regard to:

- a. the types and quantities of the fittings; and
- b. the compliance and quality control history of the particular manufacturer of the fittings; and
- c. the similarity of the design of the fittings to other fittings previously supplied by that manufacturer.

Applications for waivers must be made to ERMA New Zealand.

## 6. Handling and Storage

This part should be read in conjunction with:

- The Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001;
- Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004;
- the Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001;
- the Hazardous Substances (Emergency Management) Regulations 2001.

### 6.1. Why must cylinders be handled and stored carefully?

The contents of a cylinder store the energy that has gone into compressing them, and if the cylinder is weakened, this mechanical energy may be released violently.

Some gases store a considerable amount of chemical energy, and may react chemically with the environment. In either case the chemical energy will augment the mechanical energy and increase the violence of the release.

### 6.2. Cylinder attitude.

Cylinders should be stored, handled and used in an upright attitude wherever possible, unless they have been specifically designed for horizontal use. Most general purpose LPG cylinders are designed for use in the upright (vertical) attitude. Cylinders such as vehicle cylinders and forklift cylinders are designed for use in the horizontal attitude although forklift cylinders may normally be handled and stored vertically. SCBA or SCUBA cylinders may normally be handled and stored in the horizontal attitude.

Acetylene cylinders contain acetone as a solvent for the gas, and must be used upright to avoid the possibility of acetone being discharged with the acetylene. If transported horizontally, they must be stood upright for at least one hour before use.

### 6.3. Transportation

[This section should be read in conjunction with Land Transport Rule 45001 or NZS 5433, which set out the requirements for such things as load segregation, documentation, placarding and load security].

Cylinders should be secured when being transported. Examples of preferred methods include:

- a. Cylinder(s) restrained in the upright attitude by way of tie-down straps or ropes; or
- b. cylinder(s) suitably supported in bins, racks or suitably approved transportation devices; or
- c. LPG, SCBA or SCUBA cylinders in customised supporting 'cradles' or chocks that are designed to prevent the cylinder(s) from rolling.

Flammable gas cylinders should not be stored in the same compartment or the same part of the vehicle as the driver or passengers.

No part of the cylinder or valve should project beyond the dimensions of the vehicle that is transporting them.

## 6.4. Care and Maintenance.

Adequate precautions should be taken at all times to prevent damage to the cylinder during transportation, handling, storage or use.

Protective coatings on cylinders should also be maintained in good condition.

## 6.5. What are the requirements for handling cylinders?

### 6.5.1. General.

Threshold quantities are prescribed for certain classifications of gases which, if exceeded, require those gases to be at all times under the control of an Approved Handler, who must be present and available in the workplace or the area where the gases are stored and handled unless the gases are secured against unauthorised access. Refer section 6.7 for the classifications and quantities that trigger a requirement for an Approved Handler.

### 6.5.2. Who is an Approved Handler?

An Approved Handler means a person who holds a current test certificate (issued by a test certifier registered for this activity) certifying that the person has met the regulatory requirements in relation to handling one or more hazardous substances above a prescribed threshold and for one or more phases in the lifecycle of the substance(s).

### 6.5.3. How does a person become an Approved Handler?

Regulation 5 of the Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001 sets out the requirements for approval of Approved Handlers.

The validity period for an Approved Handler test certificate is 5 years.

### 6.5.4. Exemption from the Approved Handler requirement for LPG?

Where LPG is stored and used in quantities above the threshold quantity of 100 kg and the LPG cylinders are either delivered on an exchange basis or are in-situ filled, the occupier is not required to be an Approved Handler provided:

- a. The cylinders are secure; and
- b. The occupier does not connect, disconnect or handle the cylinders; and

- c. the person delivering or in-situ filling the cylinders carries out all connections, disconnections and handling of the cylinders; and
- d. the person delivering or in-situ filling the cylinders has a current Approved Handler test certificate covering LPG for the purposes of transportation, storage and use; and
- e. there is an approved handler contactable at all times.

## 6.6. What are the requirements for storing cylinders?

Irrespective of the type of gas or the quantity stored, gas cylinders should be stored in a location that:

- a. is suitable for the type and quantity stored;
- b. is secure;
- c. is well ventilated;
- d. in the case of flammable gases, is of fire resisting construction;
- e. in the case of flammable gases or oxidising gases, is suitably separated from potential sources of ignition;
- f. in the case of flammable or toxic gases, is not a person's work area and the quantities stored meet the required separation distances from areas of high and low intensity land use (note that use of such gases may need to be in a person's work area – such as medical gases in a hospital);
- g. in the case of flammable or oxidizing gases, has portable fire extinguishers available;
- h. where required in accordance with the Hazardous Substances (Emergency Management) Regulations 2001 in relation to the quantities stored, an emergency response plan and hazardous substance warning signage are in place.

In addition to the above, it is good practice for the cylinders to be protected from the weather.

Refer section 6.7 for the classifications and threshold quantities that trigger requirements for location test certificates, establishing hazardous atmosphere zones, fire extinguishers, emergency response plans and signage.

For further guidance refer to the following standards:

AS 4332: Storage and handling of gases in cylinders

AS/NZS 1596: the storage and handling of LP Gas

## 6.7. What are the threshold levels?

A threshold level is the quantity of a hazardous substance that triggers a requirement under the HSNO Act and the regulations made under that Act.

The following table sets out the threshold levels for:

- Approved handlers.
- Hazardous locations.
- Hazardous atmosphere zones.
- Fire extinguishers.
- Emergency response plans.
- Signage.

Table 6.7 Threshold Levels

Classification	Description	Approved Handler	Hazardous Location	Hazardous Atmosphere Zone	Fire Extinguishers	Emergency Response Plan	Signage
2.1.1A	Flammable gas – High Hazard	100 kg or 100 m <sup>3</sup>	100 kg or 100 m <sup>3</sup>	30 m <sup>3</sup>	50 kg or 30 m <sup>3</sup>	300 kg or 200 m <sup>3</sup>	250 kg or 100 m <sup>3</sup>
2.1.1B	Flammable gas – Medium hazard	No	100 kg or 100 m <sup>3</sup>	30 m <sup>3</sup>	200 kg or 120 m <sup>3</sup>	1000 kg or 600 m <sup>3</sup>	500 kg or 200 m <sup>3</sup>
2.1.2A	Aerosols	3000 L	3000 L	3000 L	3000 L	3000 L	3000 L
5.1.2A	Oxidising substance - Gas	250 kg or 100 m <sup>3</sup>	100 kg or 100 m <sup>3</sup>	No	10 kg or 10 m <sup>3</sup>	100 kg or 100 m <sup>3</sup>	250 kg or 500 m <sup>3</sup>
6.1A	Acutely Toxic Substance	Any	No	No	No	100 kg or 100 L	50 kg or 50 L
6.1B	Acutely Toxic Substance	Any	No	No	No	100 kg or 100 L	250 kg or 250 L
6.1C	Acutely Toxic Substance	Any	No	No	No	100 kg or 100 L	1000 kg or 1000 L
8.1A	Corrosive to metals	No	No	No	No	No	1000 kg or 1000 L
8.2A	Corrosive to dermal tissue	Any	No	No	No	100 kg or 100 L	50 kg or 50 L
8.3A	Corrosive to ocular tissue	No	No	No	No	10,000 kg or 10,000 L	1000 kg or 1000 L
9.1A	Very ecotoxic - Aquatic	Any	No	No	No	100 kg or 100 L	100 kg or 100 L
9.2A	Very ecotoxic - soil	Any	No	No	No	No	100 kg or 100 L
9.3A	Very ecotoxic – animals/birds	Any	No	No	No	No	100 kg or 100 L
9.4A	Very ecotoxic - insects	Any	No	No	No	No	100 kg or 100 L

Note: m<sup>3</sup> is an expression which means cubic metres.

## 6.8. What are the requirements for storing cylinders

To obtain a location test certificate a person must contact a test certifier registered for this activity. Test certifiers can be found in the register on the ERMA New Zealand website

A test certifier will visit and inspect the storage location for compliance, including the following items:

- The total quantity of cylinders stored.
- Cylinder identification and labelling.
- The location where the cylinders are stored in relation to areas of high and low intensity land use.
- Storage location or facility construction.
- Ventilation.
- Hazardous atmosphere zones and sources of ignition.
- Cylinder attitudes, restraints (e.g., protection of tall cylinders from toppling) and security.
- Where required, provision of fire fighting equipment, emergency response plan, warning signage and site location plan.
- Where required, that sufficient Approved Handlers are available to cover all normal working hours, shifts as well as after-hours contactability.

Once a test certifier is satisfied that compliance in all of the above aspects has been met the certifier may issue a location test certificate. The standard validity period for a location test certificate is one year.

## 6.9. Can a location test certificate be issued for an extended period?

Where

- LPG is the only hazardous substance stored, and
- the quantity triggers the requirement to obtain a location test certificate, and
- the total quantity stored does not exceed 300 kg,

the validity period of the test certificate may be extended by the test certifier for up to 3 years.

In any other case, where the test certifier is satisfied that there is clear evidence that the person or organisation has defined and effective controls and monitoring systems in place that will result in a continued and dependable compliance history, the test certifier may recommend that the person or organisation applies to ERMA New Zealand for an extension of location test certificate for a period of up to three years using the standard application for found on the ERMA New Zealand website: [www.ermanz.govt.nz/](http://www.ermanz.govt.nz/).

An application fee must accompany the application.

## 7. Filling Cylinders

### 7.1. Which cylinders may be filled?

Regulation 56 of the CG Regulations clearly states that a person must not charge a cylinder with gas unless the cylinder is:

- a. of a design approved for filling in New Zealand; and
- b. is marked in accordance with Part 6 of the CG Regulations (refer section 4.2 of this Guide); and
- c. is within its specified test period; and
- d. an over-pressure protection device is fitted as required (refer to clauses 5.7 and 5.8 of this Guide); and
- e. there is no evidence of damage or corrosion of the cylinder and valve that indicates that the cylinder may fail a periodic test, or that the cylinder's associated fitting may leak.

A cylinder filling station must not fill any cylinder design and manufactured after March 1980 that is not listed on the Gas Cylinder Register, i.e., that is not marked with a LAB number or a LAB SP number. Refer to sections 7.1.1 and 7.1.2 for possible exceptions.

#### 7.1.1. Cylinders imported after March 1980 without a LAB number or LAB SP number

The cylinder owner will be referred to a cylinder periodic testing station for an initial determination as to whether or not the cylinder design may be of an approved design and may be filled.

Where the periodic tester identifies the cylinder as a previously approved design, the correct LAB may be stamped on the cylinder provided that:

- the periodic tester is specifically approved as a test certifier for the purpose by ERMA New Zealand to undertake this action (only specific periodic testers are approved to undertake this), and
- the correct LAB number is suffixed by the mark of the periodic tester's testing station.

Where the periodic tester cannot identify the cylinder as a previously approved design and considers that the cylinder may meet the criteria for a Waiver an allocation of a LAB SP number, an application may be made to ERMA New Zealand for a waiver of pre-commissioning in accordance with section 3.9 of this Guide.

#### 7.1.2. Cylinders on ships or planes

Refer to section 7.5.2

### 7.2. Who may fill cylinders?

Regulation 59 of the CG Regulations only permits a person to charge a compressed gas container if that person is an Approved Filler. That person must have met the regulatory requirements set out in section 7.3 of this Guide and have been certified by a test certifier who has issued an Approved Filler test certificate.

Trainees who may require practical training in cylinder filling for the purpose of becoming an Approved Filler should ensure that they are:

- a. trained by an Approved Trainer or other suitably competent person, e.g. an Approved Filler; and
- b. are directly supervised by an Approved Filler at all times that they are practising filling cylinders; and
- c. the Approved Filler remains capable of taking over or stopping the filling procedure at all times.

### 7.3. How does a person become Approved Filler?

Regulation 60 of the CG Regulations sets out the requirements for the approval of Approved Fillers.

To become an Approved Filler a person must know and be familiar with:

- a. the different forms of compressed gases, namely –
  - i. low pressure liquefiable gas
  - ii. high pressure liquefiable gas (including breathing air for SCBA and SCUBA cylinders)
  - iii. permanent gas
  - iv. cryogenic gas; and
- b. the factors that can trigger failure of a cylinder; and
- c. the potential adverse effects associated with the different forms of compressed gas; and
- d. the requirements of the CG Regulations (which may be included in a relevant code of practice) covering the visual inspection and safe charging of a cylinder which should include (but not necessarily be limited to) the following:
  - i. what is an approved cylinder design
  - ii. cylinder filling terminology, e.g., tare weight, empty weight, ullage, filling ratio, water capacity, working pressure, test pressure.
  - iii. cylinder safety devices
  - iv. test periods for types of cylinders the filler will be re-charging
  - v. cylinder markings
  - vi. valve markings
  - vii. the different types of valves fitted to cylinders the filler will be re-charging
  - viii. external visual inspection of cylinders for general condition
  - ix. in the case of a liquefiable gas cylinder, how to correctly calculate the maximum filled weight using the formula:

**MAXIMUM FILLED WEIGHT = (WATER CAPACITY x FILLING RATIO) + TARE OR EMPTY WEIGHT**

The person must also be able to demonstrate to a test certifier approved for this activity that they are competent to fill cylinders in the appropriate gas traffic(s).

The person may alternatively provide the test certifier with a written record that satisfies the certifier that they have been trained and tested in respect to their competence to fill cylinders, by a trainer or work supervisor.

An Approved Filler test certificate is valid for 5 years unless it was issued by an LPGA site trainer, in which case it is valid for 1 year. It must specify the forms and classes of gases and the types of cylinders covered by the certificate.

## 7.4. What are the Exemptions from the Approved Filler Requirements?

The Approved Filler requirements do not apply to a person who fills a portable resuscitation cylinder.

Furthermore, Approved Filler requirements do not apply to compressed gas containers where:

- a. the container has water capacity of less than 120mls, if the contents are a liquefiable flammable gas; or
- b. the container has a water capacity of less than 500mls if the contents are not a liquefiable gas with flammable properties.

## 7.5. General.

### 7.5.1. Pre-filling checks.

Before filling a cylinder the filler must ensure that:

- a. the cylinder is of a design that is approved for filling and use in New Zealand; and
- b. the cylinder is within its required test period (refer section 8.7); and
- c. the cylinder is in good external physical condition; and
- d. the cylinder markings and labelling are clear and correspond to the gas to be filled; and
- e. the valve is suitable and in good condition; and
- f. where required by the CG Regulations, an over-pressure protection device is fitted, e.g., pressure relief valve, burst disc.
- g. in the case of SCBA or SCUBA cylinders the breathing air quality requirements outlined in sections 7.11.1 and 7.11.2 of this Guide have been met.

### 7.5.2. When can maritime and aviation cylinders be filled?

Maritime and aviation cylinders which do not carry a New Zealand approval (i.e. are not marked with a LAB or LABSP number) may be filled under the following circumstances:

- a. the cylinder is on a foreign registered ship<sup>6</sup> that is subject to marine survey, or an aircraft that is registered in a country other than New Zealand and is subject to a Certificate of Airworthiness; and
- b. the cylinder is labelled or marked in compliance with – Maritime Rule 24A Carriage of Cargoes – Dangerous Goods) or Civil Aviation Rule 92: Carriage of Dangerous Goods.

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<sup>6</sup> As defined in section 2(i) of the Maritime Transport Act 1994

- c. conditions b) through f) of section 7.5.1 above are met; *and*
- d. the filler is satisfied that once filled, the cylinder(s) will be returned immediately to the ship, aircraft, etc.

### 7.5.3. Checks during filling.

Once a cylinder has commenced being filled the filler must ensure that:

- a. the cylinder valve is not leaking via its neck threads, or valve spindle; and
- b. the rate of filling does not exceed the manufacturer's recommendation for the cylinder design; and
- c. the filler remains in attendance at the filling point at all times while the cylinder is being filled.

There will be some specific exceptions to this requirement, for example, where cylinders are trickle filled, or where there is provision for an automatic shut off when the filling pressure has been reached. However there is to be NO exception to this requirement where LPG cylinders are being filled.

### 7.5.4. Post filling checks.

After filling a cylinder the filler must ensure that:

- a. the cylinder is correctly labelled in accordance with section 4.11.4 of this Guide and also in accordance with the Hazardous Substances (Identification) Regulations 2001; and
- b. the cylinder is labelled with the name or other suitable identification of the filling station; and
- c. the cylinder has been checked for leaks by soap testing the valve or immersing the cylinder and valve in a water bath; and
- d. the final fill pressure or filled weight has not exceeded the marked fill pressure or the calculated maximum filled weight respectively. Adjustments to fill pressure may be made as per 7.6.1.

## 7.6. What are the Filling Conditions for Permanent Gases?

### 7.6.1. Filling pressure.

Cylinders approved for use with permanent gases must have the filling pressure marked on them. This filling pressure (or charging or working pressure) is the maximum permitted pressure in the cylinder when the cylinder temperature, gas temperature and ambient temperature are all at 15°C.

Adjustments to the filling pressure are required:

- to compensate for the cylinder temperature, gas temperature and ambient temperature being different from 15°C; and
- to compensate for the pressure increase resulting from the heat of compression during filling (calculating the settled pressure).

### 7.6.2. How to calculate settled air pressure.

- a. Check the ambient temperature.

- b. Fill a cylinder to a pressure, based (by experience) on this temperature and the permitted filling pressure.
  - c. After filling, record the ambient temperature and filling pressure and then put the cylinder to one side.
  - d. Following a period of at least 24 hours, check the ambient temperature and the cylinder pressure.
  - e. Convert the pressure to the corresponding pressure at 15°C using table 7.6.2 for compressed air, or similar tables for other gases.
  - f. The difference between the figure calculated in e) and the permitted filling pressure represents the under or over-filling. The variations are to be recorded and used to build up the experience required in step b).
- or
- g. After filling check the temperature (e.g. by an infra red thermometer) of the shell of the cylinder and check the cylinder pressure. Convert to the corresponding pressure at 15°C.

Table 7.6 Example of Settled pressure for compressed air

<b>Settled Pressure Chart</b> (For Compressed Air Only - Figures Will Differ For Other Gases)							
<b>Filling Pressure Stamped on Cylinder</b>				<b>Adjusted Filling Pressure for Temperature</b>			
psi	MPa	5°C	10°C	15°C	20°C	25°C	30°C
1800	12.4	11.8	12.1	12.4	12.7	13.0	13.3
1980	13.7	13.0	13.3	13.7	14.0	14.3	14.7
2250	15.5	14.7	15.1	15.5	15.9	16.2	16.6
2500	17.2	16.4	16.8	17.2	17.7	18.1	18.5
3000	20.7	19.6	20.2	20.7	21.2	21.7	22.3
3250	22.4	21.3	21.8	22.4	23.0	23.6	24.1
3300	22.8	21.6	22.2	22.8	23.3	23.9	24.6
3500	24.1	22.9	23.5	24.1	24.7	25.4	26.0
3600	24.8	23.5	24.1	24.8	25.5	26.1	26.8
4000	27.6	26.1	26.8	27.6	28.3	29.1	29.9
4350	30.0	28.3	29.2	30.0	30.9	31.7	32.6

## 7.7. What are the filling conditions for liquefiable gases?

### 7.7.1. Filling by weight control.

Any person filling a liquefiable gas cylinder must fill the cylinder by weight control (not pressure). The only exception to this is where cylinders are filled by ullage control – refer section 7.7.2. Liquefiable gas cylinders are normally filled while they are positioned on platform-type scales that are:

- a. of a suitable type for the gas being filled (e.g., for flammable gases only mechanical or electric intrinsically safe scales); and
- b. clear, graduated and legible to read and
- c. have been periodically calibrated by a competent person at least 12 month intervals to ensure accuracy, or at more frequent intervals where the accuracy of the scales may have become suspect; and
- d. the scales can remain undisturbed while filling is in progress; and
- e. The cylinder can be wholly accommodated on the scales in a balanced manner without being propped up by hand.

The Maximum Filled Weight (or Gross Weight)

must be less than or equal to

(Water Capacity x Filling Ratio) + Empty Weight.

Using the above calculation does not prevent the use of a dip tube or fixed ullage gauge as an additional aid for cylinders of 25 litres water capacity or less.

#### **7.7.2. Filling by ullage control**

The following types of cylinders can be filled by ullage control i.e., by using the dip tube or a fixed ullage gauge, in accordance with the provisions of clause 6.4.1 of AS 2030.1: The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases – cylinders for compressed gases other than acetylene:

- a. a forklift cylinder that is filled while mounted on the vehicle; or
- b. a cylinder mounted on any other type of vehicle; or
- c. a cylinder that is filled in accordance with a code of practice approved by ERMA New Zealand.

#### **7.7.3. Decant filling by weight control.**

Decant filling by weight control is the only permitted method that can be used to fill cylinders having a water capacity less than 5 litres, i.e., the filling is a controlled delivery using only supply cylinder pressure or line pressure (i.e. the pressure in the pipeline from the tank that is being filled from) to transfer the gas, and is not pump assisted.

#### **7.7.4. What are the filling ratio requirements for particular gases?**

- a. Carbon Dioxide.

For cylinders having a test pressure of not less than 22 MPa the filling ratio of 0.75 may be used when calculating the maximum filled weight.

For cylinders having a test pressure of between 20.7 MPa and 22MPa the filling ratio of 0.667 must be used.

**b. LPG**

The composition of LPG available for use in New Zealand has varied in the past and may vary again in the future. Therefore, the filling ratio for propane must be used, which is 0.444.

**c. 100% Butane**

Where 100% Butane is being filled, the filling ratio for iso-Butane must be used, which is 0.508.

**7.7.5. What are the consequences of over-filling a liquefiable gas cylinder?**

If a liquefiable gas cylinder is over-filled, then the expansion of the liquid phase as the temperature increases may cause the cylinder to become 'liquid-full' with no remaining ullage space. If the temperature continues to rise, the pressure in the cylinder will rise disproportionately. At the very least, liquid will be forced out of the pressure relief valve creating further problems (or, in the case of a flammable liquefiable gas, a dangerous situation) for the end user including malfunction of their appliance, or a fire. At the very worst, if there is no pressure relief valve, or it fails to operate, the cylinder may burst after only a small rise in temperature.

**7.7.6. Over-filling Protection Devices (OPD's)**

Refer section 5.8.

**7.8. What are the procedures for imported pre-filled cylinders?**

In certain cases it may be necessary to import pre-filled cylinders, e.g. specialist gases not manufactured or not available in New Zealand.

Before any pre-filled cylinder is imported it should first be determined that it is of an approved design and that the cylinder will eventually be able to be recharged in New Zealand. The only exception to this is where a pre-filled cylinder is imported, used and then returned to the country of origin for re-charging, i.e. it will not be filled at any time in New Zealand. In this case the cylinder must be approved in the country of origin (i.e. the country in which it is charged) and must also meet the transport codes (normally the IMDG Code<sup>7</sup>).

Where any imported pre-filled cylinder is not marked in accordance with regulation 39 of the CG Regulations, before that cylinder can be re-charged in New Zealand it must be verified as being a cylinder that is approved for filling in New Zealand and correctly marked. This may entail correct identification and marking of the cylinder (refer to section 7.1.1 of this Guide) or undertaking design verification and pre-commissioning (section 3 of this Guide). If the cylinder cannot be identified as being approved for filling in New Zealand, it must not be filled.

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<sup>7</sup> The International Maritime Dangerous Goods Code

## 7.9. What are the requirements for cylinders that are used in another country but filled in New Zealand?

Any cylinder intended for use in another country but is filled in New Zealand, must comply fully with the New Zealand requirements in the CG Regulations and be of an approved design.

## 7.10. Filling SCBA and SCUBA Cylinders.

### 7.10.1. General.

SCBA and SCUBA cylinders must only be charged with air that meets the air quality requirements set out in the following standards:

- AS 3848.2 – Filling of portable gas cylinders – Filling of portable cylinders for self-contained underwater breathing apparatus (SCUBA) and non-underwater self-contained breathing apparatus (SCBA) – Safe procedures.
- AS/NZS 2299.1 – Occupational diving operations – standard operational practice.

### 7.10.2. What are the breathing air quality requirements?

Breathing air used in SCBA and SCUBA must meet the following requirements. It must:

- a. Have no objectionable or nauseating odour; and
- b. Contain not less than 20% and not more than 22% by volume of oxygen; and
- c. Contain no more than 11 mg/m<sup>3</sup> (10 ppm.) of carbon monoxide at 15°C and 100 kPa; and
- d. Contain no more than 900 mg/m<sup>3</sup> (480 ppm.) of carbon dioxide at 15°C and 100 kPa; and
- e. for high pressure cylinders, contain no more than 100 mg/m<sup>3</sup> (130 ppm. by volume) of water at 15°C and 100 kPa; and
- f. contain no more than 1 mg/m<sup>3</sup> of oil at 15°C and 100 kPa when sampled from a cylinder filled to a pressure of at least 12 MPa; and
- g. where the air is supplied from a compressor that is intended for use with or may be used to charge cylinders intended for use with, occupational diving or as SCBA, the compressor has undergone a test at 3 monthly intervals to ensure that the compressed air satisfies the requirements of a) to f) above.

NOTE: It is recommended that breathing air intended for recreational diving also be tested at regular intervals to ensure that it meets the requirements of a) to f) above.

### 7.10.3. What is the recommended filling rate?

The cylinder manufacturer's recommended safe filling rate for a cylinder design should not be exceeded for SCBA or SCUBA cylinders. In the absence of a manufacturer's recommended filling rate, the maximum filling rate of 2-4 MPa/20-40 Bar/300-600 psi per minute should be used.

#### **7.10.4. What are the consequences of exceeding the recommended filling rate?**

Exceeding the filling rate recommended by the cylinder manufacturer or that recommended in section 7.11.3 will generally place undue stress on the cylinder shell as a result of both the rapid pressurisation and the increased heat of compression during filling, thus increasing the likelihood of the cylinder rupturing.

#### **7.10.5. What are the maximum filling pressures?**

The maximum filling pressure for a SCBA or SCUBA cylinder must not exceed the manufacturer's design working pressure stamped on the cylinder (refer also section 7.6.2 for calculating settled air pressure) or the filling pressure marked on the cylinder valve whichever is least.

For open face type valves marked with a maximum filling pressure, the maximum filling pressure must not exceed 22.5 MPa or 225 bar, or the maximum filling pressure marked on the valve or the cylinder – whichever is least.

.For open face type valves not marked with a maximum filling pressure, the maximum filling pressure must not exceed 20.7 MPa or 207 bar.

For DIN valves the maximum filling pressure should be in accordance with the valve manufacturer's recommendations.

#### **7.10.6. Using cylinder restraints during filling**

Cylinders should be suitably restrained during filling in order to prevent them toppling during the filling process or from moving uncontrollably in the event of the filling connection becoming disconnected from the cylinder during filling.

If a water bath is used for this purpose, the filler must ensure that the entire cylinder shell is submerged (as opposed to being partly submerged).

#### **7.10.7. Checking cylinder residual air quality before filling**

The quality of residual air contained in a cylinder must be checked by the filler, prior to connecting the filling connection, for any objectionable odour. Should an objectionable odour be detected, filling should not take place until such time as the cylinder has been de-pressurised, had its valve removed and has been thoroughly internally cleaned.

### **7.11. Filling SCUBA cylinders with mixed gases (Nitrox, Enriched Air/ EANx, De-nitrogenated Air/DNAx)**

#### **7.11.1. General.**

There are specific hazards relating to compression, filtering, gas blending, purging/cleaning and filling cylinders with breathing mixtures that involve elevated levels of oxygen. This Guide applies to all methods of filling cylinders with mixed gases, including:

- Enriched Air/EANx

- Nitrox
- De-nitrogenated Air/DNAx

#### **7.11.2. How does a person become Approved Filler for NITROX?**

As well as the basic regulatory requirements for an Approved Filler (refer section 7.3 of this Guide) a person should be able to provide evidence to the test certifier that they have successfully completed a course of training in NITROX filling through a suitable training provider, for example:

- a. International Association of Nitrox and Technical Divers (IANTD); or
- b. Technical Divers International (TDI); or
- c. American Nitrox Divers International (ANDI); or
- d. Diving Science and Technology/TecRec (DSAT)

#### **7.11.3. What is the maximum permitted percentage of oxygen in NITROX?**

The maximum permitted percentage of oxygen in NITROX filled cylinders is 40%, i.e. the oxygen content must not exceed 40%.

#### **7.11.4. Gas quality for mixed gas SCUBA**

Air used in blending mixed gas for SCUBA must meet the standard for breathing (refer section 7.11.2) with the following modifications. It must:

- a. contain no more than 2mg/m<sup>3</sup> (2 ppm) of carbon monoxide at 15 °C and 100 kPa; and
- b. contain no more than 0.1 mg/m<sup>3</sup> (0.1 ppm) of traceable condensed hydrocarbons; and
- c. oxygen used for the blending process, where applicable, must meet the standard for medical or breathing grade gas.

#### **7.11.5. Changes of gas traffic from compressed air to NITROX.**

Not all cylinder designs that have been approved for compressed air SCUBA are necessarily approved for a change of traffic to NITROX.

Before contemplating obtaining a cylinder for NITROX or changing the gas traffic of an existing SCUBA air cylinder to NITROX, the cylinder owner and/or the filler should refer to the register of cylinder designs and ascertain whether it is currently approved for NITROX.

Refer also section 3.9 – changes of gas traffic.

### 7.11.6. What are the cleaning requirements?

Irrespective of the method of filling normally used, NITROX cylinders must be oxygen- cleaned using a suitable cleaning process at the following times:

- a. Immediately prior to entering NITROX traffic for the first time; and
- b. Prior to re-charging with NITROX if the filler's pre-filling gas analysis indicates that the mixture percentages of the contents shows that the cylinder has been used for standard breathing air since its last recorded NITROX fill; and
- c. If the cylinder is empty and a pre-filling gas analysis is not possible; and
- d. Immediately following cylinder periodic inspection or testing; and
- e. If for any reason the filler believes that the cylinder, valve and contents have become contaminated.

Cleaning methods should be in accordance with current codes of practice approved by one of the organizations listed in section 7.11.2.

### 7.11.7. 'O' Rings, seals and lubricants.

Increased partial percentages of oxygen can cause explosive reactions when combined with incompatible materials or contaminants.

NITROX filling stations must ensure that only those 'O' rings, seals and lubricants recommended for use with NITROX cylinders and valves are used. Periodic testing stations that are not qualified approved fillers for NITROX must not refit valves to NITROX cylinders after inspection or testing.

### 7.11.8. How are mixed gas percentages tested?

The approved NITROX filler should test the oxygen content of each cylinder filled to ensure accuracy of the filling mixture requested by the cylinder user. The result of the analysis should be recorded by the filler, checked and then signed for by the cylinder user.

Gas analysers should have an accuracy as specified in the relevant code of practice (refer section 7.11.2). A general recommended accuracy of +/- 2% should be used unless otherwise stated in the code of practice.

### 7.11.9. Labelling and identification of NITROX cylinders

Refer section 4.14 of this Guide.

## 7.12. The NZLPGA Filler Training Programme.

Since 2000 the NZLPGA has provided a comprehensive programme for sites that fill LPG cylinders. Training resources (available either individually or as part of a training kit) include the following:

- A DVD (or video) entitled 'Filling LPG Cylinders'
- A Trainee workbook.
- A reference manual.

- A Site trainer-manager's guide.
- LPGA Approved Filler test certificates.
- Laminated copies of cylinder filling instructions.

### **National Trainers.**

National trainers are persons appointed by the LPGA to carry out the following:

- The training and test certification of LPG Site Trainers.
- The training and test certification of Approved Fillers.
- Periodic compliance auditing of selected sites.

### **Site Trainers.**

Site trainers are Test Certifiers trained by National Trainers to carry out the following:

- The training and test certification of Approved Fillers employed by the same company as the site trainer, either on a single site or within a cluster of sites if owned by the same company.
- Annual re-assessment of all fillers employed by the same company to ensure ongoing competence.

### **Approved Fillers.**

Approved Fillers are trained and test certified either by a site trainer or by a National Trainer.

For further information visit the NZLPGA website [www.lpga.co.nz](http://www.lpga.co.nz), or email [lpga@clear.net.nz](mailto:lpga@clear.net.nz) or telephone (04) 473 9519.

## **7.13. Filling Stations.**

### **7.13.1. Who is responsible for the filling station?**

The person in charge of the site, (normally the person with ultimate day to day responsibility for the operation) is the person who must also take responsibility for ensuring that the requirements of the Act, and regulations made under the Act, are met at all times. This person must also ensure that a high standard of filler competence and filling station equipment is maintained. At a number of sites that store and handle LPG, the site trainer or supervisor may also be the person in charge.

### **7.13.2. What are the requirements?**

The person in charge must ensure that:

- a. all persons filling cylinders hold a valid Approved Filler test certificate issued for the relevant gas traffic(s) and cylinder type(s), and that a copy of each certificate is available on site; and
- b. all equipment necessary to safely fill cylinders is provided and maintained; and
- c. the filling and cylinder storage areas are kept orderly and tidy; and
- d. the electronic editions of the following registers can be accessed from a computer on site:
  - the Gas Cylinder Register

- the Special Register
- the register of testing stations, and

e. this Guide is available on site in hard copy or electronically by computer.

### 7.13.3. What equipment is required?

The person in charge must ensure that the following items of equipment are provided and maintained:

- Cylinder filling instructions.
- Filling hoses of a suitable pressure rating and suitable for the gas being filled.
- All required cylinder filling connections.
- Soapy water solution or a water bath, for leak checking
- In the case of liquefiable gases, calibrated weighing scales of a type suitable for the gas being filled.
- In the case of flammable gases, a portable fire extinguisher.
- All hand tools necessary for fitting and removing filling connections, e.g., adjustable spanner, flat bladed screwdriver.
- Filling station identification labels.
- All other labels required for identification of cylinder contents in accordance with the Hazardous Substances (Identification) Regulations 2001.
- Leather gloves.
- Eye protection.
- First-aid kit on site.
- Hazardous Substances warning signage in accordance with the Hazardous Substances (Emergency Management) Regulations 2001.

## 7.14. Disposable Gas Cartridges

### 7.14.1. Definition

Cartridges are small containers, generally for propane, butane, or LPG, with or without valves, filled during manufacture and fitted to a suitable apparatus which uses the contents. Cartridges may contain up to 1400 ml (depending on the specification) whereas aerosols are defined as having a brimful capacity of 100 ml or less. Cartridges are not intended for reuse, i.e. are one trip or disposable.

Because of their size, cartridges are defined as cylinders, however, because of their design, construction and use they are comparable to aerosol designs.

### 7.14.2. What are the requirements?

The design, construction and use of cartridges must meet the following requirements:

1. All cartridges must be manufactured to an approved specification and design in accordance with or Regulation 25 of the CG Regulations.

2. The liquid and solid contents of the completed cartridge as offered for sale must be such that they will not occupy more than 90% of the closed container at 55oC.
3. Cartridges must be tested and examined after manufacture for leakage and deformation or any other defect in accordance with the specification.
4. All imported cartridges must be accompanied by a manufacturer's test certificate as required by the specification. Copies must be retained by the importing agency.
5. Valves, if fitted, must either:
  - a. Have a special adaptor to operate such that the removal closes the valve; or
  - b. Be provided with adequate protection against discharge.
6. Marking and labelling must be in accordance with Section 4.11.4 and 4.16 of this Guide.

### 7.14.3. Approved Specifications

Specifications for cartridges that have been approved in accordance with Regulation 25 of the CG

Regulations include:

- BS 5329
- AS 2278
- DOT 2P
- TRG 301
- BS 3914
- AS 207
- EN 417
- 75/324/EEC
- NSW N1375P
- NSW N 2427 P

## 8. Periodic Inspection and Testing

### 8.1. What does periodic inspection and testing involve?

All cylinders must be inspected and tested after manufacture and then at intervals throughout their life. The original inspection and test confirm that the cylinder complies with its stated specifications. Copies of the manufacturer's test reports are checked as follows:

- During the design verification of a new cylinder design.
- During the cylinder pre-commissioning test certification of the initial shipment of the cylinders.
- During the imported cylinder test certification of all subsequent shipments of the cylinders.

Subsequent periodic inspections and tests are to ensure that the individual cylinder is still compliant.

Note: A cylinder may still be used past its test date but it must not be recharged past this date until it has been retested.

### 8.2. What are the controls that set out the requirements for periodic testing?

The periodic inspection and testing of cylinders in New Zealand must only be carried out by approved Periodic Testers and in accordance with the following regulations and standards:

- Part 7 of the CG Regulations and amendments.
- AS 2337.1 Gas Cylinder Testing Stations Part 1: General Requirements, inspection and tests.
- AS 2337.3 Gas Cylinder Testing Stations Part 3: Inspection and testing of fibre reinforced plastics (FRP) gas cylinders.
- AS 2030.1 The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases Part 1: cylinders for compressed gases other than acetylene.
- AS 2030.2 for acetylene cylinders

### 8.3. Who can carry out periodic inspection and testing?

Only cylinder periodic testers that have been approved as test certifiers by ERMA New Zealand. Other testing personnel, e.g., periodic tester trainees, may assist in inspection and testing procedures but they can only do so at times when they can be directly supervised by an approved periodic tester.

An approved periodic tester is the only person who can issue a cylinder periodic test certificate.

### 8.4. How does a person become a periodic tester?

This section should be read in conjunction with regulation 11 of the Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001.

For persons to become cylinder periodic testers, they must first be able to provide evidence to ERMA New Zealand in relation to the following:

- a. Their proven ability to competently inspect and test cylinders of the specified types, having undergone a suitable period of training at a cylinder testing station under the supervision of an approved periodic tester, and having successfully completed an audit by a competent authority, e.g., IANZ, NZ Underwater or SAI Global, and
- b. An awareness and understanding of the Hazardous Substances and New Organisms Act 1996 and associated regulations, pertaining especially to compressed gases, to the inspection and testing of gas cylinders, and to their legislative responsibilities as a cylinder periodic tester, and
- c. Evidence of professional indemnity insurance.

## 8.5. What are the inspection and testing requirements?

### 8.5.1. Inspection.

An inspection may only be carried out by an periodic tester approved by ERMA New Zealand at an accredited testing station. The inspection consists of:

- a. Identification of the cylinder (refer section 9.1)
- b. Removal of any external attachments, e.g., mounting straps.
- c. External examination in accordance with AS 2337.1.
- d. Removal of the valve (except as described in section 8.10) followed by thorough cleaning of the cylinder interior and the neck threads.
- e. Internal examination in accordance with AS 2337.1.
- f. Checking the valve for correct function and condition in accordance with AS 2337.1.
- g. Correctly refitting the valve and checking the cylinder/valve for leaks, by partially charging the cylinder with compressed air or nitrogen.
- h. Tagging or labelling the cylinder in accordance with section 4.9.1.
- i. Preparation of a periodic test certificate for the customer.

### 8.5.2. Testing.

A test may only be carried out by an approved periodic tester approved by ERMA New Zealand at an accredited testing station and consists of the following:

- a. An inspection as described above.
- b. A pressure test or ultrasonic examination undertaken in accordance with the cylinder specification or Section 7 of AS 2337.1. Unless otherwise instructed, the test is to be at the marked or calculated test pressure.

- c. Correctly refitting the valve and checking the cylinder/valve for leaks by partially charging the cylinder with a suitable gas traffic that the cylinder is approved for.

Note: SCBA or SCUBA cylinders must only be charged with breathing-quality compressed air that meets the requirements of AS 384.8.2 and AS/NZS 2291.1.

- d. Stamping the cylinder in accordance with Section 4.9.2 of this Guide and regulation 39(2) of the CG Regulations.
- e. Preparation of a periodic test certificate for the customer.

Notes:

1. Removal and re-fitting of the cylinder valve must only be done by a suitably competent person<sup>8</sup>.
2. If the cylinder is going to be re-charged at the place of inspection or testing, then additional leak checking will not be required.

## 8.6. Why is the Date of Manufacture of a Cylinder Important?

A cylinder's date of manufacture is the date that the container was completely fabricated in the factory. It is akin to a 'date of birth' for a cylinder and was a snapshot in time of materials, tooling, conditions, environment, quality control and testing.

Irrespective of the type of service that a cylinder is used in and therefore the required re-test period, the period before the first re-test starts from the date of manufacture.

Example: A SCUBA cylinder manufactured in June 2008 is due for testing in June 2010 even if it is not first used until December 2009.

The practice of re-stamping unused cylinders at the time of their sale or, in the case of fire extinguishers, at the time that they are assembled and filled, is not permitted. Where it is found that a date of manufacture may have been altered, ground off, re-stamped, etc., the validity of all the cylinder markings and in some cases the cylinder design approval itself, may be questioned and will need to be satisfactorily re-established.

## 8.7. Inspection and Test Periods of Validity.

The following table sets out the maximum intervals that must be observed between periodic inspections and tests (refer to regulation 52(1) of the Hazardous Substances (Compressed Gases) Regulations):

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<sup>8</sup> A person with mechanical aptitude who has been trained in the removal and re-fitting of cylinder valves.

Table 8.7 Periodic Inspection Intervals

Type of cylinder	Interval (years)
Cylinder for liquefied petroleum gas, propane or butane (including automotive LPG tanks)	10 years
Acetylene: monolithic mass (visual inspection)	1 year after entering service, then 10 year intervals
other porous mass (visual inspection)	1 year
Self contained Breathing Apparatus (SCBA) not designed for underwater use, other than fibre wrapped composite cylinder	5 years
Self Contained Underwater Breathing Apparatus (SCUBA):	
• visual inspections	1 year
• hydrostatic tests	2 years
Fibre wrapped composite cylinder	3 years
Fire Extinguisher	5 years
Cylinder with shrunk-on foot rings	2 years
Cylinder for any of the following gases: Air (except SCBA or SCUBA), argon, cyclopropane, ethylene, helium, hydrogen, krypton, neon, nitrogen, nitrous oxide, oxygen, xenon and mixtures of the above containing not more than 30% by volume of carbon dioxide (having a dew point below -40°C at 1 atmosphere).	10 years (up to 40 years of age) then 5 year intervals
All other cylinders	5 years

Note: these intervals relate to the periods beyond which a person must not charge a cylinder unless that cylinder has been inspected/tested i.e., the period is not required to be applied until the cylinder has been discharged.

## 8.8. Fire Extinguishers

### 8.8.1. How are fire extinguishers categorised?

Fire extinguishers are categorized in a number of ways, for example –

- According to the type of extinguishing agent that they contain e.g. foam dry powder, CO2 etc.
- According to their size or capacity.
- According to their performance on certain types of fires (called their fire rating) in accordance with AS/NZS 1850 Portable Fire Extinguishers – classification, rating and performance testing.
- According to their method of operation.

This last category is the one that relates to periodic inspection and testing of fire extinguishers and the following definitions apply:

- Portable Fire Extinguisher means a first aid fire fighting appliance that can be carried by hand or wheeled on a mobile trolley. It may be stored pressure or gas cartridge operated.

- Fixed Extinguisher means an extinguisher that forms part of a fixed application system and only needs to be removed for servicing purposes. It may be stored pressure or gas cartridge operated.
- Gas Cartridge means a container that holds gas sufficient to expel the extinguishing agent. The gas may be liquefiable or dry and the cartridge is normally fitted into the discharge head of the extinguisher.
- Stored Pressure Extinguisher means an extinguisher that has the extinguishing agent and the expellant gas in a single chamber such that the extinguisher is always under pressure and discharge is controlled by a shut-off valve.
- Cartridge Operated Extinguisher means an extinguisher where the expellant gas is stored in a separate gas cartridge located within or adjacent to the cylinder shell containing the extinguishing agent. This gas is only released when the extinguisher is operated to expel the agent.

### 8.8.2. What are the testing requirements for fire extinguishers?

For high pressure fire extinguishers, e.g., CO<sub>2</sub>, Nitrogen, and Argon, the testing requirements are the same as for other high pressure gas cylinders (refer section 8.5).

For low pressure fire extinguishers, e.g., dry chemical, wet chemical, halon, foam, and water, an approved method of proof testing is required. Periodic testers and testing stations must be accredited by IANZ for the required categories of fire extinguishers before they can carry out this type of test.

There is no legal requirement for fire extinguisher cylinders under 500 mls water capacity (of the gas cartridge type) to be periodically pressure tested.

Similarly, there are no legal requirements for pressure testing hoses and operating heads that make up the assembled extinguisher. It is recommended, however, that in the interests of safety these be tested as they are still subjected to similar pressures as the extinguisher cylinder.

If there is no apparent manufacturing or previous test date marked or attached to an extinguisher, the extinguisher must be considered due for test.

If there is no unique identifying mark such as a serial number on an extinguisher, then a recorded sequence must be set up and used to identify each cylinder. The identifier must be permanently marked on the cylinder and may be the test certificate number prefixed by the periodic tester's or the testing station's mark. An approved void label may be used to provide the identification details as above.

### 8.8.3. What standards apply when inspecting and testing fire extinguishers?

AS 2337.1	Gas cylinder test stations – Part 1: general requirements, inspection and tests – gas cylinders.
AS 2337.3	Gas cylinder test stations – Part 3: transportable gas cylinders, periodic inspection and testing of composite cylinders
AS 2030.1	Verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases – Part 1: cylinders for compressed gases other than acetylene.
NZS 4503	Specification for the distribution, installation and maintenance of hand-operated fire fighting

	equipment.
NZS 4506	Specification for portable fire extinguishers of the water, foam and dry powder type.
NZS 4508	Specification for portable carbon dioxide fire extinguishers.
NZS 4551	Specification for portable fire extinguishers of the halogenated hydrocarbon type.

#### 8.8.4. What are the tests?

##### *Test Periods.*

The periodic test period specified for fire extinguishers is 5 years. If an extinguisher has been discharged (even partially) and it has either been more than 5 years since its date of manufacture or more than 5 years since the date of its last periodic test, then the extinguisher cannot be re-charged until it has been re-tested.

If, however, the extinguisher has not been discharged and does not require recharging then there is no legal requirement for the extinguisher to be re-tested. It is advisable however to do so at intervals (e.g. 5 yearly) in order to guarantee the continued efficacy of the extinguishing agent.

##### *Hydrostatic testing.*

All high pressure fire extinguishers e.g., CO<sub>2</sub>, Nitrogen and Argon, over 500 mls water capacity must be inspected then hydrostatically tested in accordance with section 8.5.2 of this Guide and with AS 2337.1.

##### *Proof testing.*

All low pressure fire extinguishers, e.g., dry chemical, wet chemical, foam, halon and water, must be inspected then proof pressure tested in accordance with AS 2337.1 using a non-water jacket test rig.

##### *What if the test pressure is not marked on the cylinder or the label?*

The periodic test pressure of the cylinder must be 1.5 times the working pressure or 20 bar, whichever is greater.

##### *What if the test pressure is marked on the cylinder or the label?*

The periodic test pressure of the cylinder must be the higher of:

- a. the marked test pressure; or
- b. 1.5 times the working pressure but in any case must not be less than 20 bar.

##### *Safety considerations.*

Because the fire extinguisher cylinders are usually thin-walled, additional care should be taken when testing these, including safety provisions that will protect the periodic tester and their work colleagues from injury.

#### *Extinguishers that pass inspection and testing.*

High pressure fire extinguisher cylinders that pass hydrostatic testing must be stamped on the cylinder shoulder with the month and year of the date of test, plus the identifying mark of the periodic tester or testing station. Refer section 4.9.2.

Low pressure fire extinguishers, as a result of their thin wall construction, must not be stamped but have the test information recorded on a suitable metallic adhesive label or equally durable material which is then affixed to the cylinder, e.g., 'void labels'. Refer section 4.9.1.

All extinguishers of dry chemical or halon types must have their cylinder operating heads, caps and hose assemblies thoroughly dried out internally before being refitted. If heat drying is used, the drying temperature must not exceed 66°C.

After testing, the extinguisher should have its operating head or cap re-fitted. If a delay is anticipated in getting this done the extinguisher cylinder should be suitably plugged to prevent ingress of foreign matter that could affect the extinguisher operation.

#### *Repairs to extinguishers.*

Refer section 8.13.

#### *Extinguishers that fail inspection and testing.*

An extinguisher that fails an inspection or test must be disposed of in accordance with section 8.12.

### **8.8.5. Disposable Fire Extinguishers.**

Any person or organisation wishing to manufacture, import, sell or use a disposable type of fire extinguisher, i.e., one that is not primarily designed or intended to be re-charged after use, must nevertheless ensure that the type of extinguisher is designed, constructed and maintained to an approved design specification.

Any person or organization wishing to recharge and/or service a previously designated disposable extinguisher must be able to:

- a. provide documentary evidence that the specification that it was constructed to, allows re-charging and servicing; and
- b. be able to comply with those requirements. For example, BRK extinguishers built to UL 299 allows disposable extinguishers to be re-charged, serviced etc., provided a service manual is produced by the manufacturer demonstrating how this can be achieved safely and correctly by a recognized agent.

### **8.8.6. Approval of Rechargeable Fire Cylinders.**

Any person or organisation wishing to manufacture, import, sell or use a rechargeable type extinguisher must ensure that it is of a design that is approved for charging and use in this country.

High pressure fire extinguisher cylinder designs have the same approval requirements as per other gas cylinders. A check as to whether a particular fire extinguisher design is approved and can be filled, should first be made using the flow charts set out in Part 9 of this Guide.

If the extinguisher is of a design not previously approved for use in this country then the cylinder approval process set out in Part 3 of this Guide should be followed.

Low pressure fire extinguishers, if manufactured after 1 October 2004, must have passed product certification by an accredited product certification body prior to the extinguisher being imported, sold or used in New Zealand. Refer section 3.10.3 of this Guide.

## 8.9. Acetylene Cylinders.

Acetylene cylinders are not hydrostatically tested apart from the original test undertaken prior to insertion of the porous mass. They must, however, be periodically inspected and test certified as per AS2032.2 at the inspection periods set out in section 8.7 of this Guide.

Each time an acetylene cylinder is received at a filling station, its overpressure protection devices must be examined in accordance with AS 2030.2 The verification, filling, inspection, testing and maintenance of cylinders for the storage and transport of compressed gases - Cylinders for dissolved acetylene.

## 8.10. What if a cylinder cannot be inspected internally?

Cylinders that by way of their small neck aperture make internal examination impossible, e.g., primus cylinders having a recessed valve. These cylinders must be either:

- a. hydrostatically tested using a water-jacket apparatus, with dry air or nitrogen as the pressurising medium, or
- b. examined in accordance with the provisions 9.6 of AS 2030.5-2009 provided that they are within the scope of this clause, or
- c. disposed of in accordance with section 8.12.3 of this Guide.

## 8.11. What type of lubricants and sealants are suitable?

Correct sealants and lubricants must be used. This becomes even more important where cylinders are used for breathing air (SCBA, SCUBA, Nitrox, and Medical Oxygen) or food grade gas (e.g., carbonated drinks).

Some lubricants and sealants have been determined by the Previous Approving Authority, as being both safe and suitable for service with the intended gas traffic. .

Table 8.11: Examples of accepted lubricants and sealants.

Cylinders other than breathing air, Nitrox, oxygen or food grade gases.	Breathing air or food grade gases.	Oxygen, Nitrous Oxide, Nitrox
'Dag' Dispersion 709 colloidal molybdenum disulphide in toluene. Fluorolube 5-30 (Occidental Chemical Corp.) PTFE tape, degreased.	(Vegetable – based lubricants)? Compressor operation only PTFE tape, degreased and certified suitable for oxygen service. 'Crystalube' – refer TDI handbook Silicon spray (specific type)	Fluorocarbon oils and greases as specifically approved for the operating pressures/temperatures PTFE tape, degreased and certified suitable for oxygen service.

## 8.12. What happens when a cylinder fails periodic inspection or test?

### 8.12.1. General.

A cylinder may have failed its periodic inspection or test for a variety of reasons, which may include any of the following:

- a. the visual inspection criteria set out in AS 2337.1, e.g., corrosion, physical damage, neck thread cracks; or
- b. the hydrostatic test criteria set out in AS 2337.1; or
- c. for acetylene cylinders the criteria set out in AS 2030.2; or
- d. the proof test criteria set out in AS 2337.1; or
- e. wire-wound cylinders; or
- f. re-cut neck threads, i.e., where the neck threads have been machined out and a new thread cut (does not include cleaning up of original threads, provided thread tolerances have not been exceeded); or
- g. neck thread inserts/spacers/reducers, i.e., where the basic neck thread is reduced in size by an insert threaded to take the valve; or
- h. cylinders that have had markings obliterated, filed off, ground out or changed without satisfactory explanation; or
- i. cylinders that have evidence of having been involved in a fire and/or have been subjected to extreme heat temperatures, including scorched or blistered paintwork, melted or deformed soft alloy or plastic parts.

The reason(s) for the cylinder having failed inspection or test should be fully explained to the cylinder owner.

If for any of the above reasons, the cylinder fails its periodic inspection it must not re-enter service. It must either:

- be rendered unserviceable as a compressed gas container (refer to section 8.12.3), or

- if the failure is due to reasons other than neck thread inserts or re-machining of markings being obliterated, the cylinder may be retested under the supervision of an enforcement officer, or
- be repaired if repair is provided for in the design to which the cylinder was manufactured.
- The cylinder may not leave the premises of the periodic tester except with the consent of an Enforcement Officer.

Refer to sections 8.12.2 and 8.12.3 for further detail.

### **8.12.2. Can a failed cylinder be re-inspected or re-tested?**

A cylinder that fails periodic inspection or testing should normally be condemned by the periodic tester without re-testing being necessary. However, there may be exceptions, as follows:

- If the periodic tester believes that a fault in their equipment or procedure may have occurred that may have invalidated the test result, then the cylinder should be re-tested once the fault has been rectified.
- If the cylinder owner believes that the test result may not be valid then they may request an Enforcement Officer to authorise a re-test. The re-test must be carried out at the cylinder owner's expense and under any conditions that the Enforcement Officer may specify.

A cylinder should not be subjected to its test pressure more than once in any 24 hour period. If a cylinder fails re-test it is considered condemned and must then be rendered unserviceable immediately.

### **8.12.3. How must a condemned cylinder be disposed of?**

The following procedure sets out the requirements and methods for disposing of condemned cylinders by periodic testers:

- a. A condemned cylinder can be immediately rendered unserviceable as a compressed gas container with the cylinder owner's permission and the cylinder valve and fittings returned to the owner.
- b. A condemned cylinder can be rendered unserviceable as a compressed gas container without the cylinder owner's permission if 30 or more days have elapsed since the cylinder failed inspection or test. Condemned cylinders must be kept in a secure place, separate from the testing area until the 30 day minimum elapsed period has ended.
- c. A condemned cylinder must not be returned to the cylinder owner except where the cylinder has first been rendered unserviceable as a compressed gas container.
- d. Rendering unserviceable as a compressed gas container may be accomplished by any of the following methods:
  - i. Flattening the cylinder; or
  - ii. Cutting the cylinder into two pieces, away from any welds; or
  - iii. Drilling a hole of at least 25mm diameter through the wall or base of the cylinder; or
  - iv. Destroying the neck thread at least down to the root of the thread over a minimum of 6 mm of the thread circumference.

## 8.13. Can a cylinder be repaired?

### 8.13.1. Repairs not recommended

Repairs to cylinders are not recommended. They can only be undertaken if they are in accordance with a procedure specified in the standard applying to the design which the cylinder was manufactured to. Following such a repair, a certificate must be obtained from a recognised inspection agency that the repair has been carried out in accordance with the design and meets the quality assurance requirements specified in the design. The cylinder cannot be re-filled unless this certificate has been obtained.

### 8.13.2. Cylinder Specifications

Provision for repair in some cylinder specifications generally applies to repairing defects discovered during manufacture. Repairs, where undertaken, must comply fully with the procedures set out in the specification, including re-inspection by a suitably competent person.

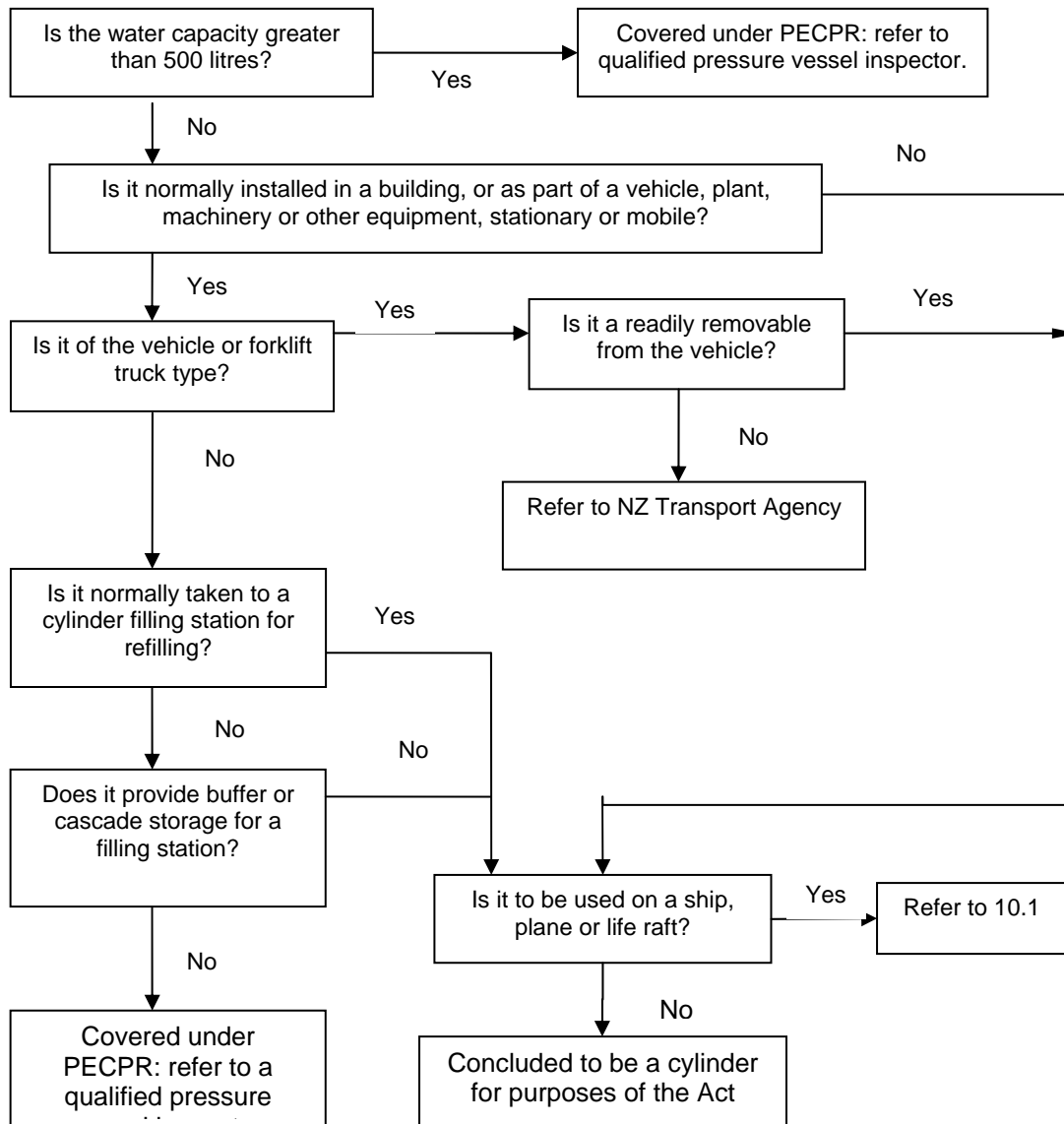
### 8.13.3. Maintenance

Maintenance is distinguished from repairs. Maintenance (such as sandblasting and painting of steel cylinders or repairing scratches in a composite cylinder) may be undertaken.

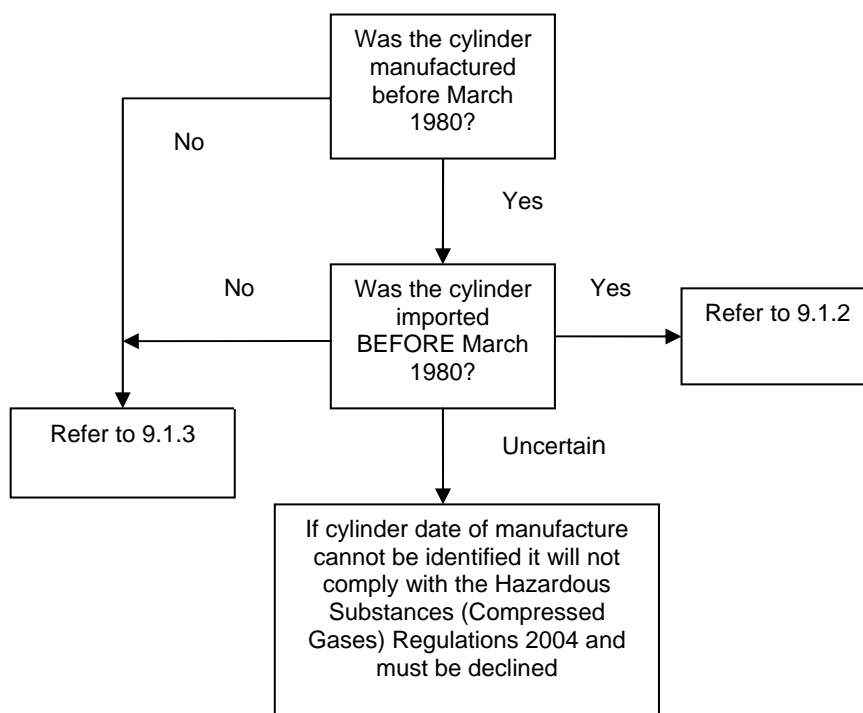
## 9. Identification of Cylinders

### 9.1. Identification of Approved Cylinders

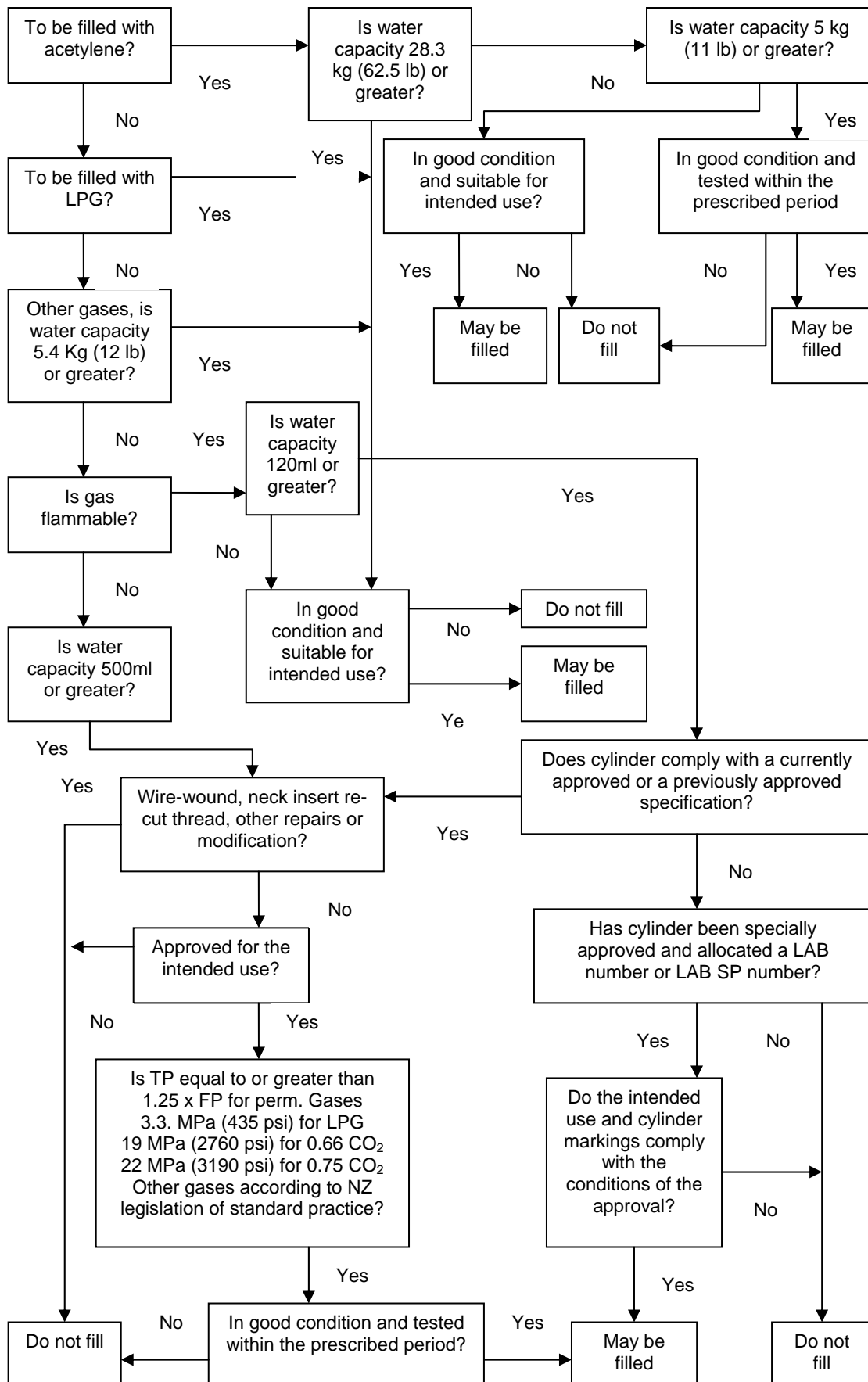
#### 9.1.1. Determination of a cylinder



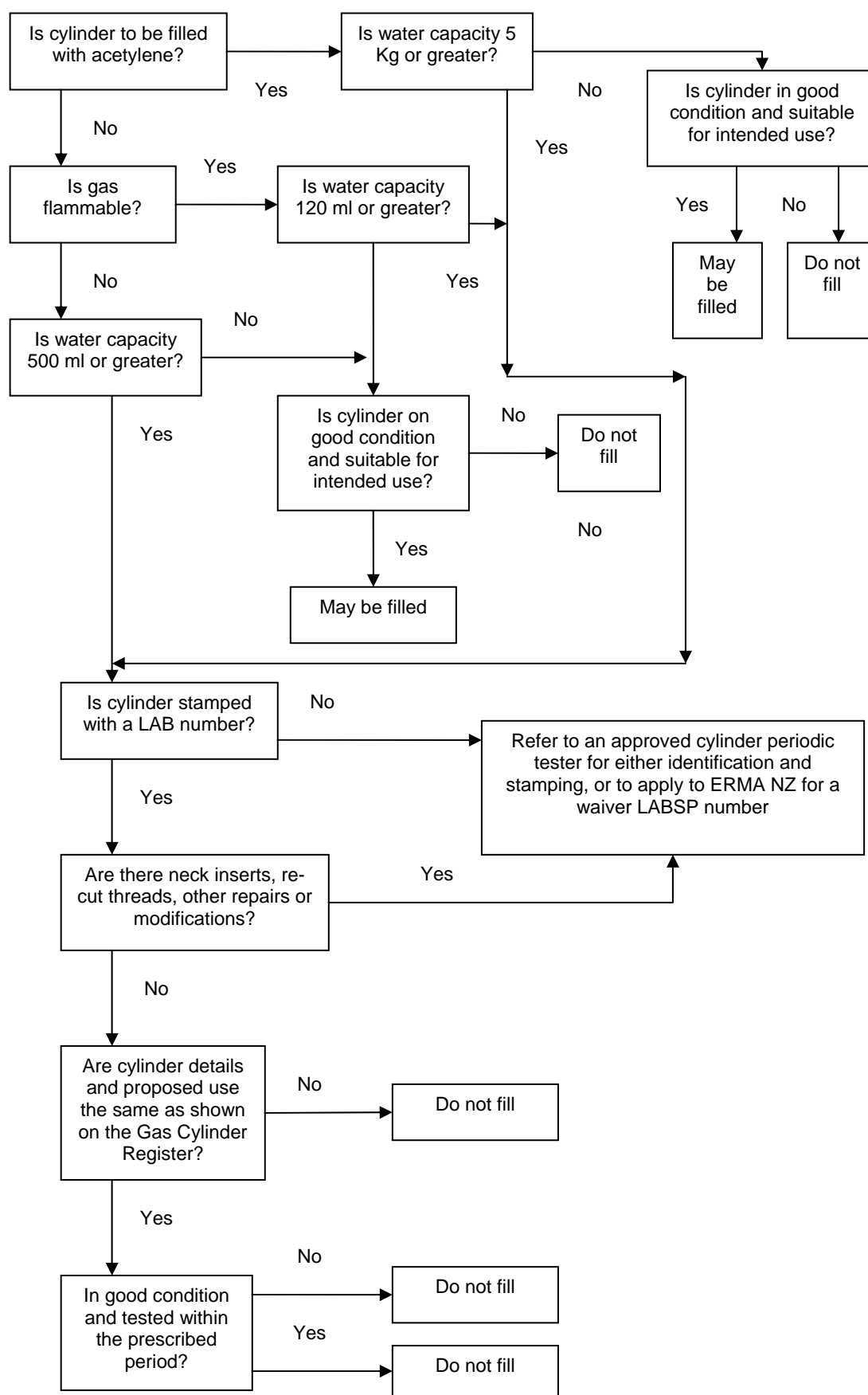
### 9.1.2. Identification of Approved Cylinders



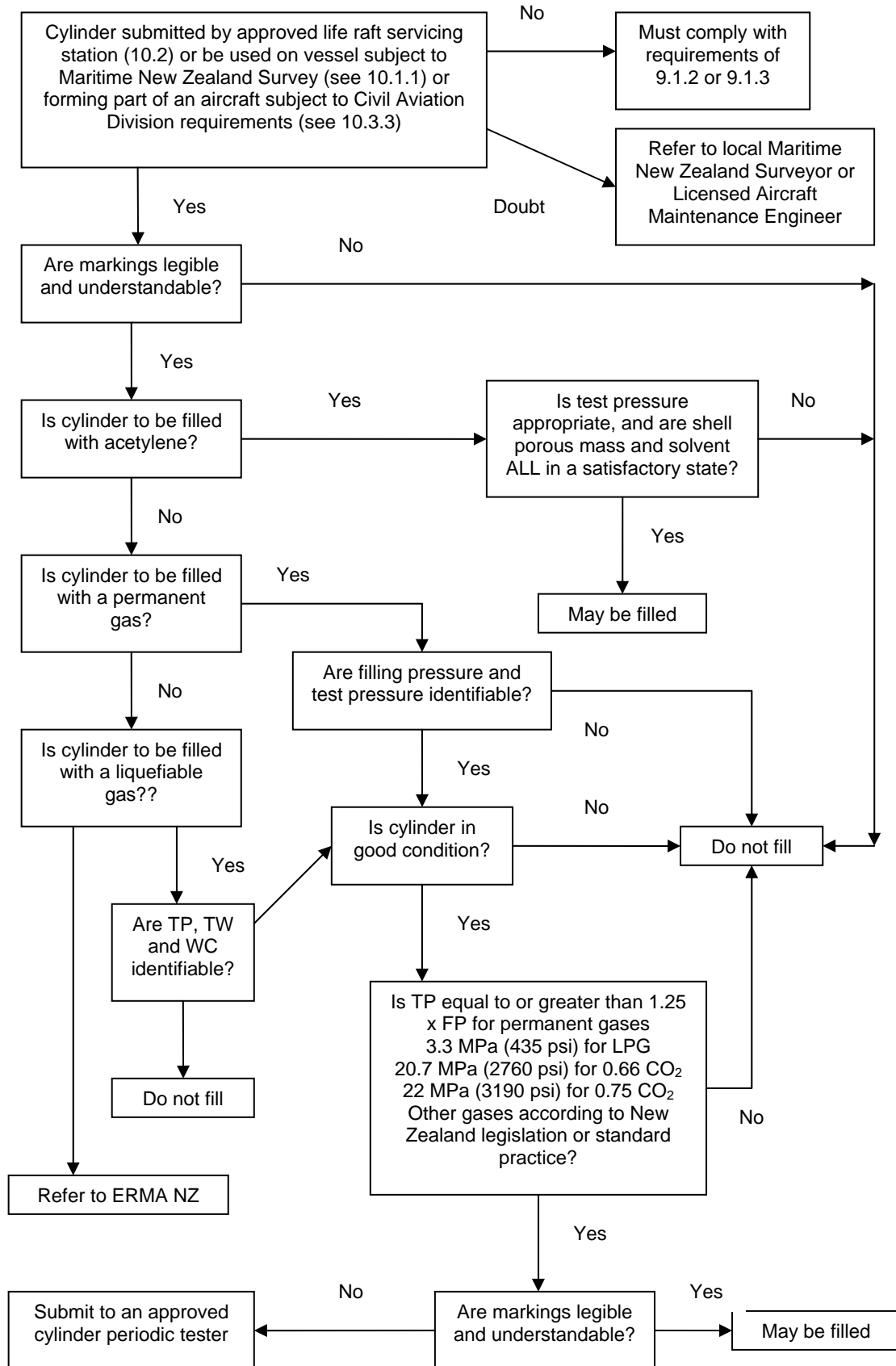
9.1.3. Identification of Approved Cylinders Imported Before March 1980



### 9.1.4. Identification of Approved Cylinders Imported after March 1980



### 9.1.5. Identification of Acceptable Cylinders Which Are to Be Used on Boats, Ships, Planes and Life rafts



## Attachment 1: Antecedents

February 1983	Original issue of Guide to Gas Cylinders by the Explosives and Dangerous Goods Division, Dept of Labour. Issued to Dangerous Goods Inspectors, cylinder importers, manufacturers, testing stations and regulatory authorities.
April 1985	First reprint of Guide by Dept of Labour, incorporating all amendments, information bulletins and lists. Issued to all holders of original copies.
January 1991	Second reprint of Guide by Dept of Labour, incorporating all further amendments, information bulletins, lists and featuring specific new information on fire extinguishers, and supplements. Issued to all holders of original copies.
April 2001-February 2004	Revisions to Guide supplements and minor amendments to Guide by Dept of Labour. Issued to all testing stations, cylinder importers, CTLA and NZU.
October 2004	Commencement of CG Regulations.

## Attachment 2: Equivalent Metric and Imperial Pressures

Note: The pressures given as equivalents have been rounded for practical purposes.

Quoted Pressure psi	Equivalent Pressure		Quoted Pressure MPa	Equivalent Pressure	
	MPa	Bar		Bar	psi
240.0	1.7	17	1.55	15.5	225
272.0	1.9	19	3.0	30.0	435
275.0	1.9	19	3.3	33.0	497
480.0	3.3	33	3.31	33.1	480
544.0	3.8	38	13.65	136.5	1980
550.0	3.8	38	17.5	175.0	2538
1800.0	12.4	124	17.6	176.0	2553
1980.0	13.7	137	18.9	189.0	2740
2015.0	13.9	139	22.0	220.0	3190
2133.0	14.7	147	22.2	222.0	3220
2265.0	15.6	156	23.2	232.0	3365
2275.0	15.7	157	23.3	233.0	3379
2400.0	16.6	166	24.3	243.0	3524
2475.0	17.1	171	24.5	245.0	3553
2850.0	19.7	197	27.5	275.0	3989
3000.0	20.7	207	27.6	276.0	4003
3300.0	22.8	228	28.5	285.0	4134
3358.3	23.2	232	29.2	292.0	4235
3360.0	23.2	232	29.4	294.0	4264
3555.0	24.5	245	31.9	319.0	4627
3560.0	24.6	246	32.0	320.0	4641
3600.0	24.8	248	32.4	324.0	4699
3775.0	26.0	260	34.2	342.0	4960
3791.7	26.2	262	34.5	345.0	5004
3840.0	26.5	265	35.2	352.0	5105
4000.0	27.6	276			
5000.0	34.5	345			
5500.0	37.9	379			
6000.0	41.4	414			
6400.0	44.1	441			
8333.3	57.5	575			

## Attachment 3: Glossary of Terms and Definitions Used in this Guide

Aerosol	means a substance packed under pressure and designed to be released as solid or liquid particles in a suspension of gas, as a foam, paste or powder, or in a liquid or in a gaseous state.
Approved	means approved as suitable for filling or use in NZ by ERMA New Zealand or a previous approving authority.
Breathing Apparatus	(BA, SCBA) means apparatus for the supply of breathing air to the wearer when in a noxious or hostile atmosphere. Does not include SCUBA.
'Billet Pierced' Cylinder	means a cylinder in which the base and walls are made in one hot forming process
Cartridge	means a non-refillable container for propane, butane or LPG, and has the same meaning as 'single tripper' or 'disposable' container.
CG Regulations	means the Hazardous Substances (Compressed Gases) Regulations 2004 and amendments.
Charge	means to load or fill a compressed gas container with a gas or combination of gases.
Charging pressure	has the same meaning as Filling Pressure or Working Pressure
Coating or Liner	means a non-removable membrane applied by the cylinder manufacturer to adhere to the internal walls and base of a cylinder.
Composite cylinder	means a cylinder that is either wrapped with glass reinforced plastic (fibreglass) or is constructed fully from carbon fibre or similar non-metallic material suitable for cylinder construction.
Compressed Gas Container	has the same meaning as per the Hazardous Substances (Compressed Gases) Regulations 2004.
Critical Temperature	means the temperature above which a gas cannot exist as a liquid.
Cryogenic Container	means a container designed to hold a compressed cryogenic gas or refrigerant gas, with or without an external means of maintaining the gas at a cryogenic or refrigerant constant temperature.
Cylinder	has the meaning given to it in the Hazardous Substances (Compressed Gases) Regulations 2004. These are used to store or transport compressed, liquefied or dissolved gases, but does not include an aerosol or a cartridge. They have a water capacity of 120 mls or greater if the content is a liquefied flammable gas, a water capacity of 500 mls or greater if the content is other than a liquefied flammable gas, and a water capacity not exceeding 500 L.

Design	means all specifications (including drawings) necessary to describe the attributes of a compressed gas container.
Design Pressure	means the pressure used in the equations for designing the cylinder. This may be: <ul style="list-style-type: none"> <li>a. service pressure</li> <li>b. working pressure</li> <li>c. developed pressure</li> <li>d. test pressure</li> <li>e. burst pressure</li> </ul> depending on the standard to which the cylinder is designed.
Design Verifier	means a test certifier approved by ERMA New Zealand to issue design verification test certificates for cylinder designs under regulation 15 of the Regulations.
Developed Pressure	means the pressure developed in a cylinder at the reference temperature, particularly when the cylinder has been filled in accordance with the approved filling ratio or filling pressure.
Dew Point	in the case of a dry gas means the temperature at which the gas is saturated with respect to a condensable component.
Dissolved Gas	means a gas which, when packaged under pressure for transport, is dissolved in a liquid phase solvent.
Dry Gas	means a gas having a dew point of less than $-40^{\circ}\text{C}$ at a pressure of 101.3 kPa absolute.
Empty Weight	means the weight of the empty cylinder complete with its valve, fittings and related items that are normally on the cylinder when it is filled. <sup>9</sup>
Enforcement Officer	A person appointed under section 98 or 99 (3) of the HSNO Act.
ERMA New Zealand	means the Environmental Risk Management Authority, which is the authority responsible for administering the HSNO Act.
Fibre Wrapped	means a cylinder of metallic construction that is externally reinforced by wrapping in glass reinforced plastic (fibreglass).
Filling Pressure or Charging Pressure	means the pressure to which a cylinder is filled with a gas when both the gas and the cylinder are at $15^{\circ}\text{C}$ . Applicable only for permanent gases
Filling Ratio	in relation to a liquefied gas means the ratio of the mass of gas charged into a compressed gas container to the mass of water at $15^{\circ}\text{C}$ that fills the container.
Fire Extinguisher	means a compressed gas container intended to hold an extinguishant that can be discharged onto a fire by, or by being,

<sup>9</sup> This Guide adopts the Australian and North American terminology. The European ISO standards have the Tare Weight and empty weight interchanged with the terminology that is used in this Guide.

	a gas under pressure.
Fitting	<p>in relation to a compressed gas container, means a device (including a valve, adapter, automatic changeover device, gauge, regulator, seal or hose) that is connected to a compressed gas container and that is used to:</p> <ol style="list-style-type: none"> <li>fill or empty the container with gas; or</li> <li>seal a connection to a container with gas; or</li> <li>connect the container directly to another item associated with the use of gas; or</li> <li>protect the container from over-pressurising.</li> </ol> <p>Generally this does not extend past the outlet of the first stage regulator.</p>
Gas	<p>means a substance that:</p> <ol style="list-style-type: none"> <li>is completely gaseous at 20 °C and at 101.3 kPa absolute pressure; or</li> <li>has a vapour pressure of more than 300 kPa absolute pressure at 50 °C.</li> </ol>
Guide	This Guide to Gas Cylinders
High Pressure Fire Extinguisher means	a CO <sub>2</sub> fire extinguisher.
High Pressure Liquefiable Gas means:	a liquefiable gas that has a critical temperature greater than -50 °C but not exceeding 65 °C.
HSNO Act	means the Hazardous Substances and New Organisms Act 1996.
Liquefiable Gas	means a gas that has a critical temperature greater than -50 °C and a boiling point not exceeding 20 °C at 101.3 kPa absolute.
Low Pressure Fire Extinguisher means	a fire extinguisher that is not a CO <sub>2</sub> fire extinguisher
Low Pressure Liquefiable Gas means:	a liquefiable gas that has a critical temperature exceeding 65°C.
Over-filling Protection Device (OPD) means:	a device fitted to the valve of an LPG cylinder and designed to prevent the cylinder from being over-filled.
Over-pressure Protection Device (Pressure Relief Device) means:	a device incorporated in the design of a valve or a cylinder and designed to release the cylinder contents when subjected to excessive heat or pressure, thus preventing the cylinder from bursting.
Periodic Test Certificate means:	a test certificate issued by a periodic tester following inspection and/or testing of a cylinder.
Periodic Tester	means a test certifier approved by ERMA New Zealand to issue periodic test certificates under regulation 52 of the Regulations.
Permanent Gas	means a gas with a critical temperature not exceeding -50 °C.
Person in Charge	<p>in relation to a place that has a gas cylinder located in it, means</p> <ol style="list-style-type: none"> <li>the person who is the owner, lessee, sublessee, occupier, or person in possession of the place or any part of it, or</li> </ol>

	b. any other person who, at the relevant time, is in effective control or possession of the relevant part of the place.
'Plugged' cylinder	means a cylinder in which a permanent closure in the base of the finished cylinder has been effected by a plug.
Pre-commissioning Tester:	a test certifier approved by ERMA New Zealand to issue pre-commissioning test certificates under regulation 22 of the Regulations.
Previous Approving Authority means:	the authority undertaking approvals prior to the HSNO Act coming into effect. In most cases this was the Chief Inspector under the Dangerous Goods Act 1974.
Product Certification Body means:	a body accredited to ISO/IEC Guide 65 by a national or New Zealand joint accreditation agency operating to ISO/IEC Guide 61 for the product certification of fire extinguishers.
Reference Temperature means:	a. for liquefiable gases, the temperature at which the liquid density is to be evaluated for calculating the filling ratio, and b. for permanent gases, the temperature at which the developed pressure is determined.
Self-Contained Underwater Breathing Apparatus (SCUBA) means:	self-contained apparatus for the supply of breathing air to the wearer whilst underwater.
Service Pressure	is used for a cylinder designed to DOT or CTC specifications as a pressure rating for the cylinder. It has no defined meaning for cylinders to other specifications.
'Spun' Cylinder	means a cylinder in which the end closure in the base of the finished cylinder has been forge welded by the spinning process.
Tare Weight	means the weight of the empty cylinder without its valve and other fittings or related items that are normally on the cylinder when it is filled. <sup>10</sup>
Test Certificate	means a certificate issued by a test certifier under section 82 of the HSNO Act 1996.
Test Certifier	means a person approved by ERMA New Zealand under section 84 of the HSNO Act to issue test certificates.
Test Pressure	means the pressure the cylinder is designed and tested to withstand.
Ullage	means the allowable vapour space within a cylinder containing a liquefiable gas.
Volume of Gas	means the volume of a gas at 101.3 kPa absolute pressure and 15°C.

<sup>10</sup> This Guide adopts the Australian and North American terminology. The European ISO standards have the Tare Weight and empty weight interchanged with the terminology that is used in this Guide.

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Water Capacity	means the volume of water at 15°C that fills a compressed gas container that is fitted for use with any valve, dip tube, float or other necessary fittings.
Working Pressure	has the same meaning as Filling Pressure or Charging Pressure.

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## Attachment 4: Abbreviations Used in this Guide

ABS	American Bureau of Shipping
ALFW	Aluminium Fibre Wrapped
ANZIGA	Australian and New Zealand Industrial Gases Association
AS	Australian Standard
ASME	American Society of Mechanical Engineers
ASME Code	ASME Boiler and Pressure Vessel Code, Section VIII for the design of unfired pressure vessels
AS/NZS	Australian and New Zealand joint standard
BA	Breathing Apparatus (not underwater)
BCGA	British Compressed Gas Association
BS	British Standard
BSP	British Standard Pipe.
BV	Bureau Veritas
CAA	New Zealand Civil Aviation Administration
CAN	Standard Council of Canada
CGA	Compressed Gas Association of America
CG Regulations	Hazardous Substances (Compressed Gases) Regulations 2004
CNG	Compressed Natural Gas
CP	Charging Pressure
CTC or TC	Canadian Transport Commission / Transportation Canada
CTLA	Cylinder Testing Laboratories Association of New Zealand Inc.
DIN	Deutsche Industrie Norm (German Standard)
DNAx	Denitrogenated Air mix (mixed gas diving)

DoL	Department of Labour, New Zealand
DOT	Department of Transportation (USA)
DOT 3AA, etc	DOT Specifications per the Bureau of Explosives Tariff or Code of Federal Regulations (CFR) 49
EANx	Enriched Air Nitrogen Mix (mixed gas diving)
ESS	Energy Safety Service of the Ministry of Consumer Affairs, New Zealand.
EW	Empty Weight
IANZ	International Accreditation New Zealand
FP	Filling Pressure
JAS – ANZ	Joint Accreditation System of Australia and New Zealand
JIS	Japanese Industrial Standard
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LPGA	Liquefied Petroleum Gas Association Inc
LTNZ	Land Transport New Zealand
MfE	Ministry for Environment, New Zealand
MNZ	Maritime New Zealand, formally Maritime Safety Authority
MoH	Ministry of Health, New Zealand
NGS	National Gas Straight.
NGT	National Gas Taper.
NITROX	Nitrogen – Oxygen mixture (for mixed gas diving)
NPT	National Pipe Taper.
NPTF	National Pipe Taper Fine.
NPSM	National Pipe Straight Mechanical thread mill inserts.
NZDF	New Zealand Defence Force

NZS	New Zealand Standard
NZU	New Zealand Underwater Association Inc
OPD	Over-filling Protection Device
P & L	Permanent and Liquefiable Gases
PECPR	The Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations 1999
PH	Hydraulic Test Pressure (ISO 13769 cylinder markings)
POL	'Prest O Lite'
PRD	Pressure Relief Device
PW	Working Pressure (ISO 13769 cylinder markings)
QCC	Quick Connection Coupling
SCBA	Self Contained Breathing Apparatus (same as BA)
SCUBA	Self Contained Underwater Breathing Apparatus
TELARC	Testing Laboratory Registration Council of NZ
TRG	Technische Regeln Druckgase (German Compressed Gas Regulations)
TP	Test Pressure
TW	Tare Weight
UL	Underwriters Laboratories Inc., USA
ULC	Underwriters Laboratories of Canada
UNF	Uniform National Fine
WP	Working Pressure

## Attachment 5: Other Relevant Abbreviations

ABSTECH	ABS Worldwide Technical Services
ANCC	Associazione Nazionale per il Controllo della Combustion (Italy)
CIG Gas Cylinders	Commonwealth Industrial Gases (Australia) Gas Cylinder division now part of Luxfer Gas Cylinders. CIG is Commonwealth Industrial Gases (Australia) which is owned by BOC Ltd and has now been rebranded BOC Ltd
CTCo	Chesterfield Tube Company
DNV	Det Norske Veritas (Norway)
INTECO	International Inspection Company
IWK	Industrie – Werke Karlsruhe (Germany)
IWKA	Industrie – Werke Karlsruhe Aktiengesellschaft
SGS	Societe Generale de Surveillance
SISIR	Singapore Institute of Standards and Industrial Research
TISTR	Thailand Institute of Scientific and Technological Research
TDI	Technical Diving International, Canada
TUV/TU	Technischen Überwachungs Vereine (Germany)

## Attachment 6: Inspection Types

Schedule A (visual)	Schedule B (non-destructive)	Schedule C (destructive)
General appearance.	Internal examination.	In accordance with the design standard, and may include yield strength, tensile strength, elongation, flattening, weld x-ray, bend testing, cyclic and burst testing.
Markings (including recognised inspection agency stamp).	Check tare and empty weight.	
Check manufacturer's certificates.	Check water capacity.	

Schedule A is used typically for import clearance with Schedules B and C typically used for pre-commissioning

The rate of testing of each shipment will be determined by the test certifier except where the design standard specifies otherwise, for example:

Schedule A: 1 in 200

Schedule B: 1 in 200

Schedule C: Typically one for burst testing and one for tensile testing

Where any of the cylinders initially selected for type testing fail any of the tests, the test certifier may request that further samples be tested from the shipment.

Where cylinders pass type testing, the test certifier will compare the type testing report with the manufacturers test report for consistency of results. Where the test certifier is satisfied that no inexplicable or significant inconsistency exists between the two reports, the certifier will issue a cylinder pre-commissioning test certificate.

Examples of Inspection Schedules for Gas Cylinders.

Pre inspection information includes:

- Cylinder Manufacturer:
- Recognised Inspection Agency:
- Date of Manufacture:
- Specification:
- Gas Traffic:
- Water Capacity:
- Test Pressure:
- Working Pressure:
- Cylinder Register No. (LAB No.):
- Total Number of Units in Shipment:
- Valve Manufacturer:

- Valve Type:
- Manufacturer's Test Report No:
- Serial Number Range:
- Date of Examination:

Name of Examiner:

Items verified in the Separate Inspection Types

<b>Schedule A</b>	<b>Complies Y/N</b>
<p>External appearance good, symmetrical.</p> <p>Welding apparently good quality.</p> <p>Valve protection adequate.</p> <p>Surface finish, coating of good quality.</p> <p>Cylinder, valve and fittings markings</p> <p>Markings:</p> <ul style="list-style-type: none"> <li>• clear and legible</li> <li>• match design verification</li> <li>• correct units</li> <li>• accurate</li> <li>• meet requirements of the CG Regulations</li> </ul>	
<p>Remedial action required: Yes/No</p>	
<p>Details</p>	
<b>Schedule B</b>	<b>Complies Y/N</b>
<p>Internal appearance good.</p> <p>Welding apparently good quality.</p> <p>Internal surface good, no corrosion.</p> <p>Neck thread satisfactory.</p> <p>Tare weight</p> <p>Empty weight</p> <p>Water capacity</p> <p>Manufacturers Certificates:</p> <ul style="list-style-type: none"> <li>• match cylinder shipment</li> </ul>	

- whole shipment covered

Drawing number

Remedial action required: Yes/No

Details

**Schedule c**

**Complies Y/N**

Measured acceptable

Tensile strength (MPa)

Yield strength (MPa)

Elongation (%)

Weld bend test

Hydrostatic test

Cyclic test

Burst test

Other (specify)

Remedial action required: Yes/No

Details



Environmental  
Protection Authority  
*Te Mana Rauhi Taiao*

BP House, (Level 1), 20 Customhouse Quay, Wellington 6011, New Zealand

