

Guide to gas cylinders

***APPROVING, TESTING,
FILLING, HANDLING AND
STORAGE OF GAS CONTAINERS,
VALVES AND FITTINGS***

August 2019



These guidelines provide information on:

- the approval of gas containers and fittings**
- the testing, filling and handling of cylinders, and**
- the marking of cylinders, valves and fittings, aerosols and non-refillable containers.**

ACKNOWLEDGEMENTS

WorkSafe would like to acknowledge and thank the many stakeholders who have contributed to the development of this guidance.

Guide to gas cylinders

KEY POINTS

- Improper handling of gases under pressure may cause injury, death or ill health to a person due to the pressure of their containers.
- Cylinders, including cryogenic containers and fire extinguishers (but not aerosol dispensers) must be approved before being filled in New Zealand.
- Every cylinder and its contents must be clearly identified.
- Cylinders must be handled and stored carefully.
- Only approved fillers may fill compressed gas containers.
- All cylinders must be inspected and tested after manufacture and then at intervals throughout their life.

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1.0

Scope

IN THIS SECTION:

1.1. Introduction

1.2 Scope

1.3 Exclusions

1.1 Introduction

This guide is to assist 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 Part 15, *Gases under Pressure* of the Health and Safety at Work (Hazardous Substances) Regulations 2017 (the HS Regulations) for these activities but does not exempt persons from the obligation to become familiar with and comply with these Regulations.

This guide must be read in conjunction with the following Regulations and Group Standards:

- the Health and Safety at Work (Hazardous Substances) Regulations 2017: [HS Regulations](#)
- the [Aerosols Group Standards 2017](#)
- the [Gas Under Pressure Mixtures Group Standards 2017](#)

A list of sources of information can be found in Appendix 3.

1.2 Scope

Improper handling of gases under pressure may cause injury, death or ill health to a person and cause damage to property or the environment due to the pressure of their containers. They pose a risk to:

- fillers
- test stations
- drivers
- handlers
- emergency services and
- the general public

during their transportation, storage, filling, testing and use. The hazardous properties of the gases may also pose risks.

The aim of this guide is to ensure that all persons dealing with containers of gases under pressure understand the risks and the mechanisms and procedures to prevent accidental damage or injury.

This guide does not detail the requirements of other legislation. Compliance with this guide does not remove the requirement to comply with the [Health and Safety at Work Act 2015](#) (HSWA) and its other associated regulations.

This guide applies to the design, manufacture and approval of the gas containers and fittings as defined in [Part 15 of the HS Regulations](#) including:

- refillable cylinders
- high and low-pressure fire extinguishers
- cylinder fittings
- aerosols and non-refillable containers.

In addition to the above, this guide includes:

- periodic testing of cylinders
- filling of cylinders and tanks
- handling and storage of cylinders
- marking and identification of cylinders, valves and fittings, aerosols and non-refillable containers.

1.3 Exclusions

The definition of gas container in Regulation 3 excludes from the Regulations: 'a pressurised container that forms an integral part of the motive or control system of a vehicle, a ship or an aircraft (including the emergency system for a vehicle ship or aircraft).'

However, there will be cases where the guide refers to the filling of cylinders from vehicles, ships and planes and the testing of these cylinders at test stations authorised by WorkSafe under provisions provided by the New Zealand Transport Agency, the Civil Aviation Authority and Maritime New Zealand.

Examples of cylinders covered by this exclusion include automotive LPG cylinders, hot air balloon LPG cylinders, and oxygen cylinders in aircraft and gliders and cylinders for inflating ship life-rafts.

The exclusion means these cylinders are not required to have LAB approval numbers and they can be filled by persons that are not approved fillers but operate under rules or arrangements under the oversight of the transport agencies.

2.0

Gases under pressure

IN THIS SECTION:

- 2.1 How are gases under pressure classified?
- 2.2 Classifications for common gases
- 2.3 What is a permanent gas?
- 2.4 What is a dry gas?
- 2.5 What is a liquefied gas?
- 2.6 Other gases

2.1 How are gases under pressure classified?

Gases under pressure are classified in two ways:

- the Environmental Protection Authority (EPA) Hazardous Substances (Classification) Notice which follows the Globally Harmonised System (GHS)¹ of substance classification where gases are classified according to their hazardous properties
- the United Nations (UN) Recommendations for Transport of Dangerous Goods classification for transport which classifies all gases as Class 2 (eg Class 2.3 for toxic gases).

Under the GHS classification, all hazardous gases have hazard classifications (eg Class 2 (flammable), Class 5 (oxidising), and Class 6 (toxic)). These hazard classifications are subdivided according to the level of hazard (eg high, medium or low hazard). They can be further sub-classified according to the criteria by which the hazard is measured (eg the flammability or combustibility range of the gas mixture with air; or the level of acute (toxic) exposure).

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 ₅₀ 100 - 500 ppm as a gas in air as a result of acute exposure by animals, and by the inhalation route.

TABLE 1:
Gas hazard
classifications

2.2 Classifications for common gases

Table 2 Common gas classifications:

CLASSIFICATION	PROPERTIES	EXAMPLES
2. 1. 1A	Flammable gas - high hazard	LPG, propane, butane, CNG, acetylene (ethyne), hydrogen, methane, fluoro-methane (R41), 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

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

CLASSIFICATION	PROPERTIES	EXAMPLES
6. 1B	Toxic gas	dichlorovos, Insectigas, hexaflouroacetone
6. 1C	Toxic gas	sulphur dioxide, carbon monoxide, anhydrous ammonia
Not classified under GHS	Compressed non-hazardous gases	compressed air, argon, carbon dioxide, helium, nitrogen, neon, refrigerant gases

TABLE 2:
Common gas classifications

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 EPA Hazardous Substances (Classification) Notice: www.epa.govt.nz
3. A summary of the classifications and controls for each approved substance is available from:
 - the hazardous substance register at: www.epa.govt.nz or
 - the [Hazardous Substances Calculator](http://www.hazardoussubstances.govt.nz) on the Toolbox website: www.hazardoussubstances.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°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 liquefied gas?

General

Liquefied gases are gases that are partially liquid at temperatures above -50°C when packaged under pressure.

Liquefied 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 liquefied gases must have sufficient ullage (vapour space) to ensure the liquid will not expand to fill the container.

A liquefied gas 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.

High pressure liquefied 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 of this guide.

Although acetylene (ethyne), in a scientific sense, is a high pressure liquefied gas, its special properties require it to be considered separately (Section 2.6 of this guide *Acetylene (ethyne)*).

Low-pressure liquefied 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, the balance is 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 liquefied gases, their special properties require them to be considered separately (Section 2.6 of this guide *Chlorine and Anhydrous ammonia*).

Filling of low-pressure liquefied gases is controlled by the filling ratio – refer to Part 7 of this guide.

2.6 Other gases

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.

Chlorine

Chlorine is a non-flammable, low-pressure liquefied 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 respiratory tract (Class 6.9A)
- corrosive to metals (Class 8.1A)
- corrosive to skin tissue (Class 8.2A)
- corrosive to eye tissue (Class 8.3A)
- very ecotoxic 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 the filling ratio (refer Part 7 of this guide).

Anhydrous ammonia

Anhydrous means without water (ie 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 liquefied 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 ecotoxic to aquatic environments (Class 9.1A).

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

Liquid oxygen

Oxygen has a critical temperature of -118°C and must therefore be kept below this temperature to remain in its liquid form. This is achieved by using cryogenic containers or tanks.

Fumigant gases

Fumigant gases such as dichlorvos, 'Pestigas'², 'Insectigas', methyl bromide etc are low-pressure liquefied gases. They are typically classified as toxic and ecotoxic in varying concentrations. Methyl bromide is also classified as a medium hazard, flammable gas. A controlled substance licence is required to possess a fumigant and gas containing 20 g/kg phosphine and gases that are classified as 6.1A or 6.1B are also tracked substances in any quantity.

Cryogenic gases

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

Compressed gas mixtures

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.

For example:

- Argon + CO₂, Nitrogen + Hydrogen
- Argon + CO₂ + Helium

Compressed gas mixtures are also encountered in Self-Contained Underwater Breathing Apparatus (SCUBA) diving where, for different dive operations, the standard nitrogen - oxygen components of air are adjusted (eg nitrox, heliox). Refer also Part 7 of this guide.

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:

- the developed pressure for which the cylinder is designed and is approved
- the identification markings and/or the labelling for the cylinder, or
- the specified inspection or test period for the cylinder.

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

² Pestigas and Insectigas are trademarks of BOC Ltd.

3.0

Approval of cylinders

IN THIS SECTION:

- 3.1 Which cylinders require approval?
- 3.2 What are approved design standards?
- 3.3 What are the design requirements?
- 3.4 What are the steps for obtaining a compliance certificate for cylinder design verification?
- 3.5 What are the steps for obtaining a compliance certificate for cylinder pre-commissioning?
- 3.6 Exemption from need to obtain certain certificates
- 3.7 What are the steps for obtaining a compliance certificate for cylinder import?
- 3.8 One off cylinders
- 3.9 Change of type of gas in a cylinder
- 3.10 Approval of fire extinguishers

3.1 Which cylinders require approval?

Under the HS Regulations, the term 'cylinder':

- means a refillable or non-refillable gas container that is used or intended to be used for storing and transporting gases under pressure, and
- includes a cryogenic container and a fire extinguisher, but
- does not include an aerosol dispenser.

Cylinders include fire extinguishers which are gas containers intended to hold an extinguishant that can be discharged onto a fire by, or by being, a gas under pressure.

All such cylinders require approval prior to being filled in New Zealand.

By approval we mean that the cylinder design, manufacture and importation has to comply with regulations as detailed below.

There are three ways you can have cylinders approved for use in New Zealand. These apply to:

1. imported UNRTDG cylinders
2. non-UNRTDG cylinders – new design
3. non-UNRTDG cylinders – approved design.

UN model regulations cylinders

This approval applies to cylinders which are designed, constructed, tested and marked in accordance with the provisions of Chapter 6.2 of the UN Recommendations on the Transport of Dangerous Goods-Model Regulations 2015 (UNRTDG).

These cylinders can be issued a compliance certificate for imported cylinders in accordance with [HS Regulation 15.3](#) and [Schedule 19 of the HS Regulations](#) if they have markings which are in accordance Clause 6.2.2.7 of the UNRTDG (see Appendix 10: *Marking of refillable UN pressure receptacles*).

Importing/manufacturing non-UNRTDG cylinders – new design

If you are importing or manufacturing a non-UNRTDG cylinder and the design of the cylinder has not been approved (that is, it does not have a record number (LABxxxx)) they need the following certification before the cylinder can be filled in New Zealand:

- a. design verification certificate: [HS Regulation 15.13](#)
- b. manufacturing certificate: [HS Regulation 15.15](#)
- c. pre-commissioning certificate: [HS Regulation 15.17](#)
- d. compliance certificate for imported cylinders: [HS Regulation 15.16](#)

Importing non-UNRTDG cylinders – approved design

If the cylinder design has been previously approved by WorkSafe it will have a record number (LABxxxx). The following certification is needed before the cylinder can be filled in New Zealand:

- a. manufacturing certificate: [HS Regulation 15.15](#)
- b. compliance certificate for imported cylinders: [HS Regulation 15.16](#)

Exemption from requirement to obtain some certificates

Application may be made to WorkSafe under [HS Regulation 15.18](#) for an exemption from the need to have the following certificates:

- a. design verification certificate

- b. pre-commissioning certificate
- c. compliance certificate for imported cylinders.

Design verification compliance certificate

A PCBU who designs, manufactures, imports, or supplies a cylinder, other than a fire extinguisher, must ensure that the cylinder complies with a design standard that is listed in [Schedule 21 of the HS Regulations](#). New design standards are added via a safe work instrument.

A PCBU may apply to a compliance certifier approved for verification of cylinder designs for a design verification compliance certificate (Section 3.4 of this guide).

The compliance certifier must, as soon as practicable after issuing a design verification compliance certificate, provide WorkSafe with information about the certificate.

On receiving the information, WorkSafe will allocate a record number (LABxxxx) to the verified design and enter the details of it on the record of [approved gas cylinder designs](#)

Manufacturer's certificate

A PCBU who manufactures a cylinder must manufacture the cylinder to an approved design.

The PCBU must obtain a manufacturer's certificate for each batch of cylinders from a recognised inspection agency. The manufacturer's certificate must state that the batch of cylinders has been manufactured in accordance with that design and meets the quality assurance requirements specified in the design.

The PCBU must provide copies of the manufacturer's certificate to the purchaser of the batch to which the certificate relates.

Pre-commissioning compliance certificate

A PCBU must not use or supply an imported or manufactured cylinder of a design that has not been previously imported into, or manufactured in, New Zealand unless the PCBU has first obtained a pre-commissioning certificate.

A PCBU may apply to a compliance certifier approved for cylinder pre-commissioning for a pre-commissioning certificate for a cylinder design. The compliance certifier will issue a pre-commissioning certificate for the cylinder design if they are satisfied that there is a manufacturer's certificate for the batch of cylinders and testing of samples of the cylinders show compliance with the tests specified in Section 3.5 of this guide.

Import compliance certificate

A PCBU who imports a cylinder or a batch of cylinders must obtain an import compliance certificate for each cylinder.

A compliance certifier may issue a compliance certificate for the cylinders if satisfied that the cylinders show compliance with the prescribed requirements of [HS Regulation 15.16](#) and the sampling provisions in Section 3.7 of this guide.

3.2 What are approved design standards?

Approved design standards

Cylinders for use in New Zealand must be designed to prescribed standards. Prescribed standards are listed in [Schedule 21 of the HS Regulations](#) and in the [Approved Design Standard Record](#) on the WorkSafe website.

The record of *Previously Approved Design Standards* advises standards that have been withdrawn and cannot be used to verify new designs. However, existing approved cylinders can be marked with these previously approved standards if manufactured at the time these standards were approved.

Applications for further standards to be approved can be submitted to WorkSafe. This application is for a safe work instrument to be made in accordance with [HS Regulation 15.8\(1\)\(b\)](#)

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.

When may American Society of Mechanical Engineers (ASME) Code VIII be used?

The ASME VIII pressure vessel code may be accepted by WorkSafe 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 (eg cryogenic), or
- b. the cylinder design in respect to its intended installation or use, is not or cannot be manufactured to another approved standard (eg fixed installation vapour withdrawal cylinders)
- 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.

What are the non-approved design standards?

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

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

Cylinders that were designed to standards that were previously approved are approved for import provided they were manufactured while the record number (LABxxxx) remained current.

There are cylinder design standards that have never been approved because they are considered unsuitable as cylinder designs in this country. In these cases, the non-approved standards will be listed on the record of non-approved cylinder specifications by WorkSafe.

ISO standards

There is a trend away from individual country design standard towards unified international design standards. This process is led by the International Standards Organisation (ISO). These ISO standards are the only standards applicable to UN approved cylinders.

3.3 What are the design requirements?

General

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.

What is reference temperature?

The reference temperature for liquefied 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 BS EN 13096: 2003. The reference temperatures for cylinders in New Zealand are as follows:

Low-pressure liquefied gases (not exceeding 250 L water capacity)	57.5°C
Low-pressure liquefied gases (exceeding 250 L but not exceeding 500 L water capacity)	52.5°C
High pressure liquefied gases (not exceeding 500 L capacity)	55°C
Permanent gases (any size)	65°C

TABLE 3:
Reference temperatures for cylinders in New Zealand

What is developed pressure?

Developed pressure for permanent gases (eg air, oxygen or nitrogen) means the pressure developed in a cylinder at the reference temperature.

The pressure in a cylinder of a liquefied gas (eg LPG) is the pressure of the vapour phase. This is dependent on the gas composition and the temperature of the vapour and of the liquid surface, provided the cylinder has not been over-filled (Section 7.7 of this guide *What are the consequences of over-filling a liquefied gas cylinder?*).

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 EN 13099: 2003 may be used to establish the developed pressure for cylinder design verification purposes. Alternatively, cylinder design may comply with the developed pressure requirements contained in the standard to which it was designed.

Test pressures and filling ratios for certain gases

GAS	DESIGN PRESSURE (MPa)	MINIMUM TEST PRESSURE (MPa)	MAXIMUM FILLING RATIO
Carbon dioxide		20.7 22	0.667 0.75
Nitrous oxide		20	0.75
Ethylene		18	0.325
LPG	2.34	3.3	0.444 for cylinders not exceeding 250 L water capacity. 0.449 for cylinders exceeding 250 L but not exceeding 500 L water capacity.
Acetylene	1.55		

TABLE 4:
Test pressures and filling ratios for certain gases

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

Filling ratios low-pressure liquefied gases

GAS	FOR CYLINDERS NOT EXCEEDING 250 L WATER CAPACITY	FOR CYLINDERS EXCEEDING 250 L BUT NOT EXCEEDING 500 L WATER CAPACITY
Ammonia	0.553	0.558
Boron 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
Cyclopropane	0.552	0.555
Propylene	0.453	0.458
Sulphur dioxide	1.269	1.277
Vinyl chloride	0.830	0.835

TABLE 5:
Filling ratios
low-pressure
liquefied gases

3.4 What are the steps for obtaining a compliance certificate for cylinder design verification?

It should be noted that the listing of a standard on the record of [approved cylinder design standards](#) does not guarantee the issue of a design verification compliance certificate for a particular cylinder design.

A PCBU wanting to obtain a cylinder design compliance certificate should:

- a. Check the Gas Cylinder Record to ensure that the proposed cylinder design has not previously been approved. **Note:** It may be possible that an existing certified cylinder design may be suitable for the intended purpose.
- b. Ensure that the proposed cylinder is designed to an approved standard.
- c. Obtain a design verification compliance certificate from a compliance certifier approved for cylinder design verification. The compliance certifier will send you confirmation of the cylinder record number (LABxxxx) issued by WorkSafe.

To obtain a design verification compliance certificate it is necessary to forward to the compliance certifier the documentation asked for including:

- a copy of the design drawing
- the design calculations
- the cylinder markings layout, and
- 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 recognised inspection agency approved for the country of manufacture.

Cylinders do not need a cylinder design compliance certificate if they have been designed, constructed, initially tested and marked to Chapter 6.2 of the UNRTDG 19th Edition 2015.

Figure 1 sets out the steps for obtaining a cylinder design compliance certificate.

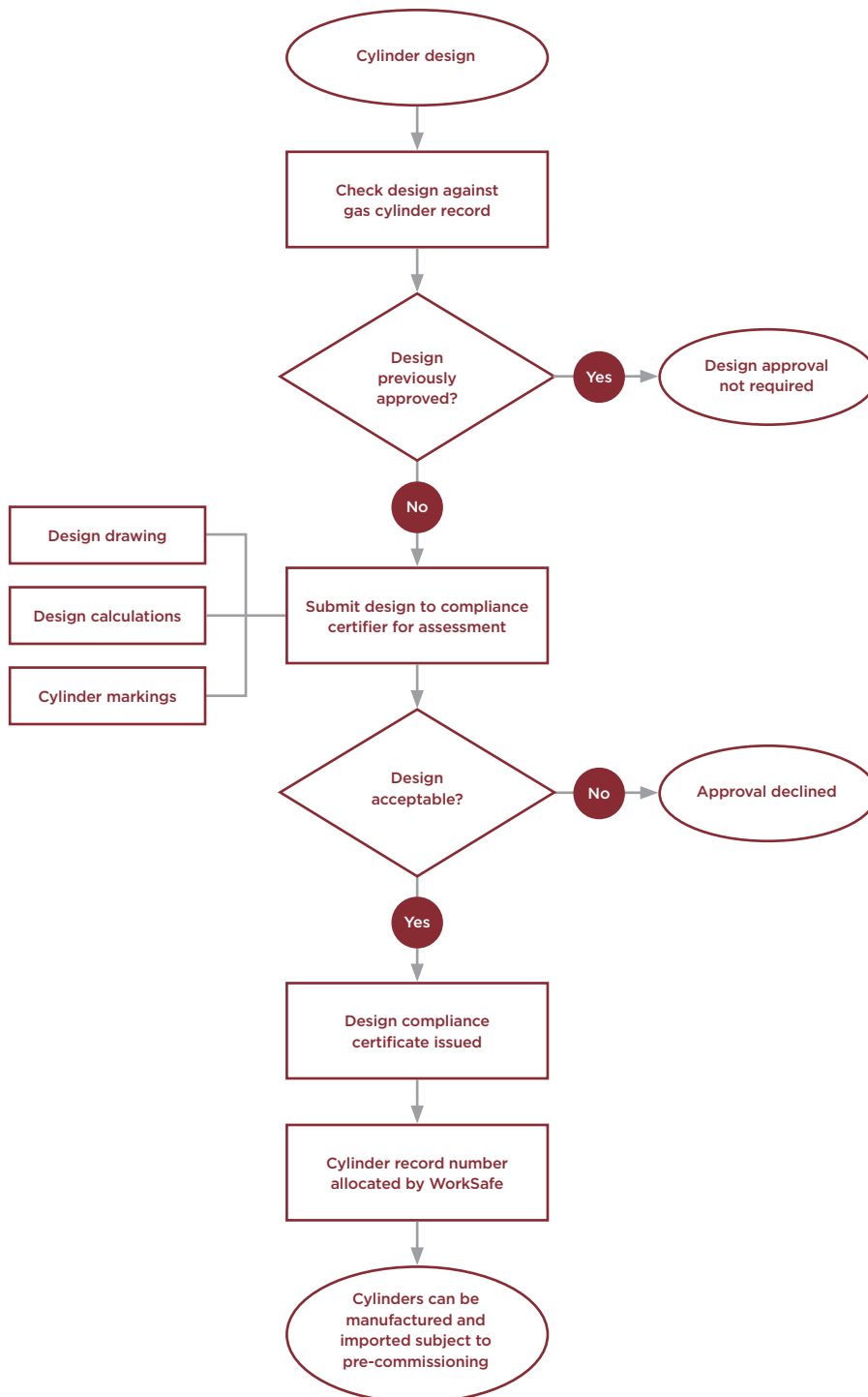


FIGURE 1:
Steps for obtaining a cylinder design compliance certificate

Recognised inspection agencies

The PCBU must obtain a manufacturer's certificate for each batch of cylinders from a recognised inspection agency.

A register of recognised inspection agencies can be found on the WorkSafe website.

The original inspection agency is listed in the record but subsequent batches may use a different inspection agency as long as they are on the WorkSafe approved list for the country of manufacture.

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. The recognised inspection agency will permit their approved mark to be stamped or permanently marked on each cylinder when it is satisfied that a particular production run of cylinders has been:

- a. manufactured at the approved manufacturing facility
- 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.

Manufacturer's 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
- b. provided to the compliance certifier issuing the pre-commissioning certificate, and
- c. provided to the compliance certifier issuing the compliance certificate for imported cylinders.

3.5 What are the steps for obtaining a compliance certificate for cylinder pre-commissioning?

This section should be read in conjunction with [HS Regulation 15.17](#) and [HS Regulation 15.19](#)

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

Except for UN Cylinders, the cylinder record number (LABxxxx) 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 record number (LABxxxx) in accordance with [HS Regulation 15.60](#) by an authorised test station.

- a. Upon arrival of the first shipment a pre-commissioning compliance certifier must inspect the shipment. A copy of the manufacturer's test report and a list of all lots and cylinder serial numbers in the shipment must be provided to the compliance certifier.
- b. Where type testing of sample cylinders has been required by the design verifier, the required number of samples must be taken from the shipment and delivered to an International Accreditation New Zealand (IANZ) 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 do not need to obtain a pre-commissioning compliance certificate if they have been designed, constructed, initially tested and marked to Chapter 6.2 of the UNRTDG 19th Edition 2015.

Figure 2 sets out the steps for obtaining a cylinder pre-commissioning compliance certificate:

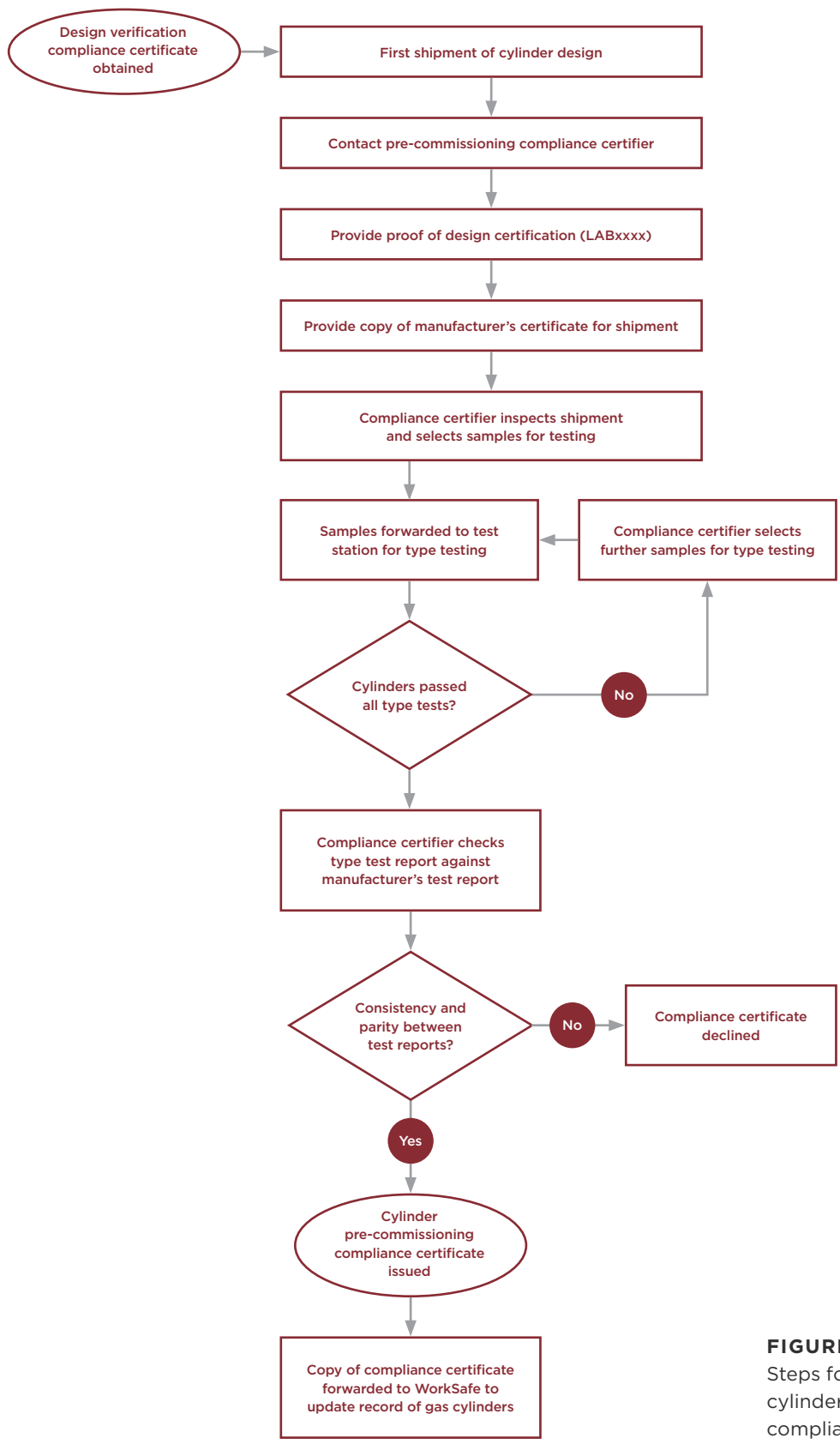


FIGURE 2: Steps for obtaining a cylinder pre-commissioning compliance certificate

3.6 Exemption from need to obtain certain certificates

What is an exemption from certain certificates?

An exemption can be granted by WorkSafe on application and exempts specified cylinders from the requirement for design verification, pre-commissioning and a compliance certificate for import.

When may an exemption be granted?

An exemption from certification may be granted where:

- a. a cylinder design or similar design has already received a design verification compliance certificate, and
- b. where there are a small quantity of cylinders intended to be imported (present and future) due to the specialised nature of their intended use (eg some medical gas cylinders, waste gas recovery cylinders, installed fire protection systems).

How to apply for an exemption

An application for an exemption from certain certificates must be made to WorkSafe by a test station on behalf of the cylinder owner.

[HS Regulation 15.18](#) states that WorkSafe may grant an exemption from compliance certificate requirements provided that specific matters have been considered.

An application fee (incl. GST) must be paid by direct credit on receiving an invoice.

The amount of this fee is listed in [Schedule 2 of the HS Regulations](#)

The application form [Application for Exemption from Certain Certificates](#) is located on the same webpage as this guide.

Where WorkSafe considers that an application meets the criteria, it may grant an exemption, allocate a record number (LAB SPxxxx) for the cylinder and add the cylinder details to the Special Cylinder record.

Where WorkSafe declines an application, the applicant is advised of the reasons. Cylinders that are declined may not be tested or filled in New Zealand unless they go through the New Zealand specific approval process.

3.7 What are the steps for obtaining a compliance certificate for cylinder import?

This advice is relevant to both a compliance certificate for imported cylinders under [HS Regulation 15.16](#) and a compliance certificate for UNRTDG cylinders under [HS Regulation 15.3](#) and [Schedule 19 of the HS Regulations](#)

All shipments of cylinders must be inspected and cleared by a compliance 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 compliance certifier and that compliance certifier has inspected and cleared the shipment, followed by the issue of a compliance certificate. A copy of the manufacturer's certificate(s) completed by a third party inspection agency and covering all lots and serial numbers of cylinders in the shipment must be provided to the compliance certifier.

Note: a manufacturer's certificate is a certificate by a third party inspection agency detailing the standard and design that the cylinders are manufactured to and the tests performed.

The number of cylinders inspected will be determined by the formal sampling plan established by the compliance certifier. The following ratios 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.

Appendix 9: *Compliance certificates for UNRTDG cylinders* provides guidance on the examination of UN imported cylinders by the compliance certifier.

Figure 3 sets out the steps for obtaining a compliance certificate for import.

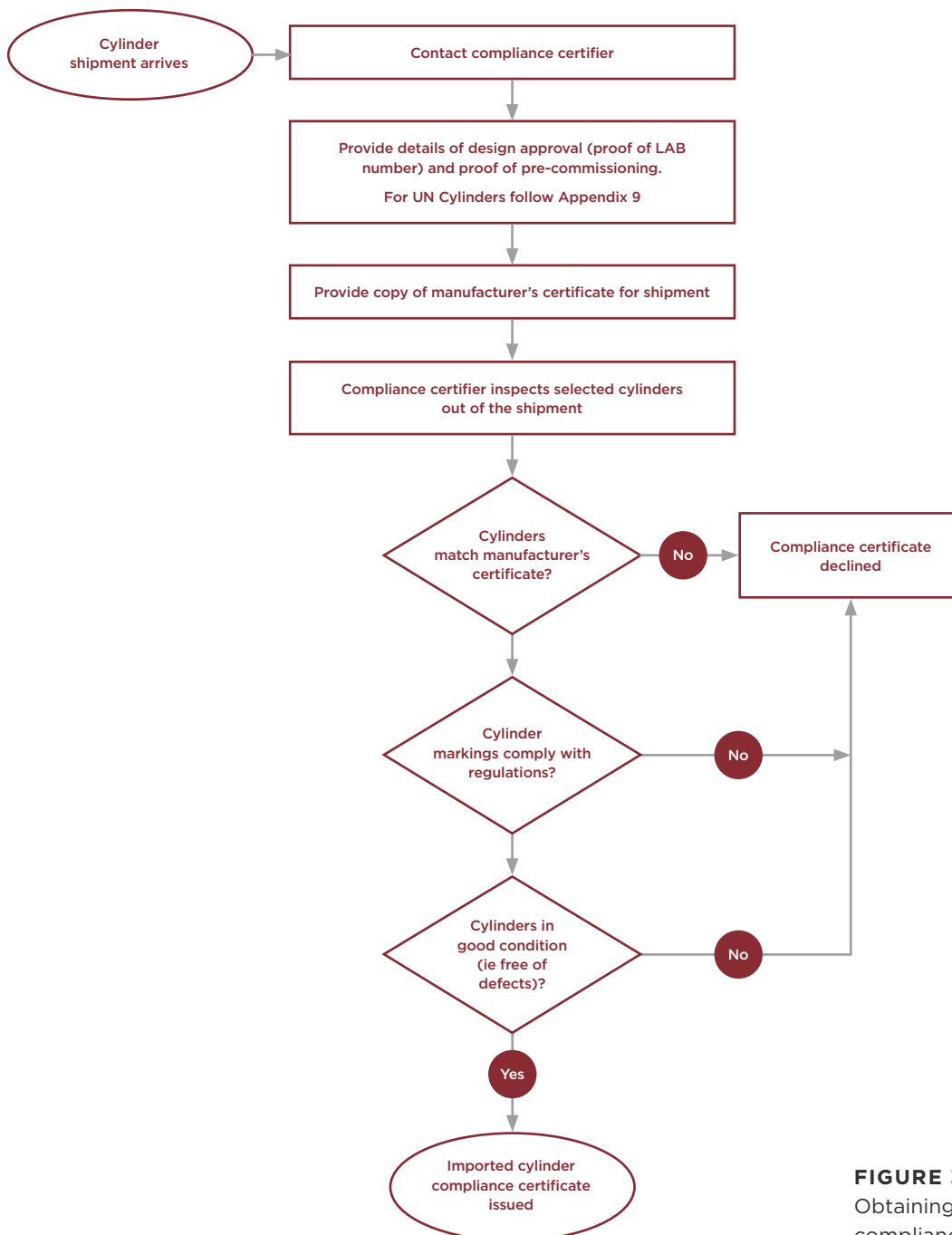


FIGURE 3: Obtaining an import compliance certificate

3.8 One off cylinders

A cylinder filling station must not fill any cylinder manufactured after March 1980 that is not listed on the Gas Cylinder Record (ie that is not marked with a record number (LABxxxx or a LAB SPxxxx) number).

Note: Cylinders on ships and planes do not have to be listed on the Gas Cylinder Record.

The cylinder filler should refer the cylinder owner to a cylinder test station for an initial determination as to whether or not the cylinder design may be of a certified design.

Where the test station identifies the cylinder is an exact match to a certified design, the record number (LABxxxx) may be stamped on the cylinder provided that:

- a. the test station is specifically authorised by [HS Regulation 15.52](#) to undertake this action, and
- b. the correct record number (LABxxxx) is followed by the mark of the test station.

Where the cylinder is not an exact match to an approved design, but may meet the criteria for an exemption, the test station may, subject to the cylinder owner's consent, apply to WorkSafe for a record number (LAB SPxxxx) (Section 3.6 of this guide).

3.9 Change of type of gas in a cylinder

Where a person intends using a cylinder for a different gas to that specified in the cylinder design compliance certificate or specified in the Gas Cylinder Record for that cylinder, that person must re-submit the details of the cylinder design to a design compliance certifier. The certifier should be given the manufacturer's drawings, specifications and certificate so that they can assess the design for the new gas. Developed pressures and reference temperatures for the new gas will be of particular consideration. The change is not approved until a new compliance certificate is issued. A copy of this compliance certificate, together with the details of the application to the compliance certifier, must be forwarded to WorkSafe by the compliance certifier.

Where the filling pressure remains unchanged for the new permanent gas, a new cylinder record number (LABxxxx) will not be necessary and the entry in the cylinder record will be amended to include the new gas.

Where the filling pressure/filling ratio changes for the new gas, a new cylinder record number (LABxxxx) will be allocated. However, for liquefied gases, a new gas with a different filling ratio may be added to the approval and record number (LABxxxx) with the agreement of WorkSafe. WorkSafe will authorise a test station to stamp the new filling ratio onto cylinders that are to be used for that gas traffic.

Note: If one design is initially approved for use with more than one type of gas (eg permanent and liquefied 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 of this guide for suffix abbreviations.

Prior to changing the gas traffic, the cylinder(s) will require re-inspection and re-testing by a test station, including purging and cleaning where required, in accordance with AS 2030.1-2009 and AS 2337.1-2004.

The above provisions for change of gas traffic do not apply to SCUBA cylinders as follows:

- SCUBA cylinders approved for the use of SCUBA Air or SCUBA gases up to 40% oxygen the cylinder can be filled with various breathing mixtures up to 40% oxygen (eg NITROX and/or TRIMIX) if cleaned in accordance with the requirements in Section 7.11 of this guide.

- SCUBA cylinders that are approved for SCUBA gases up to 100% oxygen or cylinders that are approved for any permanent and liquefied gas can be filled with various breathing mixtures up to 100% oxygen (eg NITROX and/or TRIMIX) if cleaned in accordance with the requirements in Section 7.11 of this guide.
- As helium has a lower developed pressure than air and/or oxygen the percentage of helium in the mix does not require any additional design approval or cleaning.

3.10 Approval of fire extinguishers

General

Rechargeable fire extinguishers, whether they are high pressure types (CO₂, 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 apply irrespective of whether the extinguisher is initially charged in New Zealand or whether it is imported in a pre-charged condition.

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 (Sections 3.4–3.8 of this guide).

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. The procedure is covered under [HS Regulations Part 15, Subpart 3](#)

[HS Regulation 15.22](#) requires low-pressure fire extinguishers to have a fire extinguisher registration number before they can be imported into New Zealand. Only accredited providers can issue a registration number. An accredited provider will put the fire extinguisher through systems that are equivalent to the design verification and manufacturing certificates that are required for cylinders and high pressure extinguishers.

Accredited providers are known as product certification bodies. The product certification body will routinely audit the fire extinguisher manufacturer and test each extinguisher design at a fire ground test facility. On successful completion of the audit and testing, the product certification body will allocate a fire extinguisher registration number that must be permanently marked on each fire extinguisher. (Section 4.1 note 4 of this guide covers marking for a low-pressure fire extinguisher).

WorkSafe will not keep or maintain a record of fire extinguisher registration numbers. Any enquiry in this regard should be directed to the product certification body.

For low-pressure fire extinguishers the following illustrates the equivalence of the approval process:

FIRE EXTINGUISHER REGISTRATION NUMBER

[HS Regulation 15.22](#)

The fire extinguisher registration number is the equivalent of a manufacturing certificate and a design verification certificate, and design record number (LABxxxx).

The product certification body (for the fire extinguisher registration number) is the equivalent of a recognised inspection agency.

STANDARDS FOR LOW-PRESSURE FIRE EXTINGUISHERS

[HS Regulation 15.23](#)

The design for a low-pressure fire extinguisher must comply with the standard set out under this regulation or an applicable standard listed in [Schedule 21](#) or the record of [approved cylinder design standards](#)

MANUFACTURE OF LOW-PRESSURE FIRE EXTINGUISHERS

[HS Regulation 15.24](#)

A person who manufactures a low-pressure fire extinguisher must manufacture the fire extinguisher to a design that complies with a design standard referred to in [HS Regulation 15.23](#) and ensure the fire extinguisher markings comply with [HS Regulations Part 15, Subpart 6](#)

PRE-COMMISSIONING CERTIFICATE

[HS Regulation 15.21](#)

At the time an extinguisher is first imported, the fire extinguisher registration number will provide evidence that [HS Regulation 15.17](#) has been met. That is, pre-commissioning testing is not required for fire extinguishers with a fire extinguisher registration number.

IMPORT CERTIFICATE

[HS Regulation 15.21](#)

Low-pressure fire extinguishers require a compliance certificate under [HS Regulation 15.16](#) as specified by [HS Regulation 15.21](#)

PERIODIC TESTING

[HS Regulations Schedule 22](#)

This is only required when a fire extinguisher needs to be recharged and it has been five years since manufacture or the extinguisher's last periodic test.

Low-pressure fire extinguishers imported

1 October 2004 – 1 November 2012

A low-pressure fire extinguisher that complied with Part 2 of the Hazardous Substances (Compressed Gases) Regulations 2004 is deemed to comply with the requirements set out above.

Low-pressure fire extinguishers imported prior to 1 October 2004

Low-pressure fire extinguishers imported prior to 1 October 2004 may remain in service subject to complying with labelling and marking requirements of [HS Regulation 15.40](#) (Section 4.4 of this guide).

Fire extinguishers exceeding 23 kg

The design standard for low-pressure fire extinguishers, AS/NZS 1841.1-8: 2007, limits the gross mass of a portable fire extinguisher to 23 kg. A limited number of design standards for extinguishers of greater mass are listed in [Schedule 21 of the HS Regulations](#). Any new standard is required to be approved in a safe work instrument [HS Regulation 15.23](#)

4.0

Marking and labelling

IN THIS SECTION:

- 4.1 What are the identification requirements?
- 4.2 Permanent markings for cylinders and fire extinguishers
- 4.3 Alternative marking locations for empty weight
- 4.4 Markings for low-pressure fire extinguishers
- 4.5 Additional markings for certain cylinders
- 4.6 Markings on cylinders manufactured prior to March 1980
- 4.7 Abbreviations and units of pressure, capacity and weight
- 4.8 Use of suffixes for identifying gas traffic
- 4.9 Marking and labelling by test station
- 4.10 Colour code for identification of periodic re-testing
- 4.11 Cylinder contents identification/labelling
- 4.12 Identification/labelling of fire extinguishers
- 4.13 Identification/labelling of SCBA and SCUBA cylinders
- 4.14 Identification/labelling of mixed gas SCUBA diving cylinders (NITROX, EANx, DNAX and TRIMIX)
- 4.15 Identification/labelling of aerosol dispensers
- 4.16 Identification/labelling of non-refillable containers
- 4.17 Additional marking for LPG cylinders
- 4.18 Marking for valves
- 4.19 Markings for regulators
- 4.20 Markings for adaptors
- 4.21 Marking for automatic change-over devices for LPG
- 4.22 Clarity of markings on valves and fittings
- 4.23 Cylinder contents identification by colour

4.1 What are the identification requirements?

Every cylinder and its contents must be clearly identified for the benefit of all users, fillers, test stations, 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 6 and the following notes 3 to 5. The marking requirements for cylinders and valves are prescribed in [Subpart 6 of Part 15 of the HS Regulations](#) while the labelling of gas contents and warnings are prescribed in [Part 2 of the HS Regulations](#)

ITEM	FORM OF MARKING
Cylinder identification (manufacture, standards, test dates, test station mark, approval number etc)	Stamped or permanently marked ³⁻⁵
Valves and fitting identification.	Stamped or permanently marked.
Gas identification User warning identification Filling station identification (optional)	Adhesive or attached labels.

TABLE 6:
Identification
of cylinders and
their contents

4.2 Permanent markings for cylinders and fire extinguishers

This section should be read in conjunction with [HS Regulations 15.40 to 15.44](#)

The following markings must be permanently and clearly marked with character size according to [HS Regulation 15.43](#)

- a. the standard to which the cylinder is designed
- b. the cylinder manufacturer's name or mark
- c. the serial number of the cylinder, or in the case of a low-pressure fire extinguisher, the batch number
- d. the test pressure
- e. in the case of a permanent gas, the charging pressure
- f. the water capacity
- g. the tare weight
- h. in the case of a liquefied gas, the empty weight
- i. the month and year (mmyy) of manufacture of the cylinder
- j. the cylinder record number (LABxxxx) of the design or the special record number (LAB SPxxxx)⁶
- k. the mark of the recognised inspection agency (third party)
- l. the month and year of each periodic test conducted in accordance with [HS Regulation 15.56](#) and
- m. the mark of the test station which conducted the inspection and/or test.

Refer to Section 4.7 of this guide for acceptable units.

³ 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 (eg Primus LPG cylinders).

⁴ For low-pressure fire extinguishers, it is not considered appropriate to stamp the cylinder shell owing to the thin-wall construction. Markings must appear on an indelible, permanent label affixed to the extinguisher. Alternatively, markings can be roll-pressed during the cylinder shell manufacturing process.

⁵ 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 test station in the course of testing or authorised composite repair, must be by way of a label sealed over using a suitable resin repair product.

⁶ Note that if the cylinder was imported up to and including March 1980, the cylinder may not have been issued with a record number (LABxxxx).

The above marking requirements do not apply to a cylinder that is marked in accordance with clause 6.2.2.7 of UNRTDG 19th Edition 2015. Clause 6.2.2.7 is included in Appendix 10: *Marking of refillable UN pressure receptacles*.

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
- be legible
- be protected from accidental damage, and
- not impede or restrict operation of the valve hand wheel.

In the case of carbon dioxide fire extinguishers, AS/NZS1841.6:2007 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

For low-pressure fire extinguishers:

- a. the marks (a) to (h) of Section 4.2 of this guide are marked as per Note 4 of Section 4.1
- b. the marks (l) and (m) of Section 4.2 of this guide are to be marked according to Section 4.9 *After inspection*
- c. the fire extinguisher record number must be used instead of marks (i) and (j) of Section 4.2.

4.5 Additional markings for certain cylinders

Table 7 sets out additional permanent markings that are required for cylinders containing certain gases:

GAS TRAFFIC	MARKING
Dry gas	5 pointed star
Toxic gas Class 6.1A or 6.1B	skull mark

TABLE 7:
Additional permanent markings

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 of this guide. Such cylinders have been previously exempted and 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, accepted and non-preferred abbreviations and units for marks denoting pressure, capacity and weight. These are included in Table 8.

INFORMATION	PREFERRED ABBREVIATIONS AND UNITS	ACCEPTED ABBREVIATIONS AND UNITS (NOT PREFERRED FOR NEW CYLINDERS)	NON-PREFERRED ABBREVIATIONS AND UNITS		
			T, PH	kPa	psi, kg/cm ²
Test pressure	TP	MPa or Bar	T, PH	kPa	psi, kg/cm ²
Charging pressure	WP or CP	MPa or Bar	FP, F, PW	kPa	psi, kg/cm ²
Water capacity	WC	kg	V	L	lb, oz
Tare weight	TW	kg	T	lb, oz	
Empty weight	EW	kg	E	lb, oz	

TABLE 8: Preferred, accepted and non-preferred abbreviations and units for marks

If cylinders are marked with non-preferred units then the cylinder can be stamped with the preferred units by an authorised 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

In order to comply with the requirements of [HS Regulation 15.76](#) for developed pressure, or the requirements of [HS Regulation 15.67](#) for maximum filling ratio 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 another gas, then the respective filling pressures must be marked alongside a suffix denoting the type of gas.

Examples of suffixes used include:

- AIR denoting the filling pressure for atmospheric or industrial air only
- OXY denoting the filling pressure for any permanent gas other than CNG or methane, or
- CNG denoting the filling pressure for CNG only.

No suffix is taken to mean the filling pressure for any permanent gas other than CNG or methane. Most SCUBA cylinders do not have suffixes for identifying gas traffic.

4.9 Marking and labelling by test station

After inspection

Section 8.4 of this guide *Inspection* 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 plastic non-removable tag such as those available from New Zealand Underwater (NZU)
- a non-ferrous (preferably aluminium) loose collar retained by the valve
- 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
- a non-removable adhesive label or 'void' label.

The label or tag must:

- be durable
- be legible (eg 6 mm characters although 3 mm characters may be used for small labels or tags)
- be corrosion and abrasion resistant
- not be easily detached from the cylinder
- not impede or restrict operation of the valve hand wheel, and
- clearly signify the month and year of inspection plus the identification of the test station as mmXXyy, where XX is either the unique mark of the test station or, in the case of a NZU affiliated test station, the station number underscored by the NZU authorised flag stamp.

After testing

HS Regulations 15.40(2)(j) and (k) require a cylinder that has passed its periodic test to be stamped on the thickened portion (eg the shoulder, with the month and year of test plus the identification of the test station as mmXXyy, where XX is either the unique mark of the test station or, in the case of a New Zealand Underwater affiliated test station, the station number underscored by the NZU authorised flag stamp).

For cylinders used on ships an 'M' shall be stamped before the year stamp; for cylinders used on aircraft an 'A' shall be stamped before the year 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)
- 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 so that the ring cannot be removed without first removing the valve or physically cutting off the ring.

The stamping must be legible and meet the requirements of HS Regulation 15.43

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 non-removable adhesive material which is then affixed to the cylinder (eg 'void' labels).

The label must contain the following information:

- a. month and year of test
- b. test pressure used
- c. name and mark of the test station
- d. cylinder serial number and/or periodic certificate number
- e. fill pressure.

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

Instead 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.

Additions or alterations to cylinder markings

Test stations are able to make the following additions or alterations to cylinder markings:

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

Any additions or alterations made by the test station must have the identification of the test station stamped after it, and must be recorded on a periodic 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 test station has reason to believe that a cylinder marking has been added, altered, removed or replicated/forged by an unauthorised person, the test station should store the cylinder in a secure place and contact WorkSafe.

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

4.10 Colour code for identification of periodic re-testing

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 9 below.

Where can it be used?

Examples of how the colour coding system can be used to identify periodic inspection 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 as in Section 4.9 of this guide *After inspection*.

What are the colour codes?

Table 9 below sets out the year of test and the colours corresponding to each test period as appropriate to the type of cylinder (Section 8.6 of this guide for test periods).

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
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
2021	Dark green	Mauve	Yellow	Dark brown	Light blue
2022	Mauve	Yellow	Lime green	Black	White
2023	Yellow	Lime green	Pink	Claret	Light brown
2024	Lime green	Pink	Dark brown	Royal blue	Grey
2025	Pink	Dark brown	Black	Red	Dark green
2026	Dark brown	Black	Claret	Light blue	Mauve

TABLE 9:
Colour codes

4.11 Cylinder contents identification/labelling

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.

What are the priority identifiers?

Priority identifiers are information that must be available to any person handling the cylinder. 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 (ie not under a peel off label).

For gases, the priority identifiers primarily give:

- an indication that it is flammable/oxidising/toxic/corrosive/ecotoxic
- an indication that it is a gas.

The standard UN pictograms should be used (refer to Table 10).

What are the secondary identifiers?

A secondary identifier is 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:

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

Examples

The following table sets out the identification/labelling requirements for particular classifications and gases. If a gas is not listed, refer to the following to confirm the classification for a particular gas:

- [Approved hazardous substances with controls database](http://www.epa.govt.nz) on the EPA website: www.epa.govt.nz or
- the [Hazardous Substances Calculator](http://www.hazardoussubstances.govt.nz) on the Toolbox website: www.hazardoussubstances.govt.nz

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, phosphine		Danger	Extremely 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, nitrous oxide		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, sulphur dioxide, Insectigas, carbon monoxide, dichlorvos, phosgene, phosphine, methyl bromide		Danger	Fatal/toxic if inhaled. Keep out of reach of children. Avoid inhalation. Use in well ventilated area. Wear respiratory protection.




CLASSIFICATION	EXAMPLES	PRIORITY IDENTIFIERS	SIGNAL WORD	SECONDARY IDENTIFIERS (select as appropriate)
8.1A/8.2A/8.3A	Chlorine, anhydrous ammonia, sulphur dioxide, phosgene, methyl bromide		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, phosphine, methyl bromide		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	Contains gas under pressure/contains refrigerant gas under pressure. Avoid eye and skin contact. (Suggested)

TABLE 10: Priority and secondary identifiers

4.12 Identification/labelling of fire extinguishers

The provisions for labelling and identification of fire extinguishers are specified in the fire extinguisher design standard AS/NZS 1841.1.

If the markings in Table 10 above do not apply, fire extinguishers (excluding deluge cylinders) should be clearly identified and labelled as follows:

- a. the cylinder shell is painted or powder-coated a differentiating colour (normally red) that will be associated with their use as fire extinguishers
- 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 (eg CO₂, dry powder, foam) in words or by colour branding
 - its fire rating in accordance with AS/NZS 1841.1:2007
 - its use (eg for wood, paper, or electrical fires)
 - its nominal capacity
 - instructions for use, and
- c. a durable servicing tag is attached to the extinguisher head to indicate the last periodic servicing and the last periodic test, in accordance with NZS 4503:2005.

Notes:

1. In certain organisations (eg hospitals, ships, aircraft and the Defence Force) alternative colour codes may be used.
2. Despite the requirements for the painting of all extinguishers in accordance with AS/NZS 1841.1: 2007, fire extinguisher shells of natural stainless steel are accepted provided they meet all the marking and labelling requirements of b) and c) above.

4.13 Identification/labelling of SCBA and SCUBA cylinders

Self-Contained Breathing Apparatus (SCBA) and SCUBA cylinders must be labelled:



For cylinders containing air and up to 40% oxygen with a durable UN green pictogram for non-flammable, non-toxic gas (or non-flammable compressed gas)

or



For cylinders containing 41%–100% oxygen, the pictogram shown in Table 10 (5.1.2A – labelled as for oxygen)

FIGURE 4:
Non-flammable compressed gas and oxidising agent labels

4.14 Identification/labelling of mixed gas SCUBA diving cylinders (NITROX, EANx, DNAX & TRIMIX)

In addition to Table 10 above, all cylinders used for 'NITROX' or 'TRIMIX' mixed gas diving must be clearly labelled as follows:

NITROX

A 100 mm emerald green band around the cylinder bordered above and below by a 25 mm yellow band. In contrasting lettering, in the green band, the words:

- 'Enriched Air' or 'EANx' or 'NITROX' in the case of enriched air filled by the 'partial pressure' or 'continuous' blending methods, or (optionally)
- 'DNAX' in the case of the 'de-nitrogenated air filling method' (ie nitrogen has been removed).

TRIMIX

A 100 mm white band around the cylinder bordered above and below by a 25 mm coloured band. In contrasting lettering, in the coloured band, the words TRIMIX or DILUENT or CUSTOM MIX:

- a label certifying that the cylinder has been oxygen cleaned (ie cleaned in preparation for oxygen-enriched service), and the date of last clean. This is required irrespective of the NITROX or TRIMIX filling method used, and
- a label certifying the gas percentage mix of Nitrogen-Oxygen-or other gas that the cylinder is charged with plus the maximum depth at which the gas can be safely breathed.

4.15 Identification/labelling of aerosol dispensers

In addition to Table 10 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 10 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 marking for LPG cylinders

LPG cylinders over 5 L water capacity

In addition to Table 10 above, LPG cylinders over 5 L water capacity must be finished in one of the following coatings:

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

Additional marking for liquid withdrawal cylinders

Liquefied gas cylinders designed and used for liquid withdrawal must be marked with either:

- a. two black vertical strips extending the length of the cylinder shell on opposing sides, or
- b. a blue top and words 30 mm high 'Liquid Withdrawal Only'.

4.18 Marking for valves

Valves imported before 1 October 2004 must be marked in accordance with the design standard they were manufactured to. They must also be marked in accordance with any approval issued for that valve design by the previous approving Authority – Refer to the Record of Valves and Fittings.

Valves imported after 1 October 2004 must have the following markings [HS Regulation 15.45](#):

- 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 date of manufacture or a code in the batch number that links to a date of manufacture
- f. the operating pressure of the pressure relief device.

4.19 Markings for regulators

Regulators imported prior to 1 October 2004 must be marked in accordance with the design standard they were manufactured to. They must also be marked in accordance with any approval issued for that regulator design by the previous approving Authority – refer to the Record of Valves and Fittings.

Regulators imported after 1 October 2004 must have the following markings [HS Regulation 15.46](#):

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

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 Record of Valves and Fittings.

Adaptors imported after 1 October 2004 must have the following markings

HS Regulation 15.47:

- a. the manufacturer's mark or identifier
- b. the batch number, the date of manufacture or a code that links to a date of manufacture
- c. the connection compatibilities of the adaptor.

4.21 Marking for automatic change-over devices for LPG

Automatic change-over devices for LPG imported prior to 1 October 2004 must be marked in accordance with the design standard they were manufactured to. They must also be marked in accordance with any approval issued for that device by the previous approving Authority – refer to the Record of Valves and Fittings.

Devices imported after 1 October 2004 must be marked as follows

HS Regulation 15.48:

- a. the manufacturer's mark or identifier
- b. the design standard to which the device was manufactured
- c. the batch number, the date of manufacture or a code that links to a date of manufacture
- d. the date of manufacture or a code which indicates 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 the EPA Hazardous Substances (Labelling) Notice 2017

4.23 Cylinder contents identification by colour

The primary means of identifying the contents of a cylinder is the labelling in Table 10 above. A secondary means of identification may sometimes be colour coding cylinders.

Where colour coding is used it should conform to the current edition of AS 4484. 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.

5.0

Neck threads, valves, safety devices and fittings

IN THIS SECTION:

- 5.1 Preferred cylinder neck threads
- 5.2 Non-preferred cylinder neck threads
- 5.3 Valve specifications
- 5.4 LPG cylinder valve adaptors (HS Regulation 15.35)
- 5.5 How should valves be protected?
- 5.6 How must valves be removed and re-fitted?
- 5.7 Over-pressure protection devices
- 5.8 Over-filling protection devices (OPDs) in LPG cylinders
- 5.9 Regulators and automatic change-over devices
- 5.10 Compliance certification of fittings for LPG
- 5.11 What happens if a compliance certifier fails to give clearance to a fitting?
- 5.12 Exemption from of clearance requirements

5.1 Preferred cylinder neck threads

There are permitted and preferred neck threads for cylinders in accordance with HS Regulation 15.10. These are included in Table 11.

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 (NPT, NPTF)	LPG or acetylene cylinders
3/8" -18 NGT	Small acetylene cylinders
3/4" -14 NPSM4 (NGS5)	SCUBA cylinders
M14 x 1.5	Primus LPG cylinders
3/4" BSP8	

TABLE 11:
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 (eg large diameter quick acting)
- 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.

5.2 Non-preferred cylinder neck threads

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

TABLE 12:
Typical applications
of some non-preferred
neck threads

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

5.3 Valve specifications

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.

Inlet (stem) specifications

Refer Section 5.1 of this guide.

Outlet connections for cylinders other than LPG cylinders

These must comply with:

- Clause 5.1 of AS 2030.5-2009, or
- an existing design standard under [Schedule 1 of the HS Regulations](#)

Alternative outlets

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

- a. portable fire extinguishers
- b. resuscitation kits and other portable medical uses, or
- c. 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 the next section of this guide.

Outlet connections for LPG cylinder valves

Outlet connections for LPG cylinder valves must be of an approved type as shown in Table 13 [HS Regulation 15.29](#):

TYPE	APPLICATION
UL 2061	Cylinders < 25 L water capacity
M 14 x 1.5 Right-hand internal (Primus) (14 mm ISO metric)	Cylinders < 25 L water capacity
3/8" BSP Right-hand internal (Cadac)	Cylinders < 25 L water capacity
3/8" BSP Right-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 (vapour withdrawal only)
1 1/4" 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

TABLE 13:
Approved outlet connections for LPG cylinder valves

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

This section should be read in conjunction with [HS Regulation 15.35](#)

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 according to the manufacturer's instructions, and
- b. the adaptor outlet connection is an approved outlet connection [HS Regulation 15.29\(2\)](#) (Section 5.3 of this guide *Outlet connections for LPG cylinder valves*).

Note: A clip-on adaptor must not 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. Test stations 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:

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

5.6 How must valves be removed and re-fitted?

General

Valves must only be removed and re-fitted by suitably competent persons⁷ 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
- torque wrench
- soft mallets (eg 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 (Section 8.10 of this guide).

⁷ Persons with mechanical aptitude who have been trained to remove and install valves.

Valve torque values

Upon re-fitting, valves should be torqued to the value recommended by the manufacturer. If the correct value, or a suitable torque tool, cannot be ascertained, advice from a suitably competent⁸ person should be sought.

Guidance torque values are included in Table 14. These are included for guidance only and should only be used when no specific information is otherwise available:

THREAD	TORQUE VALUE			
	Minimum		Maximum	
	N-m	Ft-lb	N-m	Ft-lb
Steel cylinders (use 2½ turns of PTFE tape compatible with approved gas contents)				
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

TABLE 14:
Valve torque values
(guidance only)

For aluminium and composite cylinders refer to cylinder manufacturer's recommendations (eg Luxfer, Catalina).

Care should be taken as these can vary between 50 ft-lb (78 NM) to 105 ft-lb (140 NM).

Note: All parallel thread valves are sealed using an O-ring at top of the neck thread which seals in a chamfer or step in the cylinder neck and against the flange of the valve and therefore do not require the use of sealing tape.

5.7 Over-pressure protection devices

This section should be read in conjunction with [HS Regulation 15.31](#)

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.

⁸ A Technician with experience in the cylinder industry.

When are they required?

[HS Regulation 15.31](#) requires that most cylinder designs and types must be fitted with an over-pressure protection safety device in accordance with Clause 5.3 of AS 2030.5: 2009 or a relevant safe work instrument.

What are the exceptions to the requirement?

- a. A cylinder with a valve that was approved under [clause 17 of Schedule 1 of the HS Regulations](#)
- b. A cylinder designed to contain a Class 6.1 acutely toxic substance must not under any circumstances be fitted with an over-pressure protection device.
- c. A fire extinguisher designed to operate at pressures not greater than 19 MPa is not required to have an over-pressure device.
- d. A cylinder of less than 3.5 L water capacity or less than 115 mm in diameter (Table 6 of AS 2030.5 2009).
- e. A cylinder manufactured prior to March 1980.
- f. A cylinder manufactured between March 1980 and October 2004 where the fitting of an over-pressure protection device was not a specific legal requirement or a requirement of the cylinder design approval.

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
- 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 (eg 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.

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
- 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 2030.5:2009 (which refers to AS 2613).

5.8 Over-filling protection devices (OPDs) in LPG cylinders

What are they?

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. Full OPDs must not be used to decide the gross filled weight.

When are OPDs required to be fitted?

This section should be read in conjunction with [HS Regulation 15.34](#)

All LPG cylinders holding greater than 4 kg of LPG and less than 11 kg of LPG manufactured after March 2003 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 for these LPG cylinders: those manufactured after March 2003 **must** be fitted with a valve incorporating an OPD; those manufactured prior to March 2003 **may** be fitted with a valve incorporating an OPD.

5.9 Regulators and automatic change-over devices

This section should be read in conjunction with [HS Regulation 15.32](#) and [HS Regulation 15.33](#)

Regulators and automatic change-over devices must comply with one of the nominated design standards included in Table 15.

REGULATORS FOR GASES OTHER THAN LPG	REGULATORS AND AUTOMATIC CHANGE-OVER DEVICES FOR LPG
AS 3840.1:1998	AS 4621:2004
AS 4267:1995	UL 144:2012 UL 252:2017 BS EN 16129:2013
A Safe Work Instrument	A Safe Work Instrument

TABLE 15:
Design standards for regulators and automatic change-over devices

5.10 Compliance certification of fittings for LPG

This section should be read in conjunction with [HS Regulation 15.37](#)

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

- regulators
- valves
- adaptors
- automatic change-over 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 compliance certification under HSWA is whether or not that fitting is installed upstream from the regulator (ie it is installed between a cylinder valve and the regulator).

In order to assess a fitting for compliance a compliance 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.

To issue a compliance certificate, the compliance certifier must be satisfied:

- a. the information marked on the fittings complies with the [HS Regulations Part 15, subpart 6](#)
- b. the test 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 HS Regulations.

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

Upon completion of assessment, the compliance certifier may issue a compliance certificate and is subsequently required to provide WorkSafe with copies of both the compliance certificate and the test report. Following receipt of a compliance certificate for the first batch of fittings, WorkSafe must:

- a. allocate a record number to the cylinder fitting, and
- b. enter the details on the Cylinder Fittings Record.

5.11 What happens if a compliance certifier fails to give clearance to a fitting?

This section should be read in conjunction with [HS Regulation 15.38](#)

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

- a. allow the fittings in that batch to be brought in to compliance if the certifier considers this possible
- 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 provide a report to WorkSafe setting out what actions have been taken.

5.12 Exemption from of clearance requirements

[HS Regulation 15.39](#) allows WorkSafe in any particular case, to grant an exemption of the compliance 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 importer or particular manufacturer of the fittings; and
- c. the similarity of the design of the fittings to other fittings previously supplied by that importer or manufacturer.

Applications for exemptions must be made to WorkSafe.

6.0

Handling and storage

IN THIS SECTION:

- 6.1 Why must cylinders be handled and stored carefully?
- 6.2 Cylinder position
- 6.3 Transportation
- 6.4 Care and maintenance
- 6.5 What are the requirements for handling cylinders?
- 6.6 What are the requirements for storing cylinders?

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 position

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

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 position by way of tie-down straps or ropes
- 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?

General

Highly hazardous gases must be under the control of a certified handler. The handler 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.

Also, a person must not possess a gaseous fumigant unless they hold a controlled substance licence (CSL) authorising possession of the gas.

Which gases require a certified handler?

A certified handler is required if the workplace needs to handle:

- fumigants [HS Regulation 14.3](#) or
- acutely toxic (class 6.1A and 6.1B) gases, for example chlorine [HS Regulation 13.9](#)

Information on whether a particular gas requires a certified handler can be found on the [Hazardous Substances Calculator](#) on the Toolbox website: www.hazardoussubstances.govt.nz

Who is a certified handler?

A certified handler means a person who holds a current certified handler compliance certificate (issued by a compliance certifier authorised for this activity and type of substance) certifying that the person has met the regulatory requirements in relation to handling one or more hazardous substances and for one or more phases in the life cycle of the substance(s).

How does a person become a certified handler?

[HS Regulation 4.3](#) of sets out the requirements for certification as a certified handler.

To become a certified handler a person needs to contact a compliance certifier who is authorised to issue a certified handler compliance certificate for the hazardous substance concerned. See our website for a [list of compliance certifiers](#)

To become a certified handler a person needs to meet the same general training requirements as all workers who handle hazardous substances. However, they also need the specific knowledge about the substance(s) they are going to use or handle.

The validity period for a certified handler compliance certificate is five years from its date of issue.

How does a person get a Controlled Substance Licence (CSL)?

CSLs are granted by WorkSafe under [HS Regulation 7.1](#). Information on applying for a CSL can be found on the WorkSafe website: worksafe.govt.nz

To apply for a CSL, a person must:

- hold a current certified handler compliance certificate that covers the relevant gas
- be 17 years of age or over
- require possession of the gas to carry out their work, and
- be a fit and proper person to possess the substance concerned.

6.6 What are the requirements for storing cylinders?

Gases that must be secured

Some gases must be secured so that only workers who are permitted will have access to the cylinders. The [Hazardous Substances Calculator](#) can be used to find out any restrictions that apply to particular gases.

General storage requirements

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 oxidising gases, has portable fire extinguishers available
- h. where required in accordance with the HS Regulations 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.

For further guidance refer to the following standards:

- AS 4332-2004: Storage and handling of gases in cylinders
- AS/NZS 1596:2014: The storage and handling of LP-Gas.

7.0

Filling cylinders

IN THIS SECTION:

- 7.1 Which cylinders may be filled?
- 7.2 Who may fill cylinders?
- 7.3 How does a person become an approved filler?
- 7.4 What are the variations to the approved filler requirements?
- 7.5 General
- 7.6 What are the filling conditions for permanent gases?
- 7.7 What are the filling conditions for liquefied gases?
- 7.8 What are the procedures for imported pre-filled cylinders?
- 7.9 What are the requirements for cylinders that are used in another country but filled in New Zealand?
- 7.10 Filling SCBA and SCUBA cylinders
- 7.11 Filling SCUBA cylinders with mixed gases (NITROX, Enriched Air/EANx, De-nitrogenated Air/DNAX, and TRIMIX)
- 7.12 The LPGA filler training programme
- 7.13 Filling stations
- 7.14 Disposable gas cartridges
- 7.15 Aerosols

7.1 Which cylinders may be filled?

This section should be read in conjunction with [HS Regulation 15.61](#)

A PCBU must ensure that no person fills a cylinder with gas at the workplace unless the cylinder:

- a. has a water capacity less than 500 L and is:
 - of a design approved for filling in New Zealand and is marked in accordance with [HS Regulation 15.40](#) (Section 4.2 of this guide), or
 - is marked in accordance with Clause 6.2.2.7 of Chapter 6.2 of UNRTDG 19th Edition 2015
- b. is within its specified test period
- c. has an over-pressure protection device fitted as required (Sections 5.7 and 5.8 of this guide)
- d. there is no evidence of damage or corrosion of the cylinder or valve that indicates that the cylinder may fail a periodic test, or that the cylinder's associated fitting may leak, and
- e. the maximum life specified in the standard to which the cylinder was designed has not expired.

A cylinder filling station must not fill any cylinder designed and manufactured after March 1980 that is not listed on the Gas Cylinder Record (ie that is not marked with a record number (LABxxxx or LAB SPxxxx)). See below for possible exceptions.

Cylinders imported after March 1980 without a record number (LABxxxx or LAB SPxxxx)

The cylinder owner will be referred to a cylinder test 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 test station identifies the cylinder as a previously approved design, the correct record number (LABxxxx) may be stamped on the cylinder provided that:

- the test station is specifically authorised for the purpose by WorkSafe to undertake this action, and
- the correct record number (LABxxxx) is suffixed by the mark of the test station.

Where the test station cannot identify the cylinder as a previously approved design and considers that the cylinder may meet the criteria for an exemption and allocation of a LAB SP number, an application may be made to WorkSafe in accordance with Section 3.6 of this guide.

7.2 Who may fill cylinders?

This section should be read in conjunction with [HS Regulation 15.64](#)

A PCBU must ensure that no person fills a compressed gas container unless that person is an approved filler, or being trained and under the supervision of an approved filler. That person must have met the regulatory requirements set out in [HS Regulation 15.66](#) (Section 7.3 of this guide) and have been issued an approved filler compliance certificate by a compliance certifier.

A person undertaking a course of instruction to become an approved filler can fill a compressed gas container with compressed gas if the person:

- a. is directly supervised at all times while filling the cylinder by an approved filler, and
- b. the approved filler remains capable of taking over or stopping the filling procedure at all times.

7.3 How does a person become an approved filler?

[HS Regulation 15.66](#) sets out the requirements for issuing an approved filler certificate.

To become an approved filler a person must know and be familiar with:

- a. the different forms of compressed gases, namely:
 - i. low-pressure liquefied gas
 - ii. high pressure liquefied gas
 - iii. permanent gas (including breathing air for SCBA and SCUBA cylinders)
 - iv. cryogenic gas, and
- b. the factors that can trigger failure of a cylinder
- c. the potential adverse effects associated with the different forms of compressed gas
- d. the requirements of the HS Regulations or relevant safe work instrument covering the visual inspection and safe filling of a cylinder including what is/are:
 - i. an approved cylinder design
 - ii. cylinder filling terminology (eg 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 filling
 - v. cylinder markings
 - vi. valve markings
 - vii. the different types of valves fitted to cylinders the filler will be filling
 - 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 compliance certifier authorised for this activity that they are competent to fill cylinders for specific gases (the gas traffic).

The person may alternatively provide the compliance 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 compliance certificate is valid for five years. The certificate must specify the forms and classes of gases and the types of cylinders covered by that certificate. Where the certificate includes the filling of SCUBA cylinders the approved filler can fill approved cylinders with mixtures other than air in accordance with Section 7.11 of this guide.

7.4 What are the variations to the approved filler requirements?

Resuscitation and LPG cylinders

This section should be read in conjunction with [HS Regulation 15.64\(2\)](#)

The approved filler requirements do not apply to a person who fills:

- a. a portable resuscitation cylinder or
- b. an LPG cylinder of less than 110 kg water capacity, if the person charging the LPG cylinder, meets the requirements set out in a safe work instrument.

Automotive, marine and aviation cylinders

The approved filler requirements also do not apply in the case of the automotive, marine and aviation cylinders that are excluded from the HS Regulations. They may be filled without a LAB number under arrangements managed by the transport authorities, Maritime New Zealand (MNZ), Civil Aviation Authority (CAA) and the New Zealand Transport Authority (NZTA). For example, CAA issue a form, (Form 2) identifying the cylinder as an aviation cylinder.

7.5 General

Pre-filling checks

Before filling a cylinder, the filler must make sure that:

- a. the cylinder is marked according to Section 4 of this guide [Part 15, subpart 6 of the HS Regulations](#) or according to [Clause 6.2.2.7 of Chapter 6.2 of UNRTDG HS Regulation 15.3](#)
- b. the cylinder is within its required test period (Section 8.6 of this guide)
- c. the cylinder is in good external physical condition
- d. the cylinder markings and labelling are clear and correspond to the gas to be filled
- e. the valve is suitable and in good condition, and
- f. where required by the HS Regulations, an over-pressure protection device is fitted (eg pressure relief valve, burst disc), and
- g. in the case of SCBA or SCUBA cylinders the breathing air quality requirements outlined in Section 7.11 of this guide have been met.

Checks during filling

Once a cylinder has commenced being filled, the filler must make sure that:

- a. the cylinder valve is not leaking via its neck threads, or valve spindle
- 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.

Post filling checks

After filling a cylinder, the filler must make sure that:

- a. the cylinder is correctly labelled in accordance with Table 10 of this guide and also in accordance with the HS Regulations
- b. the cylinder has been checked for leaks (where considered necessary or where the valve has been removed prior to filling then leak testing should be undertaken by soap testing the valve or immersing the cylinder and valve in a water bath), and
- c. 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 Section 7.6 of this guide *Filling pressure*.

7.6 What are the filling conditions for permanent gases?

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.

Approved Fillers must ensure that they are familiar with the methodologies listed below and use as appropriate.

Adjustments to the filling pressure are required to:

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

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 16 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 (eg by an infrared thermometer) of the shell of the cylinder and check the cylinder pressure. Convert to the corresponding pressure at 15°C.

SETTLED PRESSURE CHART

For compressed air only – figures will differ for other gases.

FILLING PRESSURE STAMPED ON CYLINDER		ADJUSTED FILLING PRESSURE FOR TEMPERATURE MPa					
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

TABLE 16:
Example of settled
pressure for
compressed air

7.7 What are the filling conditions for liquefied gases?

Filling by weight control

Any person filling a liquefied gas cylinder must fill the cylinder by weight control (not pressure). The only exception to this is where cylinders are filled by ullage control, see below.

Liquefied 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 (eg for flammable gases only mechanical scales or electric scales that are intrinsically safe)
- b. clear, graduated and legible to read
- c. have been periodically calibrated by a competent person at a minimum of 12 month intervals to ensure accuracy, or at more frequent intervals where the accuracy of the scales may have become suspect
- 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 L water capacity or less.

Filling by ullage control

Filling by ullage control, (that is, by using the dip tube or a fixed ullage gauge (according to Clause 7.2.3 of AS 2030.5-2009)) can be done for the following types of cylinders:

- a. a forklift cylinder that is filled while mounted on the vehicle
- b. a cylinder mounted on any other type of vehicle, or
- c. a cylinder that is filled in accordance with [HS Regulation 15.69\(5\)\(c\)](#)

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 L. Decant filling is a controlled delivery using only the pressure from the supply cylinder or tank to transfer the gas, and is not pump assisted.

What are the filling ratio requirements for particular gases?

CARBON DIOXIDE

For cylinders having a test pressure of 22 MPa or more, a 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, a filling ratio of 0.667 must be used.

LPG

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

100% BUTANE

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

HIGH PRESSURE LIQUEFIED GASES

Fillers must ensure that the pressure at the temperatures specified in [Table 3, Schedule 20 of the HS Regulations](#) will not exceed the developed pressure by more than 20% [HS Regulation 15.67\(2\)\(b\)](#)

What are the consequences of over-filling a liquefied gas cylinder?

If a liquefied 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 risking malfunction of attached appliances and a fire. If there is no pressure relief valve, or it fails to operate, the cylinder may burst after only a small rise in temperature.

Over-pressure protection devices

See Section 5.8 of this guide.

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

In certain cases it may be necessary to import pre-filled cylinders (eg specialist gases not available in New Zealand).

If a pre-filled cylinder is returned to the country of origin for recharging and will not be filled at any time in New Zealand, the cylinder must be approved in the country of origin. It must also meet the relevant international transport code, normally the International Maritime Dangerous Goods (IMDG) Code.

If a pre-filled cylinder is to be recharged in New Zealand, it should first be determined that it has an approved design and marks. This may require design verification and pre-commissioning following Section 3 of this guide, and identification and marking of the cylinder according to Section 4 of this guide. If the cylinder cannot be identified as being approved for filling in New Zealand, it must not be filled.

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 which is filled in New Zealand, must comply fully with the HS Regulations and be of an approved design.

7.10 Filling SCBA and SCUBA cylinders

This section should be read in conjunction with [HS Regulation 15.68](#)

General

There are specific requirements for charging SCBA and SCUBA cylinders to ensure integrity of the charged cylinder.

What are the breathing air quality requirements?

In order to minimise corrosion of the cylinders, in particular aluminium cylinders, SCBA and SCUBA cylinders must only be charged with air that meets the requirements of:

- AS/NZS 2299.1: 2015 - Occupational diving operations - Standard operational practice

- AS/NZS 2299.1: 2015 except that
 - the moisture level of breathing air in the cylinder may contain not more than 100 mg/m³ of water at 15°C and 100 kPa (130 ppm by volume), and
 - the frequency of the testing for air purity may be at intervals of three months or less, or
- a relevant safe work instrument.

Reference should also be made to other requirements of breathing air quality that are necessary to ensure breathing air does not present a risk to persons using SCBA and SCUBA cylinders.

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 or 20-40 Bar or 300-600 psi per minute should be used for AIR, and 4-7 Bar or 60-100 psi per minute should be used for oxygen and helium.

What are the consequences of exceeding the recommended filling rate?

Exceeding the recommended filling rate will place undue stress on the cylinder shell as a result of the rapid pressurisation and the increased heat of compression during filling. This will increase the likelihood of the cylinder rupturing.

During the filling of NITROX and TRIMIX exceeding the recommended filling rates may increase the risk of adiabatic compression or incorrect gas mixes.

What are the maximum filling pressures?

The maximum filling pressure for a SCBA or SCUBA cylinder must not exceed the lesser of:

- a. the manufacturer's design working pressure stamped on the cylinder (refer also to Section 7.6 of this guide for calculating settled air pressure)
- b. the filling pressure marked on the cylinder valve.

For open face type valves marked with a maximum filling pressure, the maximum filling pressure must not exceed the lesser of:

- a. 22.5 MPa or 225 bar, or
- b. the maximum filling pressure marked on the valve or the cylinder.

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.

Using cylinder restraints during filling

Cylinders should be suitably restrained during filling. This is to prevent them toppling during filling or from moving uncontrollably if the filling connection becomes disconnected from the cylinder during filling.

If a water bath is used for providing restraint, the filler must ensure that the cylinder shell is completely submerged.

Checking cylinder residual air quality before filling

The residual air in a cylinder must be checked by the filler, before connecting the filling connection, for any objectionable odour. If an objectionable odour is detected, the cylinder must first be de-pressurised, its valve removed, and be thoroughly cleaned internally before filling.

7.11 Filling SCUBA cylinders with mixed gases (NITROX, Enriched Air/EANx, De-nitrogenated Air/DNAX, and TRIMIX)

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 and/or helium. Further to [HS Regulation 15.68](#) and AS/NZS 2299.1:2015, the following is advice on methods of filling cylinders with mixed gases, including:

- enriched Air/EANx
- NITROX
- de-nitrogenated Air/DNAX
- TRIMIX.

How does a person become approved filler for NITROX and/or TRIMIX?

As well as the basic regulatory requirements for an approved filler (Section 7.3 of this guide) a person should be able to provide evidence that they have successfully completed a course of training in NITROX or TRIMIX filling through a suitable recognised training provider.

What is the maximum permitted percentage of oxygen in NITROX?

The maximum permitted percentage of oxygen in NITROX filled cylinders that is labelled in Section 4.13 for AIR is 40% (ie the oxygen content must not exceed 40%). For any SCUBA cylinder with a mixture over 40% it must be appropriately labelled as for oxygen.

Gas quality for mixed gas SCUBA

Air used in blending mixed gas for SCUBA must meet the standard for breathing (Section 7.10 of this guide) with the following modifications. It must:

- a. contain no more than 2 mg/m³ (2 ppm) of carbon monoxide at 15°C and 100 kPa
- b. contain no more than 0.1 mg/m³ (0.1 ppm) of traceable condensed hydrocarbons, and
- c. oxygen used for the blending process, must meet the standard for medical or breathing grade gas.

Changes of gas traffic from compressed air to NITROX or TRIMIX

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

Before obtaining a cylinder for NITROX or TRIMIX, or changing the gas traffic of an existing SCUBA air cylinder to NITROX, the cylinder owner and/or the filler should check the WorkSafe record of cylinder designs or with the manufacturer to see whether it is approved for NITROX or TRIMIX. Refer also to Section 3.9 of this guide.

What are the cleaning requirements?

For all methods of filling, NITROX and TRIMIX cylinders must be oxygen cleaned using a suitable cleaning process at the following times:

- a. immediately prior to entering NITROX or TRIMIX traffic for the first time
- b. immediately following cylinder periodic inspection or testing, and
- c. 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 a suitable training organisation.

'O' rings, seals and lubricants

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

NITROX or TRIMIX filling stations must ensure that only those 'O' rings, seals and lubricants recommended for use with NITROX or TRIMIX cylinders and valves are used. Periodic testing stations must use only approved oxygen cleaning technicians to refit valves to NITROX or TRIMIX cylinders after inspection or testing.

How are mixed gas percentages tested?

The approved NITROX or TRIMIX 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 the accuracy specified in a relevant code of practice. If not specified in the code of practice, a recommended accuracy of +/- 1% should be used.

Labelling and identification of NITROX or TRIMIX cylinders

See Section 4.14 of this guide.

7.12 The LPGA filler training programme

Since 2000, the LPG Association of New Zealand (LPGA) 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 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 compliance certification of LPG site trainers
- the training and certification of approved fillers
- periodic compliance auditing of selected sites.

Site trainers

Site trainers are compliance certifiers trained by National Trainers to carry out the following:

- the training and compliance 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 compliance certified either by a site trainer or by a national trainer.

For further information visit the LPGA website: www.gasnz.org.nz

7.13 Filling stations

Who is responsible for the filling station?

The PCBU with management or control of the station is responsible for ensuring that the requirements of HSWA and Regulations are met at all times. The PCBU must ensure a high standard of filler competence and that filling station equipment is well maintained. The person in charge of the site is normally the person with day to day responsibility for its operation.

What are the requirements?

This section should be read in conjunction with [HS Regulation 15.61](#)

The PCBU needs to ensure that:

- a. except for the variations in Section 7.4 of this guide, all persons filling cylinders hold a valid approved filler certificate for the gas traffic and cylinder types filled, and that a copy of each certificate is available on site
- b. all equipment necessary to safely fill cylinders is provided and maintained
- c. the cylinder filling and cylinder storage areas are separated by the required distances or walls given in [Part 11 of the HS Regulations](#) for flammable gases, [Part 12](#) for oxidising gases including oxygen, and [Part 13](#) for toxic gases. The areas are to be kept orderly and tidy
- d. the following records can be accessed from the WorkSafe website:
 - the Gas Cylinder Record
 - the Special Cylinder Record
 - the Record of test station marks, and
- e. the current version of this guide is available on site in hard copy or electronically by computer.

What equipment is required?

The PCBU needs to 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
- for filling liquefied gases, calibrated weighing scales of a type suitable for the gas being filled
- for filling of flammable gases, a portable fire extinguisher
- all hand tools necessary for fitting and removing filling connections (eg adjustable spanner, flat bladed screwdriver)
- filling station identification labels (optional)
- all other labels required for identification of cylinder contents in accordance with the HS Regulations
- leather gloves or gloves providing equivalent level of protection based on the gas traffic
- eye protection
- first-aid kit on site
- warning signage in accordance with the HS Regulations.

7.14 Disposable gas cartridges

Definition

Cartridges are small non-refillable containers (see [Part 15, Subpart 4 of the HS Regulations](#)), with or without valves, and generally for propane, butane, or LPG. They are filled during manufacture and are designed to be fitted to a suitable apparatus that uses the contents. Cartridges may contain up to 1400 ml depending on the specification. Cartridges are not intended for reuse (ie they are one trip or disposable).

What are the requirements?

This section should be read in conjunction with [HS Regulation 15.26](#)

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

1. All cartridges must be manufactured to an approved standard, see below.
2. When the non-cartridge is charged with gas, the maximum developed pressure at 50°C is not more than that specified in the design to which the cartridge was manufactured.
3. Cartridges must be tested and examined after manufacture for leakage and deformation or any other defect in accordance with the standard.
4. All imported cartridges must be accompanied by a manufacturer's compliance certificate as required by the standard. Copies must be retained by the importing agency.
5. Valves, if fitted, must either:
 - a. have a special adaptor, so that when the cartridge is removed from the apparatus, the valve closes, or
 - b. be provided with adequate protection against discharge.
6. Marking and labelling must be in accordance with [Part 15, subpart 6 of the HS Regulations](#) (Sections 4.11 and 4.15 of this guide).

Approved standards [HS Regulation 15.26](#)

Cartridges must be manufactured in compliance with:

- UL standard UL 147B:2016 on Non-refillable (disposable) type metal container assemblies for butane
- an applicable standard that is listed in [Schedule 21 of the HS Regulations](#) or
- a standard relating to non-refillable gas containers that is specified in a relevant safe work instrument.

7.15 Aerosols

Definition

An aerosol is a substance packed under pressure and designed to be released as a solid, as liquid particles in a suspension of gas, as a foam, paste or powder, or in a liquid or gaseous state. The compressed gas container holding an aerosol is an aerosol dispenser.

What are the requirements?

This section should be read in conjunction with [HS Regulation 15.25](#)

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

1. All aerosol dispensers must be manufactured to an approved standard, see below.
2. The liquid and solid contents of the filled aerosol dispenser as offered for sale must be such that they will not occupy more than 90% of the closed aerosol dispenser at 50°C.
3. Aerosol dispensers must be tested and examined after manufacture for leakage and deformation or any other defect in accordance with the standard.
4. All imported aerosol dispensers must be accompanied by a manufacturer's compliance certificate as required by the standard. Copies must be retained by the importing agency.
5. Valves must be provided with adequate protection against discharge.
6. Marking and labelling must be in accordance with [Part 15, subpart 6 of the HS Regulations](#) (Sections 4.11 and 4.15 of this guide).

Approved standards

Aerosol dispensers must be manufactured in compliance with:

- AS 2278.1-2008
- an applicable standard that is listed in [Schedule 21 of the HS Regulations](#) or
- a relevant safe work instrument that specifies design standards relating to aerosol dispensers.

8.0

Periodic inspection and testing

IN THIS SECTION:

- 8.1 What does periodic inspection and testing involve?
- 8.2 What are the controls that set out the requirements for periodic testing?
- 8.3 Who can carry out periodic inspection and testing?
- 8.4 What are the inspection and testing requirements?
- 8.5 Why is the date of manufacture of a cylinder important?
- 8.6 Inspection and test periods of validity
- 8.7 Fire extinguishers
- 8.8 Acetylene cylinders
- 8.9 What if a cylinder cannot be inspected internally?
- 8.10 What type of lubricants and sealants are suitable?
- 8.11 What happens when a cylinder fails periodic inspection or test?
- 8.12 Can a cylinder be repaired?

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 confirms 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 compliance certification of the initial shipment of the cylinders
- during the imported cylinder compliance 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 re-tested.

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 an authorised test station and in accordance with [HS Regulation 15.56](#) and one of the following standards:

- the standard to which the cylinder was designed
- AS 2337.1-2004
- AS 2337.3-2006 (composite or fibre-wrapped cylinder)
- AS 2030.2:1996 (contains acetylene dissolved in a solvent)
- a standard specified in a safe work instrument.

In addition authorised test stations with IANZ approval to do so, may test aviation cylinders in accordance with the CAA Form 2, mark the cylinder as tested and supply the document of certification and cylinder to the owner/engineer with Form 2.

8.3 Who can carry out periodic inspection and testing?

Only PCBUs that have been authorised by WorkSafe under [HS Regulation 15.52](#)

8.4 What are the inspection and testing requirements?

Inspection

An inspection may only be carried out by a test station authorised by WorkSafe. The inspection consists of:

- a. Identification of the cylinder.
- b. Removal of any external attachments (eg mounting straps).
- c. External examination in accordance with AS 2337.1-2004.
- d. Removal of the valve and cleaning of the cylinder interior and the neck threads where required by AS 2337.1-2004 (Section 8.9 of this guide also gives exceptions).
- e. Internal examination in accordance with AS 2337.1-2004.
- f. Checking the valve for correct function and condition in accordance with AS 2337.1-2004.

- g. Correctly re-fitting the valve and checking the cylinder/valve for leaks, by partially charging the cylinder with compressed air or nitrogen. In the case of LPG cylinders, use LPG if available.
- h. Tagging or labelling the cylinder in accordance with [HS Regulation 15.40\(2\)\(j\) and \(k\)](#) (Section 4.9 of this guide *After inspection*).
- i. Preparation of a periodic certificate for the customer.

Testing

A test may only be carried out by a test station authorised by WorkSafe 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 2337.1-2004. Unless otherwise instructed, the test is to be at the marked or calculated test pressure.
- c. Correctly re-fitting 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/NZS 2299.1: 2015 Occupational diving operations-Standard operational practice.

- d. Stamping the cylinder in accordance with [HS Regulation 15.40](#) (Section 4.9 of this guide *After testing*).
- e. Preparation of a periodic certificate for the customer.

Notes:

1. Removal and re-fitting of the cylinder valve must only be done by a suitably competent person.⁹
2. If the cylinder is going to be recharged at the place of inspection or testing, then additional leak checking will not be required.

8.5 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 provides a snapshot of the materials, tooling, conditions, environment, quality control and testing that applied at the time.

Irrespective of the required re-test period (related to the type of service the cylinder is used in), the period before the first re-test starts from the date of manufacture. For example, a SCUBA cylinder manufactured in June 2016 is due for testing in June 2018, even if it is first used in December 2017.

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

⁹ A person with mechanical aptitude who has been trained in the removal and re-fitting of cylinder valves.

8.6 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 15.56\(1\)](#) and [Schedule 22](#) of the HS Regulations):

TYPE OF CYLINDER	INTERVAL
Cylinder for liquefied petroleum gas, propane or butane (including automotive)	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	5 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

TABLE 17:
Periodic inspection intervals

Note: these intervals are the periods beyond which a person must not charge a cylinder unless that cylinder has been inspected/tested. The period does not apply until the cylinder has been discharged.

8.7 Fire extinguishers

How are fire extinguishers categorised?

Fire extinguishers are categorised in a number of ways, for example:

- according to the type of extinguishing agent that they contain (eg foam dry powder, CO₂ etc)
- according to their size or capacity
- according to their fire rating, or performance on certain types of fires (refer to AS/NZS 1850:2009)
- according to their method of operation.

The method of operation is the category that determines the periodic inspection and testing of fire extinguishers and the following definitions apply:

Portable fire extinguisher means a first-aid firefighting 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 liquefied 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. 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.

What are the testing requirements for fire extinguishers?

For high pressure fire extinguishers (eg CO₂, Nitrogen, and Argon) the testing requirements are the same as for other high pressure gas cylinders (Section 8.4 of this guide).

For low-pressure fire extinguishers (eg dry chemical, wet chemical, halon, foam, and water) an approved method of proof testing is required. Test 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 ml water capacity (of the gas cartridge type) to be periodically pressure tested.

There are no legal requirements for pressure testing the hoses and operating head that make up the assembled extinguisher. It is recommended in the interests of safety, however, that they are tested, as they are subject 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 testing.

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, for example, the periodic certificate number prefixed by the test station's mark. An approved void label may be used to provide the identification details as above.

What standards apply when inspecting and testing fire extinguishers?

AS 2337.1-2004	Gas cylinder test stations Part 1: general requirements, inspection and tests – gas cylinders
AS 2337.3-2006	Gas cylinder test stations Part 3: transportable gas cylinders, periodic inspection and testing of composite cylinders
AS 2030.1-2009	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/NZS 1841.1 – 8:2007	Portable fire extinguishers

TABLE 18:
Fire extinguisher standards

WHAT ARE THE TESTS FOR FIRE EXTINGUISHERS?

This section should be read in conjunction with [HS Regulation 15.56](#)

Test periods

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

However, if the extinguisher has not been discharged and does not require recharging then NZS 4503:2005 should be followed (see Clause 6.4 – Inspection, Testing and Maintenance Survey Schedules).

Hydrostatic testing

All high pressure fire extinguishers (eg CO₂, Nitrogen and Argon) over 500 ml water capacity must be inspected then hydrostatically tested according to AS 2337.1-2004.

Proof testing

All low-pressure fire extinguishers (eg dry chemical, wet chemical, foam, halon and water) must be inspected then proof pressure tested according to AS 2337.1-2004 using a non-water-jacket test rig.

The periodic test pressure for a low-pressure fire extinguisher should be the lesser of:

- a. the marked periodic test pressure, or
- b. 1.5 times the working pressure but not less than 2000 kPa.

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 test station (Section 4.9 of this guide *After testing*).

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 (eg 'void labels') (Section 4.9 of this guide *After inspection*).

All dry chemical or halon extinguishers must have the internal areas of cylinder operating head, caps and hose assemblies thoroughly dried out before being re-fitted. 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 re-fitting is delayed, the extinguisher cylinder must be suitably plugged to prevent the ingress of foreign matter that could affect the extinguisher operation.

Repairs to extinguishers

Refer Section 8.12 of this guide.

Extinguishers that fail inspection and testing

An extinguisher that fails an inspection or test must be treated in accordance with [HS Regulation 15.57](#) (Section 8.11 of this guide).

Disposable fire extinguishers

Any person or organisation wishing to manufacture, import, sell or use a disposable type of fire extinguisher (ie one that is not primarily designed or intended to be recharged after use) must ensure that the type of extinguisher is designed, constructed and maintained to an approved design specification.

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

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

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 other gas cylinders. A check as to whether a particular fire extinguisher design is approved and can be filled, should first be made.

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 (Section 3.10 of this guide).

8.8 Acetylene cylinders

Acetylene cylinders are not hydrostatically tested apart from the original test undertaken prior to inserting the porous mass. They must, however, be periodically inspected and test certified as per AS 2030.2-1996 at the inspection periods set out in Section 8.6 of this guide.

Each time an acetylene cylinder is received at a filling station, its over-pressure protection devices must be examined in accordance with AS 2030.2-1996.

8.9 What if a cylinder cannot be inspected internally?

Cylinders that by way of their small neck aperture make internal examination impossible (eg primus cylinders having a recessed valve) must be either:

- a. hydrostatically tested using a water-jacket apparatus, with dry air or nitrogen as the pressurising medium
- b. examined in accordance with Clause 9.6 of AS 2030.5-2009 provided that they are within the scope of that clause, or
- c. treated in accordance with [HS Regulation 15.57](#) (Section 8.11 of this guide *How must a condemned cylinder be treated?*).

8.10 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, TRIMIX and Medical Oxygen) or food grade gas (eg carbonated drinks).

The following lubricants and sealants have been determined as being both safe and suitable for service with the specified gas traffic.

CYLINDERS OTHER THAN BREATHING AIR, NITROX, OXYGEN OR FOOD GRADE GASES	BREATHING AIR OR FOOD GRADE GASES	OXYGEN, NITROUS OXIDE, NITROX
<ul style="list-style-type: none"> - 'Dag' Dispersion 709 colloidal molybdenum disulphide in toluene - Fluorolube 5-30 (Occidental Chemical Corp) - Polytetrafluoroethylene (PTFE) tape, degreased 	<ul style="list-style-type: none"> - Vegetable oil lubricants (only for compressor operation) - PTFE tape, degreased and certified suitable for oxygen service - Silicon spray (specific type) 	<ul style="list-style-type: none"> - Fluorocarbon oils and greases as specifically approved for the operating pressures/temperatures - PTFE tape, degreased and certified suitable for oxygen service - 'Crystalube', 'Krytox' or equivalent

TABLE 19:
Examples of accepted lubricants and thread sealants

8.11 What happens when a cylinder fails periodic inspection or test?

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 2337.1-2004 (eg corrosion, physical damage, neck thread cracks)
- b. the hydrostatic test criteria set out in AS 2337.1-2004
- c. for acetylene cylinders, the criteria set out in AS 2030.2-1996
- d. the proof test criteria set out in AS 2337.1-2004
- e. the cylinder is a wire-wound cylinder
- f. re-cut neck threads, 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)
- g. neck thread inserts/spacers/reducers (ie where the basic neck thread is reduced in size by an insert threaded to take the valve)
- 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. In accordance with [HS Regulation 15.57](#) it must either:

- be rendered unserviceable as a compressed gas container
- be re-tested with the consent of WorkSafe, if the failure is due to reasons other than neck thread inserts or re-machining of markings being obliterated, or
- be repaired and re-tested if repair is provided for in the design to which the cylinder was manufactured (Section 8.12 of this guide).

The cylinder may not leave the test station except with the consent of WorkSafe.

Further detail follows.

Can a failed cylinder be re-inspected or re-tested?

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

- If the test station 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 the test station ask WorkSafe to authorise a re-test. The re-test must be carried out at the cylinder owner's expense and under any conditions that WorkSafe 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.

How must a condemned cylinder be treated?

This section should be read in conjunction with [HS Regulation 15.57](#)

The following procedure sets out the requirements and methods for treating of condemned cylinders by test stations:

- 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
 - ii. cutting the cylinder into two pieces, away from any welds
 - iii. drilling a hole of at least 25 mm 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.

8.12 Can a cylinder be repaired?

Repairs not recommended

Repairs to cylinders are not recommended. Repairs can only be undertaken if the repair follows a procedure specified in the design standard to which the cylinder was manufactured. 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.

Cylinder specifications

Provision for repair in some cylinder specifications applies to repairing defects discovered during manufacture. These repairs, undertaken prior to importation, must comply fully with the procedures set out in the specification, including re-inspection by the recognised inspection agency.

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.

Recalls and design withdrawals

This section should be read in conjunction with [HS Regulation 15.85](#)

If WorkSafe considers that a fitting, aerosol, cylinder, or non-refillable container currently in New Zealand is unsafe, WorkSafe may recall, or require a PCBU or other person to recall, the fitting, aerosol, cylinder, or non-refillable container.

If WorkSafe considers that the design for a fitting, aerosol, cylinder, or non-refillable container is unsafe, WorkSafe may withdraw approval for the design.

Appendices

IN THIS SECTION:

- Appendix 1:** Antecedents
- Appendix 2:** Equivalent metric and imperial pressures
- Appendix 3:** Sources of information
- Appendix 4:** Glossary
- Appendix 5:** Abbreviations
- Appendix 6:** Other relevant abbreviations
- Appendix 7:** Referenced standards
- Appendix 8:** Inspection types
- Appendix 9:** Compliance certificates for UNRTDG cylinders
- Appendix 10:** Marking of refillable UN pressure receptacles

Appendix 1: Antecedents

February 1983	Original issue of guide to Gas Cylinders by the Explosives and Dangerous Goods Division, Department (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 the Hazardous Substances (Compressed Gases) Regulations.
November 2012	Amendment to the Hazardous Substances (Compressed Gases) Regulations. Reissue of the guide incorporating all amendments and reformatted into the EPA format.
December 2017	Commencement of the Health and Safety at Work (Hazardous Substances) Regulations 2017.

Appendix 2: Equivalent metric and imperial pressures

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

QUOTED PRESSURE	EQUIVALENT PRESSURE		QUOTED PRESSURE	EQUIVALENT PRESSURE	
psi	MPa	Bar	MPa	Bar	psi
240	1.7	17	1.55	15.5	225
272	1.9	19	3	30	435
275	1.9	19	3.3	33	497
480	3.3	33	3.31	33.1	480
544	3.8	38	13.65	136.5	1980
550	3.8	38	17.5	175	2538
1800	12.4	124	17.6	176	2553
1980	13.7	137	18.9	189	2740
2015	13.9	139	22	220	3190
2133	14.7	147	22.2	222	3220
2265	15.6	156	23.2	232	3365
2275	15.7	157	23.3	233	3379
2400	16.6	166	24.3	243	3524
2475	17.1	171	24.5	245	3553
2850	19.7	197	27.5	275	3989
3000	20.7	207	27.6	276	4003
3300	22.8	228	28.5	285	4134
3358.3	23.2	232	29.2	292	4235
3360	23.2	232	29.4	294	4264
3555	24.5	245	31.9	319	4627
3560	24.6	246	32	320	4641
3600	24.8	248	32.4	324	4699
3775	26	260	34.2	342	4960
3791.7	26.2	262	34.5	345	5004
3840	26.5	265	35.2	352	5105
4000	27.6	276			
5000	34.5	345			
5500	37.9	379			
6000	41.4	414			
6400	44.1	441			
8333.3	57.5	575			

Appendix 3: Sources of information

The Acts and regulations referred to in this guide are available at:

www.legislation.govt.nz

The group standards referred to in this guide are available on the Environmental Protection Authority's (EPA) website at: www.epa.govt.nz/industry-areas/hazardous-substances/group-standards/2017-group-standards

The records referred to in this publication (other than the registers of hazardous substances) are available on the WorkSafe New Zealand website at:

worksafe.govt.nz/topic-and-industry/hazardous-substances/hazardous-substances-registers

Cylinders standards approved by WorkSafe can be found on the WorkSafe website at: worksafe.govt.nz/dmsdocument/2842-approved-cylinder-design-standards

A register of compliance certifiers can be found on the WorkSafe website at:

<https://compliancecertifiers.worksafe.govt.nz/home-2>

Fire extinguishers that have been issued a registered licence by SAI Global Australia are available at: <http://register.saiglobal.com>

A copy of the 19th revised edition of the UN Recommendations on the Transport of Dangerous Goods-Model Regulations (2015) is available at: www.unece.org/trans/danger/publi/unrec/rev19/19files_e.html

Cylinders standards recognised by Safe Work Instruments can be found on the WorkSafe website: worksafe.govt.nz/laws-and-regulations/safe-work-instruments/hazardous-substances/specification-of-design-standards-for-refillable-cylinders-swi-18

All references in this document to the HS Regulations are to the Health and Safety at Work (Hazardous Substances) Regulations 2017.

Appendix 4: Glossary

TERM	DEFINITION
Act	The Health and Safety at Work Act 2015 (HSWA).
Aerosol	A substance packed under pressure and designed to be released as a solid, as liquid particles in suspension in a gas, as a foam, paste or powder, or in a liquid state or a gaseous state
Aerosol dispenser	A gas container that: <ul style="list-style-type: none"> a. is non-refillable b. incorporates a valve designed to dispense the container's contents as an aerosol, and c. contains a gas that is compressed, liquefied, or dissolved under pressure.
Approved	Approved as suitable for filling or use in New Zealand by WorkSafe or a previous approving authority.
Breathing apparatus (BA, SCBA)	Apparatus for the supply of breathing air to the wearer when in a noxious or hostile atmosphere. Does not include SCUBA.
Cartridge	A non-refillable container for propane, butane or LPG, and has the same meaning as 'single tripper' or 'disposable' container.
Chapter 6.2 of UNRTDG	Requirements for the construction and testing of pressure receptacles, aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas.
Charge	To load or fill a gas container.
Charging pressure	Has the same meaning as filling pressure or working pressure.
Coating or liner	A non-removable membrane applied by the cylinder manufacturer to adhere to the internal walls and base of a cylinder.
Compliance certificate	A certificate issued by a compliance certifier under Part 6, Subpart 2 of the HS Regulations
Compliance certifier	A person authorised by WorkSafe under Part 6, Subpart 1 of the HS Regulations
Composite cylinder	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.
Critical temperature	The temperature of a gas in its critical state, above which it cannot be liquefied by pressure alone.
Cryogenic container	A closed pressure container designed to maintain an internal temperature low enough to cause the gas inside to revert to its liquid or partially liquid state.
Cylinder	Has the meaning given to it in the HS Regulations <ul style="list-style-type: none"> a. means a refillable or non-refillable gas container that is used or intended to be used for storing and transporting gases under pressure, and b. includes a cryogenic container and a fire extinguisher, but c. does not include an aerosol dispenser.
Design	All specifications (including drawings) necessary to describe the attributes of a compressed gas container.
Design pressure	The pressure used in the equations for designing the cylinder. This may be: <ul style="list-style-type: none"> a. service pressure b. working pressure c. developed pressure d. test pressure e. burst pressure depending on the standard to which the cylinder is designed.
Design verifier	A compliance certifier authorised by WorkSafe to issue design verification certificates for cylinder designs under HS Regulation 15.13
Developed pressure	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, the temperature at which the gas is saturated with respect to a condensable component.

TERM	DEFINITION
Dissolved gas	A gas that when packaged under pressure, is dissolved in a liquid phase solvent.
Dry gas	A gas having a dew point of less than -40°C at a pressure of 101.3 kPa absolute.
Empty weight	In relation to a cylinder, the weight of the empty cylinder complete with its valve and any other fittings or appurtenances, fittings and related items that are normally on the cylinder when it is filled.
EPA	The Environmental Protection Authority.
Fibre-wrapped	A cylinder of metallic construction that is externally reinforced by wrapping in glass reinforced plastic (fibreglass).
Filling pressure or charging pressure	The pressure to which a cylinder is filled with a gas when both the gas and the cylinder are at 15°C. Applicable only for permanent gases.
Filling ratio	In relation to a liquefied gas, the ratio of the mass of gas charged into a compressed gas container to the mass of water at 15°C that fills the compressed gas container.
Fire extinguisher	A gas container intended to hold an extinguishant that can be discharged onto a fire by, or by being, a gas under pressure.
Fire extinguisher registration number	A fire extinguisher registration number issued by a product certification body in accordance with HS Regulation 15.22 that is, a product certification body may issue a fire extinguisher registration number for a low-pressure fire extinguisher if it is satisfied that the fire extinguisher: <ul style="list-style-type: none"> a. has been manufactured in accordance with the HS Regulations, and b. meets the quality assurance requirements specified in the fire extinguisher’s design.
Fitting	In relation to a gas container, a device (including a valve, adapter, automatic change-over device, gauge, regulator, seal or hose) that is connected to a gas container and that is used to: <ul style="list-style-type: none"> a. fill or empty the container with gas b. seal a connection to a gas container with gas c. connect the gas container directly to another item associated with the use of gas, or d. protect the gas container from over-pressurising. <p>Generally this does not extend past the outlet of the first stage regulator.</p>
Gas	Has the same meaning given in the Hazardous Substances (Minimum Degrees of Hazard) Notice 2017, that is a substance that: <ul style="list-style-type: none"> a. is completely gaseous at 20°C and at 101.3 kPa absolute pressure, or b. has a vapour pressure of more than 300 kPa absolute pressure at 50°C.
Gas container	Has the same meaning as in HS Regulation 3 that is: <ul style="list-style-type: none"> a. a container in which a gas under pressure is held with fittings or equipment designed to retain the gas in its compressed form, and b. includes a cylinder, aerosol dispenser, fire extinguisher, cryogenic container, tank (including a stationary tank), but c. does not include: <ul style="list-style-type: none"> i. a pressure vessel that is a pipeline under the Health and Safety in Employment (Pipelines) Regulations 1999 ii. an air receiver used in connection with the starting of an internal combustion engine iii. a receiver that forms part of a compression plant iv. (a container that forms an integral part of a refrigerating unit) v. a pressurised container that forms an integral part of the motive or control system of a vehicle, aircraft, or ship vi. an aerosol container with a water capacity less than 50 millilitres or for which the absolute pressure developed at 20°C is less than 170 kPa vii. a cartridge with a water capacity less than 170 ml viii. a non-refillable container with a water capacity of less than 100 ml ix. a cylinder with a water capacity of less than 120 ml, if the contents are a liquefied gas with flammable properties x. a cylinder with a water capacity of less than 500 ml, if the contents are not a liquefied gas with flammable properties xi. a cylinder with a water capacity of greater than 500 L, except that this subparagraph does not apply in relation to subpart 8 of Part 15 or Table 1 in Schedule 20 of the HS Regulations, or xii. carbonated beverages or their containers.

TERM	DEFINITION
Gas under pressure	a. a compressed gas: b. a liquefied gas: c. a refrigerated liquefied gas: d. a dissolved gas.
Guide	This guide to gas cylinders.
High pressure fire extinguisher	A fire extinguisher that is not a low-pressure fire extinguisher.
High pressure liquefied gas	A liquefied gas that has a critical temperature above -50°C but below or equal to 65°C.
HS Regulations	Health and Safety at Work (Hazardous Substances) Regulations 2017
HSNO Act	The Hazardous Substances and New Organisms Act 1996.
Liquefied gas	A gas that is partially liquid above -50°C when packaged under pressure.
Low-pressure fire extinguisher	A fire extinguisher with a test pressure of less than 7000 kilopascals.
Low-pressure liquefied gas	A liquefied gas that has a critical temperature above 65°C.
Over-filling protection device (OPD)	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)	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.
Permanent gas	A gas with a critical temperature not exceeding -50°C.
Pre-commissioning certifier	A compliance certifier authorised WorkSafe to issue pre-commissioning compliance certificates under HS Regulation 15.19
Previous approving Authority	The authority undertaking approvals prior to HSWA coming into effect. In most cases this will be the EPA under the HSNO Act or the Chief Inspector under the Dangerous Goods Act 1974.
Product certification body	A body accredited to ISO/IEC Guide 65 by a national or New Zealand joint accreditation agency operating to ISO/IEC 17011:2004.
Recognised inspection agency	A person or organisation recognised by WorkSafe for the purposes of any of Regulations 15.15 15.16 15.37 15.40 or 15.80 of the HS Regulations.
Reference temperature	For liquefied gases, the temperature at which the liquid density is to be evaluated for calculating the filling ratio, and for permanent gases, the temperature at which the developed pressure is determined.
Refrigerated liquefied gas	A gas that when packaged is partially liquid because of its low temperature.
Safe work instrument	Is an instrument approved by the Minister to define terms, prescribe matters, or make other provision in relation to any activity or thing, including (without limitation) listing standards, control of substances, and competency requirements.
Self-contained underwater breathing apparatus (SCUBA)	Self-contained apparatus for the supply of breathing air and SCUBA gas mixtures to the wearer while 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.
Standard	Has the meaning given to it by the Standards and Accreditation Act 2015.
Tare weight	The weight of the cylinder shell with all removable fittings removed. ¹⁰

¹⁰ 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.

TERM	DEFINITION
Test pressure	The pressure the cylinder is designed and tested to withstand.
Ullage	The allowable vapour space within a cylinder containing a liquefied gas.
UNRTDG	See Appendix 5: <i>Abbreviations</i> .
Volume of gas	The volume of a gas at 101.3 kPa absolute pressure and 15°C.
Water capacity	The volume of water at 15°C that fills a 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.

Appendix 5: Abbreviations

ABBREVIATION	MEANING
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	Joint Australian and New Zealand 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
CNG	Compressed Natural Gas
CP	Charging Pressure
CSA	Canadian Standards Association
CTC or TC	Canadian Transport Commission / Transportation Canada
CTLA	Cylinder Testing Laboratories Association of New Zealand Inc.
DIN	Deutsches Institut für Normung e.V. (German Standard)
DNAx	De-nitrogenated Air mix (mixed gas diving)
DoL	Department of Labour, New Zealand (now Ministry of Business, Innovation and Employment)
DOT	Department of Transportation (USA)
DOT 3AA	DOT Specifications per the Bureau of Explosives Tariff or Code of Federal Regulations (CFR) 49
EANx	Enriched Air Nitrogen Mix (mixed gas diving)
EW	Empty Weight
FP	Filling Pressure
IANZ	International Accreditation New Zealand
IEC	International Electrotechnical Commission
ISO	International Standards Organisation
JAS - ANZ	Joint Accreditation System of Australia and New Zealand
JIS	Japanese Industrial Standard
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas

ABBREVIATION	MEANING
LPGA	Liquefied Petroleum Gas Association Inc
LPGITA	UK LP-Gas Association
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
NGO	National Gas Outlet (America)
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 Liquefied 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' valve
PRD	Pressure Relief Device
PW	Working Pressure (ISO 13769 cylinder markings)
QCC	Quick Connection Coupling
SCBA	Self-Contained Breathing Apparatus (also 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
UNRTDG	Means the 19th revised edition of the UN Recommendations on the Transport of Dangerous Goods - Model Regulations (2015): www.unece.org/trans/danger/publi/unrec/rev19/19files_e.html
WP	Working Pressure

Appendix 6: Other relevant abbreviations

ABBREVIATION	MEANING
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
CSA	Canadian Standards Association
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 Uberwachungs Vereine (Germany)

Appendix 7: Reference standards

TERM	MEANING
AS 2030.1-2009	Australian standard 2030.1-2009 <i>Gas cylinders - General requirements</i>
AS 2030.2-1996	The Australian standard AS 2030.2-2009 The verification, filling inspection testing and maintenance of cylinders for the storage and transport of compressed gases. Part 2: Cylinders for dissolved acetylene
AS 2030.5-2009	Australian standard 2030.5-2009 Gas cylinders - Filling, inspection and testing of refillable cylinders
AS 2278.1-2008	Australian standard 2278.1-2008 Aerosol containers - Metal aerosol dispensers of capacity 50 mL to 1000 mL inclusive
AS 2337.1-2004	Australian standard 2337.1-2004 Gas cylinder test stations - General requirements, inspection and tests - Gas cylinders
AS 2337.3-2006	Australian standard 2337.3-2006 Gas cylinder test stations - Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders
AS 2473.1-2006	Australian standard 2473.1-2006 Valves for compressed gas cylinders - Specifications, type testing, and manufacturing tests and inspections
AS 2473.2-2015	Australian standard 2473.2-2015 Valves for compressed gas cylinders - Outlet connections (threaded) and stem (inlet) threads
AS 2473.3-2007	Australian standard 2473.3-2007 Valves for compressed gas cylinders - Outlet connections for medical gases (including pin-indexed yoke connections)
AS 2613-2005	Australian standard AS 2613-:2005 <i>Safety devices for gas cylinders</i>
AS 3635-1990	Australian standard AS 3635-1990 Unified (ISO inch) screw threads, associated gauges, and gauging practice
AS 3840.1-1998	Australian standard AS 3840.1-1998 Pressure regulators for use with medical gases - Pressure regulators and pressure regulators with flow-metering devices
AS 4267-1995	Australian standard AS 4267-1995 Pressure regulators for use with industrial compressed gas cylinders
AS 4332-2004	Australian standard AS 4332-2004: <i>Storage and handling of gases in cylinders</i>
AS 4484-2016	Australian standard AS 44842016 Gas cylinders for industrial scientific, medical and refrigerant use - Labelling and colour coding
AS 4621-2004	Australian standard 4621-2004 Regulators for use with liquefied petroleum - Vapour phase
AS/NZS 1596:2014	Joint Australian and New Zealand standard AS/NZS 1596:2014: <i>The storage and handling of LP-Gas</i>
AS/NZS 1841.1-8:2007	Parts 1 to 8 of the joint Australian and New Zealand standard AS/NZS 1841 <i>Portable Fire Extinguishers</i> (covers design and testing)
AS/NZS 1850: 2009	Joint Australian and New Zealand standard AS/NZS 1850: 2009 <i>Portable Fire Extinguishers - Classification, rating and performance testing</i>
AS/NZS 2299.1: 2015	Joint Australian and New Zealand standard AS/NZS 2299.1: 2015 <i>Occupational diving operations - Standard operational practice</i>
BS 341-1:1991	British standard BS 341-1:1991 Transportable gas container valves. Specification for industrial valves for working pressures up to and including 300 bar
BS 1552:1995	British standard BS 1552:1995 Specification for open bottomed taper plug valves for 1st, 2nd, and 3rd family gases up to 200 mbar
BS EN 13099:2003	British Standard 13099:2003 Transportable gas cylinders. Conditions for filling gas mixtures into receptacles

TERM	MEANING
BS EN 13096:2003	British Standard 13096:2003 Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases
BS EN 16129:2013	British Standard 16129:2013 Pressure Regulators, Automatic Change-Over Devices, Having A Maximum Regulated Pressure Of 4 Bar, With A Maximum Capacity Of 150 Kg/H, Associated Safety Devices And Adaptors For Butane, Propane, And Their Mixtures
CGA V-1 (2013)	CGA Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections published in January 2013
DIN EN ISO 11363-1	DIN EN ISO Standard 11363-1 (2012-06) Gas cylinders - 17E and 25E taper threads for connection of valves to gas cylinders - Part 1: Specifications
ISO/IEC 17011:2018	ISO/IEC Standard 17011:2018 Conformity assessment - General requirements for accreditation bodies accrediting conformity assessment bodies
ISO/IEC Guide 65	Standard on General Requirements for bodies Operating Product Certification Systems. Superseded by ISO/IEC 17065:2012
NZS 4503:2005	New Zealand Standard NZS 4503:2005 <i>Hand-operated firefighting equipment (covers maintenance)</i>
UL 125:2009	Standard UL 125:2009 Standard for Flow Control Valves for Anhydrous Ammonia and LP-Gas
UL 144:2012	Standard UL 144:2012 <i>Standard for LP-Gas Regulators</i>
UL 252:2017	Standard UL 252:2017 <i>Compressed Gas Regulators</i>
UL 299:2012	Standard UL 299:2012 <i>Dry Chemical Fire Extinguishers</i>
UL 2061:2015	Standard UL 2061:2015 Adapters and Cylinder Connection Devices for Portable LP-Gas Cylinder Assemblies
UL 2227:2007	Standard UL 2227:2007 <i>Over-filling Prevention Devices</i>

Appendix 8: Inspection types

SCHEDULE A	SCHEDULE B	SCHEDULE C
Visual	Non-destructive	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 compliance 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 compliance certifier may request that further samples be tested from the shipment.

Where cylinders pass type testing, the compliance certifier will compare the type testing report with the manufacturer's test report for consistency of results. Where the compliance certifier is satisfied that no inexplicable or significant inconsistency exists between the two reports, the certifier will issue a cylinder pre-commissioning compliance 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 record number (LABxxxx)
- 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.

Items verified in the separate inspection types

SCHEDULE A	COMPLIES
External appearance good, symmetrical	<input type="radio"/> Yes <input type="radio"/> No
Welding apparently good quality	<input type="radio"/> Yes <input type="radio"/> No
Valve protection adequate	<input type="radio"/> Yes <input type="radio"/> No
Surface finish, coating of good quality	<input type="radio"/> Yes <input type="radio"/> No
Cylinder, valve and fittings markings	<input type="radio"/> Yes <input type="radio"/> No
Markings:	
- clear and legible	<input type="radio"/> Yes <input type="radio"/> No
- match design verification	<input type="radio"/> Yes <input type="radio"/> No
- correct units	<input type="radio"/> Yes <input type="radio"/> No
- accurate	<input type="radio"/> Yes <input type="radio"/> No
- meet requirements of the HS Regulations	<input type="radio"/> Yes <input type="radio"/> No
Remedial action required	<input type="radio"/> Yes <input type="radio"/> No

Details:

SCHEDULE B	COMPLIES
Internal appearance good	<input type="radio"/> Yes <input type="radio"/> No
Welding apparently good quality	<input type="radio"/> Yes <input type="radio"/> No
Internal surface good, no corrosion	<input type="radio"/> Yes <input type="radio"/> No
Neck thread satisfactory	<input type="radio"/> Yes <input type="radio"/> No
Tare weight	<input type="radio"/> Yes <input type="radio"/> No
Empty weight	<input type="radio"/> Yes <input type="radio"/> No
Water capacity	<input type="radio"/> Yes <input type="radio"/> No
Markings:	
- match cylinder shipment	<input type="radio"/> Yes <input type="radio"/> No
- whole shipment covered	<input type="radio"/> Yes <input type="radio"/> No
Drawing number	<input type="radio"/> Yes <input type="radio"/> No
Remedial action required	<input type="radio"/> Yes <input type="radio"/> No

Details:

SCHEDULE C	COMPLIES
Measured acceptable	<input type="radio"/> Yes <input type="radio"/> No
Tensile strength (MPa)	<input type="radio"/> Yes <input type="radio"/> No
Yield strength (MPa)	<input type="radio"/> Yes <input type="radio"/> No
Elongation (%)	<input type="radio"/> Yes <input type="radio"/> No
Weld bend test	<input type="radio"/> Yes <input type="radio"/> No
Hydrostatic test	<input type="radio"/> Yes <input type="radio"/> No
Cyclic test	<input type="radio"/> Yes <input type="radio"/> No
Burst test	<input type="radio"/> Yes <input type="radio"/> No
Other: (specify)	<input type="radio"/> Yes <input type="radio"/> No
Remedial action required	<input type="radio"/> Yes <input type="radio"/> No

Details:

Appendix 9: Compliance certificates for UNRTDG cylinders

1. Purpose of compliance certificate

The purpose of a compliance certificate is to verify that a cylinder has foreign test markings indicating that the cylinder has been tested in accordance with Clause 6.2.2.7 of UNRTDG (and is therefore safe to be filled in New Zealand).

2. Verifying foreign design and construction certification

If the first interval following manufacture specified in [HS Regulation 15.56 \(1\)](#) has not yet passed, a compliance certifier may issue an import test clearance for the cylinder if the cylinder is marked in accordance with Clauses 6.2.2.7.1 to 6.2.2.7.5 of Chapter 6.2 of UNRTDG:

- a. by or on behalf of the government of a country other than New Zealand, and
- b. certifying that the cylinder has been designed and constructed, and passed initial inspections and tests, in accordance with Chapter 6.2 of UNRTDG.

3. Verifying foreign periodic testing

If the first interval following manufacture specified in [HS Regulation 15.56 \(1\)](#) has passed, a compliance certifier may issue compliance certificate for a cylinder if the cylinder is marked in accordance with Clause 6.2.2.7 of Chapter 6.2 of UNRTDG:

- a. by or on behalf of the government of a country other than New Zealand, and
- b. with current periodic inspection and test markings that certify that the cylinder complies with the periodic inspection and testing requirements of Clause 6.2.2.4 and 6.2.2.6 of Chapter 6.2 of UNRTDG.

4. Issue of compliance certificate

If the compliance certifier issues a compliance certificate for a cylinder, the certifier must provide WorkSafe with a copy of the certificate.

5. Exception

Despite clauses 2 and 3 above, a compliance certifier must not issue a compliance certificate for a cylinder if they have reasonable grounds to believe that the cylinder:

- a. is unsafe, or
- b. despite its markings, does not comply with Chapter 6.2 of UNRTDG.

Appendix 10: Marking of refillable UN pressure receptacles

This Appendix is a reproduction of Clause 6.2.2.7 of the UN Model Regulations Recommendations on the Transport of Dangerous Goods 19th revised edition.

6.2.2.7 Marking of refillable UN pressure receptacles

Note: Marking requirements for UN metal hydride storage systems are given in 6.2.2.9 and marking requirements for UN bundles of cylinders are given in 6.2.2.10.

6.2.2.7.1 Refillable UN pressure receptacles shall be marked clearly and legibly with certification, operational and manufacturing marks. These marks shall be permanently affixed (eg stamped, engraved, or etched) on the pressure receptacle. The marks shall be on the shoulder, top end or neck of the pressure receptacle or on a permanently affixed component of the pressure receptacle (eg welded collar or corrosion resistant plate welded on the outer jacket of a closed cryogenic receptacle). Except for the UN packaging symbol, the minimum size of the marks shall be 5 mm for pressure receptacles with a diameter greater than or equal to 140 mm and 2.5 mm for pressure receptacles with a diameter less than 140 mm. The minimum size of the UN packaging symbol shall be 10 mm for pressure receptacles with a diameter greater than or equal to 140 mm and 5 mm for pressure receptacles with a diameter less than 140 mm.

6.2.2.7.2 The following certification marks shall be applied:

e. The United Nations packaging symbol:



This symbol shall not be used for any purpose other than certifying that a packaging, a flexible bulk container, a portable tank or a MEGC complies with the relevant requirements in Chapter 6.1, 6.2, 6.3, 6.5, 6.6, 6.7 or 6.8:

- f. The technical standard (eg ISO 9809-1) used for design, manufacture and testing.
- g. The character(s) identifying the country of approval as indicated by the distinguishing signs of motor vehicles in international traffic.
- h. The identity mark or stamp of the inspection body that is registered with the competent authority of the country authorizing the marking.
- i. The date of the initial inspection, the year (four digits) followed by the month (two digits) separated by a slash (ie '/').

6.2.2.7.3 The following operational marks shall be applied:

- j. The test pressure in bar, preceded by the letters 'PH' and followed by the letters 'BAR'.
- k. The mass of the empty pressure receptacle including all permanently attached integral parts (eg neck ring, foot ring, etc) in kilograms, followed by the letters 'KG'. This mass shall not include the mass of valve, valve cap or valve guard, any coating, or porous material for acetylene. The mass shall be expressed to three significant figures rounded up to the last digit. For cylinders of less than 1 kg, the mass shall be expressed to two significant figures rounded up to the last digit. In the case of pressure receptacles for UN 1001 acetylene, dissolved and UN 3374 acetylene, solvent free, at least one decimal shall be shown after the decimal point and two digits for pressure receptacles of less than 1 kg.
- l. The minimum guaranteed wall thickness of the pressure receptacle in millimetres followed by the letters 'MM'. This mark is not required for pressure receptacles with a water capacity less than or equal to 1 litre or for composite cylinders or for closed cryogenic receptacles.
- m. In the case of pressure receptacles for compressed gases, UN 1001 acetylene, dissolved, and UN 3374 acetylene, solvent free, the working pressure in bar, preceded by the letters 'PW'. In the case of closed cryogenic receptacles, the maximum allowable working pressure preceded by the letters 'MAWP'.

- n. In the case of pressure receptacles for liquefied gases and refrigerated liquefied gases, the water capacity in litres expressed to three significant digits rounded down to the last digit, followed by the letter 'L'. If the value of the minimum or nominal water capacity is an integer, the figures after the decimal point may be neglected.
- o. In the case of pressure receptacles for UN 1001 acetylene, dissolved, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling, any coating, the porous material, the solvent and the saturation gas expressed to three significant figures rounded down to the last digit followed by the letters 'KG'. At least one decimal shall be shown after the decimal point. For pressure receptacles of less than 1 kg, the mass shall be expressed to two significant figures rounded down to the last digit.
- p. In the case of pressure receptacles for UN 3374 acetylene, solvent free, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling any coating, and the porous material expressed to three significant figures rounded down to the last digit followed by the letters 'KG'. At least one decimal shall be shown after the decimal point. For pressure receptacles of less than 1 kg, the mass shall be expressed to two significant figures rounded down to the last digit.

6.2.2.7.4 The following manufacturing marks shall be applied:

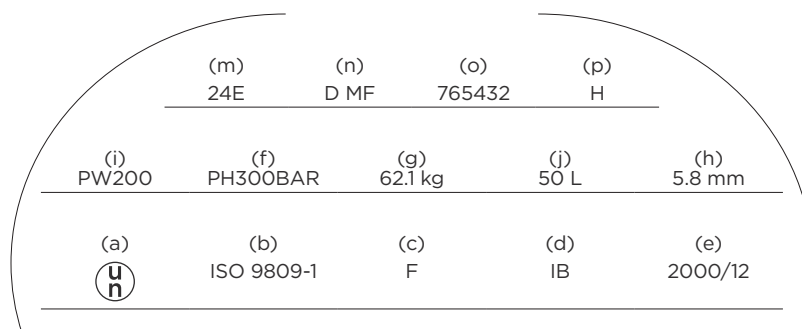
- q. Identification of the cylinder thread (eg 25E). This mark is not required for closed cryogenic receptacles.
- r. The manufacturer's mark registered by the competent authority. When the country of manufacture is not the same as the country of approval, then the manufacturer's mark shall be preceded by the character(s) identifying the country of manufacture as indicated by the distinguishing signs of motor vehicles in international traffic. The country mark and the manufacturer's mark shall be separated by a space or slash.
- s. The serial number assigned by the manufacturer.
- t. In the case of steel pressure receptacles and composite pressure receptacles with steel liner intended for the transport of gases with a risk of hydrogen embrittlement, the letter 'H' showing compatibility of the steel (see ISO 11114-1:2012).
- u. For composite cylinders and tubes having a limited design life, the letter 'FINAL' followed by the design life shown as the year (four digits) followed by the month (two digits) separated by a slash (ie '/').
- v. For composite cylinders and tubes having a limited design life greater than 15 years and for composite cylinders and tubes having non-limited design life, the letters 'SERVICE' followed by the date 15 years from the date of manufacture (initial inspection) shown as the year (four digits) followed by the month (two digits) separated by a slash (ie '/').

Note: Once the initial design type has passed the service life test programme requirements in accordance with 6.2.2.1.1 NOTE 2 or 6.2.2.1.2 NOTE 2, future production no longer requires this initial service life mark. The initial service life mark shall be made unreadable on cylinders and tubes of a design type that has met the service life test programme requirements.

6.2.2.7.5 The above marks shall be placed in three groups:

- w. Manufacturing marks shall be the top grouping and shall appear consecutively in the sequence given in 6.2.2.7.4 except for marks described in 6.2.2.7.4 (q) and (r) which shall be adjacent to the periodic inspection and test marks of 6.2.2.7.7.
- x. The operational marks in 6.2.2.7.3 shall be the middle grouping and the test pressure (f) shall be immediately preceded by the working pressure (i) when the latter is required.
- y. Certification marks shall be the bottom grouping and shall appear in the sequence given in 6.2.2.7.2.

The following is an example of marking a cylinder.



6.2.2.7.6 Other marks are allowed in areas other than the side wall, provided they are made in low stress areas and are not of a size and depth that will create harmful stress concentrations. In the case of closed cryogenic receptacles, such marks may be on a separate plate attached to the outer jacket. Such marks shall not conflict with required marks.

6.2.2.7.7 In addition to the preceding marks, each refillable pressure receptacle that meets the periodic inspection and test requirements of 6.2.2.4 shall be marked indicating:

- z. The character(s) identifying the country authorizing the body performing the periodic inspection and test as indicated by the distinguishing signs of motor vehicles in international traffic. This marking is not required if this body is approved by the competent authority of the country approving manufacture:
 - aa. The registered mark of the body authorised by the component authority for performing periodic inspection and test;
 - bb. The date of the periodic inspection and test, the year (two digits) followed by the month (two digits) separated by a slash (ie '/'). Four digits may be used to indicate the year.

The above marks shall appear consecutively in the sequence given.

6.2.2.7.8 For acetylene cylinders, with the agreement of the competent authority the date of the most recent periodic inspection and the stamp of the body performing the periodic inspection and test may be engraved on a ring held on the cylinder by the valve. The ring shall be configured so that it can only be removed by disconnecting the valve from the cylinder.

6.2.2.7.9 Deleted.

Disclaimer

This publication provides general guidance. It is not possible for WorkSafe to address every situation that could occur in every workplace. This means that you will need to think about this guidance and how to apply it to your particular circumstances.

WorkSafe regularly reviews and revises guidance to ensure that it is up-to-date. If you are reading a printed copy of this guidance, please check worksafe.govt.nz to confirm that your copy is the current version.

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