GUIDE TO GAS CYLINDERS

OSH
occupational safety & health service
te ratonga oranga

DEPARTMENT OF LABOUR
TE TARI MAHI

Important Note:

All the publications in the Publications Archive contain the best guidance available at the time of publishing. However, you should consider the effect of any changes to the law since then. You should also check that the Standards referred to are still current.

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ANTECEDENTS

May 1977	Dangerous Goods Approval Notification No. 10 - Gas Cylinders. Issued to Inspectors of Dangerous Goods only.
April 1980	Dangerous Goods Approval Notification No. 68 - Gas Cylinder Design Specifications. Issued originally to Inspectors of Dangerous Goods, later made available to cylinder importers.
February 1981	*Gas Cylinder Design Specifications.* Reprinted with amendments. Issued to Inspectors of Dangerous Goods and cylinder importers.
February 1983	Original issue of *Guide to Gas Cylinders.* Issued to Inspectors of Dangerous Goods, cylinder importers, manufacturers, testing stations and regulatory authorities.
January 1984	First General Amendment to Guide. Issued to all holders of original copies.
June 1984	Amended list of *Approved Cylinder Testing Stations*.
August 1984	Information and Instruction Bulletin. Issued to Inspectors of Dangerous Goods and Cylinder Testing Stations.
October 1984	Amended list of Approved Cylinder Testing Stations. Issued to Inspectors of Dangerous Goods, Cylinder Testing Stations and all New Zealand organisations believed to have an interest.
January 1985	Second General Amendment to Guide. Not including updated list of testing stations. Issued to holders of original copies.
April 1985	Reprint of Guide incorporating all amendments.
August 1985	Information and Instruction Bulletin. Issued to Inspectors of Dangerous Goods and Cylinder Testing Stations.
November 1985	Information and Instruction Bulletin. Issued to Inspectors of Dangerous Goods and Cylinder Testing Stations. Some copies not dated.
June 1986	Third General Amendment to Guide.
July 1989	Fire Extinguishers.

PART 1: GENERAL

This publication MUST be read in conjunction with the Dangerous Goods Act 1974, the Dangerous Goods (Labelling) Regulations 1978, and the Dangerous Goods (Class 2 - Gases) Regulations 1980 and Amendments.

1.1 Introduction

This Guide has been prepared for the assistance and guidance of persons and organisations involved in any way with compressed gas cylinders, but does not exempt them from their obligation to familiarise themselves with the legal requirements. Every effort has been made to ensure the accuracy and currency of the contents, but there have been three major revisions since the original edition was published in February 1983, and further amendments are expected. Users should therefore ensure that they are referring to a copy that has been updated. Suggestions for improvements should be sent to the Explosives and Dangerous Goods Division, Occupational Safety and Health Service, Department of Labour.

The Chief Inspector of Dangerous Goods has discretionary powers of approval for many aspects of the use of cylinders. The current approvals are summarised in this guide and its supplements. Amendments and updated supplements will be issued from time to time.

1.2 Scope

This publication applies to ALL cylinders and fittings used in New Zealand except as described below:

(i) Cylinders or tanks with a water capacity exceeding 250 litres, or designed for a test pressure of less than 200 kPa.

(ii) Cylinders or tanks which form an integral part of a compressor or refrigerating unit (i.e. which cannot readily be removed for inspection and testing).

(iii) Any air receiver used in connection with the starting of an internal combustion engine.

(iv) Acetylene cylinders of less than 5 litres water capacity;

(v) Aerosol containers that comply with Regulations 113 to 116 of the Dangerous Goods (Class 2 - Gases) Regulations 1980;

(vi) Small cylinders, i.e. less than 120 ml water capacity, if used for liquefiable flammable gases, and less than 500 ml if used for other gases. (vii) Certain containers of unusual design or of large diameter.

It is only partly applicable to cylinders and tanks used as automotive fuel tanks (i.e. with regard to filling and testing). Approval for the design and installation of such cylinders and tanks rests with the Ministry of Transport, Road Transport Division.

NB: Forklift trucks are NOT classed as motor vehicles for this purpose (see 10.3).

1.3 Legal Requirements

1.3.1 General

All persons and organisations are advised to acquaint themselves with the current legislation. This guide may not be used as a substitute. Copies of the Act, Regulations and their Amendments are available from GP Books.

1.3.2 Acts

The current Act is the Dangerous Goods Act 1974, which came into effect on 1 April 1975. The Act defines compressed, liquefied and dissolved gases as dangerous goods of Class 2.

Inter alia the Act includes cylinders in the general definition of containers and requires under section 28 that all containers used or intended for use with dangerous goods must comply with any prescribed requirements. The Act does not apply within any defence area (as defined in section 2 of the Defence Act 1971). For practical purposes this provision is extended to include the filling and testing of cylinders for use in defence areas.

The current Act replaced the Dangerous Goods Act 1957.

1.3.3 Regulations

The requirements of the Dangerous Goods (Labelling) Regulations 1978 are described in section 4.2. Apart from that the current Regulations, are the Dangerous Goods (Class 2 - Gases) Regulations 1980, which came into effect on 28 March 1980.

Regulation 5(1) Quote “No person shall pack, transport, handle or store dangerous goods of Class 2 except in accordance with the provisions of these Regulations and in containers which comply with these provisions.”

Regulations Affecting Cylinders

The following notes summarise and paraphrase some of the regulations:

Reg 8(1)	All cylinders must be manufactured to a specification and design approved by the Chief Inspector.
Reg 8(2), 8(3)	All imported cylinders must be accompanied by certificates issued by an approved inspection agency. These certificates must be retained by the importer and produced when required.
Reg 8(4), 8(5)	Cylinders that do not meet with an approved specification or design must be withdrawn from service. The Chief Inspector may permit their continued use if an evaluation proves satisfactory.
Reg 9(1)	Pressure relief devices may be required.
Reg 11	Marking and labelling requirements.
Reg 12	Cylinders must be maintained in good condition.
Reg 13	The developed pressure of a permanent gas at 65°C must not exceed 85% of the test pressure.
Reg 14	Valves and fittings must comply with an approved specification. Valves for flammable gases shall have left-hand outlet screw threads unless otherwise approved by the Chief Inspector. Precautions to be taken against damage to valves. Valve caps are required for poisonous gases. Valves to be closed unless in use. Approved lubricants only to be used.
Reg 15	Cylinders must have been inspected and/or tested as required, at an approved testing station.
Reg 16	Defective cylinders must be destroyed.
Regs 17, 18,19	Filling of liquefiable gases.
Reg 20	Purity limits for carbon dioxide, nitrous oxide and ethylene.
Reg 21	Preliminaries to charging cylinders.
Regs 22, 23	Filling of chlorine and anhydrous ammonia.
Reg 36	Requirements for acetylene cylinders.

Regs 41, 42, 52,55,60,64, 65	Colour of LPG cylinders, storage at other than ambient temperature, storage and use of LPG cylinders.
Regs 84, 86, 88,89,90	Fittings, storage and use of chlorine cylinders.
Regs 93, 97, 98	Fittings, storage and use of anhydrous ammonia cylinders.
Regs 133- 136	Storage, disposal and sale, and repairs to used containers.
Reg 139	Penalties for failure to comply.

1.4 Glossary of Terms

The Act means the Dangerous Goods Act 1974, also referred to as the 1974 Act.

Chief Inspector means the Chief Inspector of Dangerous Goods as defined in the Act.

Inspector means an Inspector of Explosives and Dangerous Goods employed by the Occupational Safety and Health Service, Department of Labour.

The 1957 Act means the Dangerous Goods Act 1957.

The Regulations and any reference to Regulations by number (e.g. Regulation 11) means the Dangerous Goods (Class 2 - Gases) Regulations 1980.

Aerosol A dispensing container from which the product is discharged by means of a compressed or liquefied gas when its valve is opened. An aerosol container is an unfilled container intended for use as an aerosol.

Approved means approved by the Chief Inspector, unless the context is clearly otherwise.

Breathing Apparatus (BA, SCBA) Self-contained apparatus for the supply of breathing air to the wearer when in a noxious or hostile atmosphere. Does not include SCUBA.

'Billet Pierced' Cylinder One in which the base and walls are made in one hot forming process.

Cartridge A container for propane, butane, or LPG which is filled during manufacture and not intended to be re-filled. Known also as a one-trip or disposable container.

Critical Temperature The temperature above which a gas cannot exist as a liquid.

Cylinder A refillable container of not more than 250 litres water capacity which is used to store or transport compressed, liquefied or dissolved gases, (does not include an aerosol container or a cartridge).

Design Pressure The pressure used in the equations for designing the cylinder. This may be:

(a) service pressure;

(b) working pressure;

(c) developed pressure;

(d) test pressure;

(e) burst pressure;

depending on the specification.

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 pressure.

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 15^0C. Applicable only to permanent gases.

Filling Ratio The ratio of the mass of gas in the cylinder to the mass of water which would fill the cylinder at 15^0C (for liquefiable gases).

Fittings All valves, safety devices, gauges and other attachments that remain fixed to the cylinder at all times except when undergoing periodic re-inspection as required by Regulation 15.

High Pressure Liquefiable Gas A gas which has a critical temperature between the range of -10^0C to 70°C inclusive.

Liquefiable Gas A gas which is liquefiable by pressure at -10°C but which boils below 17.5°C when at a pressure of not more than 101 kPa.

Low Pressure Liquefiable Gas (a) a gas which has a critical temperature above 70°C; and (b) a toxic substance which is liquid at a pressure of 101 kPa at 0°C but which boils at or below 30^{0°C at that pressure.

Permanent Gas A gas which has a critical temperature below -10°C.

'Plugged' Cylinder One in which a permanent closure in the base of a finished cylinder has been effected by a plug.

Reference Temperature The temperature which, for calculation purposes, a gas is capable of reaching in service.

Self-Contained Underwater Breathing Apparatus (SCUBA) Self-contained apparatus for the supply of breathing air to the wearer whilst underwater.

Service Pressure Used for cylinders designed to DOT and CTC specifications as a pressure rating for the cylinder. Has no defined meaning for cylinders to other specifications.

'Spun' Cylinder One in which the end closure in the base of the finished cylinder has been forge welded by the spinning process.

Water Capacity The volume of water which would just fill the cylinder at 15°C. To be expressed in litres (or kilograms of water).

Working Pressure A non-preferred term whose definition may vary with each example. Unless otherwise defined, to be taken as the filling pressure for permanent gases (see 7.2).

1.5 Abbreviations

ABS	American Bureau of Shipping
ABSTECH	Worldwide Technical Services
ANCC (Italian National Code)	Associazione Nazionale per it Controllo della Combustion
AS	Australian Standard Specification
ASME	American Society of Mechanical Engineers
ASME Code	ASME Boiler and Pressure Vessel Code, Section VIII for the design of unfired pressure vessels
BA	Breathing Apparatus (not underwater)
BCGA	British Compressed Gas Association
BS	British Standard Specification
BTC	Board of Trade Commissioners (Canada) now replaced by CTC
BV	Bureau Vintas
CAN	Standards Council of Canada

CGA	Compressed Gas Association (of America)
CIG	Commonwealth Industrial Gases (Australia)
CNG	Compressed Natural Gas
CTC	Canadian Transport Commission
CTCo	Chesterfield Tube Company
DIN	Deutsche Industrie Norm (German Standard Specification)
DOT	Department of Transportation (USA)
DOT 3AA, etc	Refers to DOT specifications as set out in the Bureau of Explosives Tarrif or Code of Federal Regulations (CFR) 49
ICC	Interstate Commerce Commission (USA) now replaced by DOT
INTECO	International Inspection Company
IWK } IWKA }	Industrie-Werke Karlsruhe (Aktiengesellschaft)
JIS	Japanese Industrial Standard
LPG	Liquefied Petroleum Gas
NZS	New Zealand Standard
NZU	New Zealand Underwater
P&L	Permanent and Liquefiable Gases
SCBA	Self-Contained Breathing Apparatus, alternative designation for BA
SCUBA	Self-Contained Underwater Breathing Apparatus
SGS	Societe Generale de Surveillance
SISIR	Singapore Institute of Standards and Industrial Research
TELARC	Testing Laboratory Registration Council of NZ
TISTR	Thailand Institute of Scientific and Technological Research
TRG	Technische Regeln Druckgase (German Compressed Gas Regulations)
TU } TUV }	Technischen Uberwachungs Vereine (German Inspection Agency)
UL	Underwriters Laboratories Inc, IL

PART 2: PROCEDURES AND CRITERIA FOR APPROVAL OF CYLINDERS

2.1 General

Regulation 8 requires that all cylinders must be manufactured to an approved specification and design and be certified by an approved inspection agency. This means that the approval process has three distinct stages.

1. Approval of the specification.
2. Approval of the design.
3. Approval of the inspection agency.

Verification of compliance is also required.

2.1.1 Identification of Approved Cylinders

Items approved under the Dangerous Goods Act and the various Dangerous Goods Regulations are allocated a sequential number (e.g. LAB 060) which is then used as a reference for recording and publishing relevant information.

Every cylinder manufactured to an approved design is required to be permanently marked with the appropriate LAB number. This can then be used by Inspectors of Dangerous Goods and by cylinder filling and testing stations as the first step in identification of approved cylinders. Any cylinder marked with a LAB number must conform to the description shown in Supplement No. 1.

The LAB number reference system applies to cylinders manufactured or imported after March 1980.

2.2 Summary of Required Procedure

(a) Ensure that the proposal is to an approved specification, and that it will comply with the Act and the Regulations.

(b) Submit one copy of the design drawing and one copy of the design calculations to the Chief Inspector. Where there are a range of design factors permissible, the design factor used shall be provided, including the reasoning for its use. If the applicant wishes to have a copy of the drawing with a stamp of approval, then a second copy must be submitted. A standard condition of approval is the allocation of a reference, e.g. LAB 060, which must be stamped on every cylinder.

(c) Ensure that the inspection will be carried out by an approved agency and office. Note that an approved organisation does not necessarily have all its offices approved.

(d) Submit sample copies of the inspection certificates to the Chief Inspector as soon as possible. These certificates must be representative of the cylinders imported and must be submitted in approximately the following numbers:

NUMBER OF CYLINDERS IMPORTED IN ONE YEAR	CERTIFICATES TO BE SUPPLIED
0 - 100	Every cylinder
100 - 1000	10%
1000+	1%

NOTE: The importer must retain copies of certificates covering ALL cylinders imported.

The certificates must accompany or precede the cylinders into New Zealand. See also section 2.5.

2.3 Specifications

2.3.1 General

Cylinders, valves and other fittings must be manufactured to specifications which have been approved by the Chief Inspector. Lists of currently approved specifications for gas cylinders are given in Parts 9.2 and 9.3. These lists are believed to be adequate for New Zealand's needs. Applications for further specifications to be included on the approved list must show sufficient cause for doing so. Specifications will only be considered if they are in the English language, either originally or as an official translation published by the originating body. A copy of the specification must be supplied with any application.

2.3.2 DOT Specifications

The following policy has been adopted for all cylinders to DOT specifications:

1. Cylinders must be to a specification approved by the Chief Inspector. Currently approved specifications are listed in Part 9.
2. The service pressure must be such that the following conditions will be satisfied, denoting the various pressures as follows:

   P_S = Service Pressure

   P_E = Elevated Pressure (Developed pressure at reference temperature)

   P_T = T est Pressure

The reference temperature used by the DOT cylinder specifications is 130°F (54.4°C) (DOT 173.301(f)).

The reference temperatures for cylinders to be used in New Zealand are set out in the Regulations. These are reproduced and discussed in Section 2.4.2.

For approval in New Zealand, the value to be used for PE must be the developed pressure at the New Zealand reference temperature.

The ratio $\frac{P_E}{P_S}$ is required to be 5/4 (DOT 173.301(f)).

The ratio $\frac{P_T}{P_S}$ is is set out in the various specifications (typically 5/3 for DOT 3AA, 2 for DOT 4BW, see section 10.8).

From these two ratios may be derived the ratio $\frac{P_T}{P_E}$ (which will equal 1.33 or 1.60 in the examples above).

Example

$\frac{P_E}{P_S} = 1.25$

$\frac{P_T}{P_S} = 2$ (DOT 178.51 - 14(d))

Therefore $\frac{P_T}{P_E} = 1.6$

For LPG in cylinders the reference temperature is 57.5^0C (Regulation 6(a)) and the developed pressure for commercial propane at this temperature is 23.37 bar (2.337 MPa)

(BSD 5355: 1976, Table 7).

Therefore P_E = 2.337 MPa

P_T = 3.740 MPa

P_S = 1.879 MPa (271.2 psi)

For this reason DOT 4BA and DOT 4BW cylinders are to be designed for a minimum service pressure of 272 psi, i.e. DOT 4BA-272
DOT 4BW-272

(See also section 10.8 DOT Cylinders Specifications and Test Pressures).

2.3.3 ASME Code

ASME VIII pressure vessel code will be accepted as an approved cylinder design under the following conditions:

(i) Only allowed for special designs not covered by a standard on the approved list, e.g. Cryogenic.

(ii) Cylinders must be stamped with the ASME U-1 stamp.

(iii) Manufacturer to supply full supporting information including calculations and ASME certification.

2.3.4 Non-approved Specifications

A number of specifications which were previously approved have now been deleted from the approved list. These deleted specifications are listed separately, and cylinders complying with them which were imported while the approval was current, are deemed to be still approved.

The deletions have been made for a variety of reasons, e.g. a number of specifications may have been revised and amalgamated. Any specification that is still extant but has been deleted will be treated as a new application for approval purposes (see section 2.3.1).

2.4 Design Requirements

2.4.1 General

It should be noted that approval of a specification does not guarantee approval of the design. Most specifications provide for a range of conditions. Designs will not be approved unless they have made allowance for the reference temperature and developed pressure as described below.

Applications for design approval must include at least one good copy of the design drawing and a copy of any calculations that the specification requires. Further calculations may also be requested (e.g. for cylinder ends). The documentation must be complete, coherent, and adequately cross-referenced.

2.4.2 Reference Temperature

British Standard 5355: 1976 was based on the recommendations in the report (published in 1969) of the Home Office Gas Cylinders and Containers Committee.

Table 17 of BS 5355 shows New Zealand as being in climatic area Class A. This is the class with the lowest maximum shade temperature, apart from the United Kingdom.

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 to the gas, and convection distributes this heat.

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 liquid surface is higher than the mean bulk temperature. It is the liquid surface temperature that determines the vapour pressure, which is the pressure in the cylinder.

The Home Office committee used experimental data to derive relationships between maximum shade temperatures and the effective temperature of the containers when a cylinder was receiving solar radiation. These relationships were used to draw up Table 18 in BS 5355, from which were derived the reference temperatures given in the Regulations. Various modifications were made, e.g. to allow for the New Zealand distinction between containers of less than or more than 250 litres, and to allow for a degree of Trans-Tasman traffic. The reference temperatures for cylinders in New Zealand are:

- for low pressure liquefiable gases 57.5°C
- for high pressure liquefiable gases 55°C
- for permanent gases 65°C.

2.4.3 Developed Pressure

The pressure in a cylinder of a liquefied gas is the pressure of the vapour phase. This is dependent only on the gas composition and the temperature of the vapour and of the liquid surface, provided the cylinder has not been over-filled (see 7.3.4).

The pressure in a cylinder of a permanent gas depends on the gas composition, the temperature and pressure at which it was filled, and on the temperature which it reaches.

Tables from BS 5355: 1976 are used to establish the developed pressure for evaluation and approval purposes. The method of selection is discussed in Part 3 according to the gas in question.

2.4.4 Other Requirements

In addition to the requirements set out previously in this part, new designs must comply with the following:

GAS	DESIGN PRESSURE MPa	MINIMUM TEST PRESSURE MPa	MAXIMUM FILLING RATIO
Carbon dioxide		22	0.75
Nitrous oxide		20	0.75
Ethylene		18	0.325
LPG	2.34	3.3	0.444
Acetylene	1.55		

2.5 Inspection After Manufacture

Approval of a design does not automatically mean that cylinders may be used in New Zealand. The finished article must be certified as having been made to the correct specification, and the other details on the inspection certificate must accord with the approved design. The certificate must be issued by an approved inspection agency, must accompany or precede the cylinder into New Zealand and be retained by the importer for producing when requested (see Regulation 8). Certificates are to be retained for the life of the cylinder.

Lists of approved inspection agencies are contained in Supplement No. 2, which will be amended from time to time.

2.6 Transferred to 2.4.4

2.7 Examination in New Zealand

Representative copies of manufacturing and inspection certificates must be submitted to the Chief Inspector, approximately in the numbers listed in section 2.2. They will be checked to ensure that imported cylinders comply with the details of the approved design and any other conditions imposed.

2.7.2 Cylinder Samples

Regulation 8 gives the Chief Inspector the power to require cylinders to be examined for compliance with approved specifications or designs. Few such examinations had been carried out up until late 1982. At that timt some examinations showed that some aspects were not satisfactory; and, as a result, routine examinations have been instituted, and the following policy established.

Importers may be required at any time to make available for examination sample cylinders from any shipment. Samples will be selected randomly at a rate of approximately 1 in 200 by an Inspector, and will be examined at the importers expense by DSIR or a Telarc registered laboratory. The examination will be in accordance with one of the schedules from 2.7.4. The remainder of the shipment must be held at the point of importation until an inspector is satisfied that the samples comply in all respects with the approved design.

If the samples do not comply with the approved design (which includes compliance with the requirements of this publication) then all the cylinders in that shipment must be brought into compliance where possible; and, where this is not possible, every cylinder in the shipment must be rendered unserviceable, or re-exported to the country of origin.

2.7.3 Importation of Gas Cylinders

All imported welded or brazed cylinders are to be submitted, under the direction of an inspector, to an approved (Telarc registered) testing laboratory for examination in accordance with the schedule (in general, a cylinder testing station is to be used). Other cylinders, e.g. extruded, may be tested as directed by an inspector.

Importers are to make arrangements with an approved testing station for these examinations. All costs associated with this testing are to be borne by the importer or manufacturer.

1. The cylinder will be selected randomly at the required rate by an inspector.
2. If a visual examination only is called for, then the cylinders may be examined at the importer’s premises.
3. Arrangements must be made with an appropriate Telarc registered laboratory for any tests that are outside the certification of cylinder testing stations (such as tensile testing).
4. Testing stations are to submit to the inspector a summary of their examination in the form shown, within two weeks of the examination.
5. Shipments are not to be released by the importer for distribution or sale until the inspector has advised that the cylinders comply with the design specification including rectification where necessary.
6. If the samples cannot be deemed satisfactory, and the faults cannot be rectified, the testing station or the importer shall contact an inspector for further advice.

2.7.4 Testing Schedule

Schedule A (visual)

(a) General appearance, including welding, VPR, footring, etc.

(b) Marking and labelling in accordance with the guide.

(c) Check manufacturers' certificates.

Schedule B (non-destructive)

(a) Internal examination.

(b) Check tare and empty weight.

(c) Check water capacity.

Schedule C (destructive)

Destructive testing in accordance with the manufacturing specification, including tensile testing of the weld and parent metal, bend testing, etc.

The rate of testing will be determined by an inspector under the following guidelines:

(a) First shipment generally as follows, except where the manufacturing specification otherwise allows:

Schedule A: 1 in 200

Schedule B: 1 in 200

Schedule C: 1 in 500

(b) Second shipment, if the testing as above is satisfactory:

Schedule A: 1 in 200

Schedule B: 1 in 200

(c) Further shipments, if no further problems:

Schedule A 1 in 500

If later tests show problems, the rate of testing may be increased. If at any stage the inspector has reason to believe that there may be faults which would not be shown up by the prescribed tests, then additional tests will be required.

Examination of Gas Cylinders

Manufacturer	LAB number
Importer	Gas Traffic
Examiner	No. in shipment
Serial No. Range	
Samples: Schedule A	
Schedule B	
Schedule C	

Schedule A

External appearance good, symmetrical	Yes No
Welding apparently of good quality	Yes No
Valve protection adequate	Yes No
Surface finish, coating of good quality	Yes No
Markings clear and legible	
Match approval Correct units Accuracy	
Specification	
Test pressure	
Fill press (perm gas)	
Tare weight	

Empty wt (liquefiable gases)

Remedial action

Schedule B

Internal appearance good, symmetrical	Yes No
Welding apparently of good quality	Yes No
Internal surface good, no corrosion	Yes No
Neck thread satisfactory	Yes No

Dimensions

Approved
Marked
Measured
Acceptable
Outside diameter
Wall thickness
Tare weight
Empty weight
Water capacity

Certification

Do certificates match cylinders?	Yes No
Whole shipment covered by certificates?	Yes No

Approved
Quoted
Acceptable
Drawing number
Tensile strength MPa
Yield strength MPa
Elongation %
Identification of material

Schedule C

Measured Acceptable
Tensile strength MPa
Yield strength MPa
Elongation %
Weld bend test
Hydrostatic test AS 2337
Other (specify)

2.8 Cylinder Exemption Scheme

Cylinders manufactured post 1980 that do not comply with Regulation 8 of the Dangerous Goods (Class 2 - Gases) Regulations 1980 (in that they are not approved with a LAB approval number) may be approved under the Cylinder Approval Scheme under the following conditions:

(a) applicable to small quantities of the same cylinder;

(b) cylinders to be designed and manufactured to an acceptable standard;

(c) cylinders to be from an acceptable manufacturer,

(d) cylinders to be approved by an acceptable inspection authority;

(e) approval will be issued by the Chief Inspector or nominated representative only; applicant to supply full details of the cylinder manufacture, neck thread and any supporting manufacturers' information;

(f) cylinder to be stamped with approval number “LAB XXX SP” after approval; the number will be issued;

(g) a periodic test is required, including a full external and internal visual test and a hydrostatic stretch test;

(h) if considered necessary, measurement of the cylinder wall thickness will be required (e.g. by ultrasonic testing);

(i) these approvals may be withdrawn at any time by the Chief Inspector of Dangerous Goods.

Any cylinder approved as above but failing under test or in service is to be reported to the Chief Inspector. The cylinders as approved and their operation are to comply in all other respects with the Dangerous Goods (Class 2 - Gases) Regulations 1980 and the *Guide to Gas Cylinders.*

PART 3: TYPE OF GAS

3.1 General

The Act defines all gases as Dangerous Goods of Class 2, and further subdivides them as follows:

(a) Gases (other than those included under any other paragraph of this class) when compressed, liquefied, or dissolved under pressure.

(b) Ethane, ethylene, hydrogen, methane and any other flammable gas (other than that included under any succeeding paragraph of this class).

(c) Acetylene, compressed or dissolved, and contained within a porous substance.

(d) Liquefied petroleum gas, and any other liquefied flammable gas. (e) Chlorine.

(f) Anhydrous ammonia.

(g) Liquid oxygen.

Gases are also classified in the following way:

(i) Permanent gases - which have a critical temperature of less than -10°C .

(ii) High pressure liquefiable gases which have a critical temperature between -10° and 70°C.

(iii) Low pressure liquefiable gases - which have a critical temperature of more than 70°C. The class also is defined as including toxic substances that boil at 30°C under a pressure of 101 kPa.

3.1.1 Examples of Classification

CLASS	PERMANENT	HIGH PRESSURE LIQUEFIABLE	LOW PRESSURE LIQUEFIABLE
2a	Oxygen Nitrogen Air Helium	Carbon dioxide Nitrous oxide	Refrigerant gases
2b	Hydrogen Methane CNG	Ethane Ethylene	
2c		Acetylene	
2d			LPG Butane Propane
2e			Chlorine
2f			Anhydrous ammonia
2g	Liquid Oxygen		

3.2 Permanent Gases

3.2.1 General

The filling criterion for permanent gases is the cylinder pressure when both cylinder and gas are at 15°C. For further details see Part 7.

Permanent gases are so called because they liquefy only under extreme conditions of temperature and pressure. Once a cylinder has been filled, the pressure will increase if the temperature of the gas increases.

In normal service in New Zealand the gas temperature may reach 65°, but will only exceed this temperature under abnormal conditions (see section 2.4). The pressure at this temperature also will depend on the compressibility factor of the gas.

3.2.2 Filling Cylinders with Different Gases

Although normal practice is for each cylinder to be used for one gas, the design may be intended for use with more than one gas. In such a case the evaluation considers the gas which develops the highest pressure at 65° when filled at the stated pressure.

Approval of a design for use with permanent gases is usually (a) for CNG alone, or (b) for air alone, or (c) for all permanent gases except CNG and methane. In each case the type of use makes confusion unlikely. Considerations for each case are as follows:

(a) CNG

For evaluation purposes CNG is considered to be pure methane, which has the highest pressure of those gases listed in Table 31 of BS 5355. The standard approval pressure for storage of CNG is 24.8 MPa. The standard filling pressure for automotive use, previously approved by Explosives and Dangerous Goods Division, Department of Labour was 16.5 MPa. This was amended by the Road Transport Division, Ministry of Transport to the present rating of 20 MPa. All automotive cylinders now come under the jurisdiction of the Road Transport Division of the Ministry of Transport.

(b) Air

Approval of cylinders for use with air is only given when they are to be used exclusively with compressed atmospheric air, usually for breathing purposes. Cylinders for use in deep-water diving, to which helium is added, are not included in this category.

(c) Other Permanent Gases

Oxygen is second only to methane in Table 31 of BS 5355, and is therefore used as the basis of approval for cylinders that may be used with a range of permanent gases. In such cases CNG and methane are specifically excluded from the approval.

Exceptions

If one design is approved for use with more than one of the above categories, then the approved filling pressures may be different. In such cases each respective filling pressure stamped on the cylinder must have a suffix denoting the gas to which it applies (see section 4.3.6).

3.3 Liquefiable Gases

3 3.1 General

Liquefiable gases are so called because they can be economically liquefied under pressure at normal temperatures. This reduces their volume considerably and thus reduces the cost of storage and transportation.

All containers of liquefiable gases must have sufficient ullage (vapour space) that the liquid will not expand to fill the container at foreseeable temperatures. Provided this is so, the container pressure is the vapour pressure corresponding to the liquid surface temperature (see section 2.4).

Filling in every case is controlled by the filling ratio, although some dispensations have been granted (see section 7.3).

3.3.2 High Pressure Liquefiable Gases

Carbon dioxide, nitrous oxide and ethylene are the main commercial gases in this category. For each of them a maximum filling ratio and minimum cylinder test pressure have been prescribed (see section 2.4.4).

Although, in a scientific sense, acetylene is a high pressure liquefiable gas, its special properties require it to be considered on its own.

3.3.3 Low Pressure Liquefiable Gases

LPG and its components (principally propane and butane) are the most important members of this category. At the time of publication its components are used comparatively rarely. Filling is controlled by the filling ratio, except as set out in section 7.3.

Although the Explosives and Dangerous Goods division is responsible for approving gas cylinders, the composition of LPG is determined by commercial interests. Therefore, the Chief Inspector of Dangerous Goods and the Chief Engineer Surveyor, Marine division, Ministry of Transport have agreed that the values to be used for the developed pressure of New Zealand LPG are those for commercial propane given in Table 7 of BS 5355.

For LPG cylinders the design pressure is 2.337 MPa (see also section 2.3.2 and section 2.4.4).

Although, in a scientific sense, chlorine and anhydrous ammonia are low pressure liquefiable gases, their special properties require them to be considered in classes of their own.

3.4 Acetylene

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 cylinders 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 approved solvent in which the acetylene dissolves. The combination of these features allows acetylene to be contained in cylinders at moderate pressures.

3.5 Other Gases

3.5.1 Chlorine

Chlorine is a non-flammable low pressure liquefiable gas. Although non-flammable, it is capable of supporting the combustion of certain substances. The filling of cylinders is controlled by filling ratio.

3.5.2 Anhydrous Ammonia

Anhydrous ammonia is a low pressure liquefiable gas and at atmospheric temperature and pressure it is a colourless gas but is easily compressed to a colourless liquid. It is classified as a poisonous and flammable gas, that will burn in air between the flammable limits of 16% to 25% by volume. For some purposes (e.g. bulk transportation) it is considered as equivalent to LPG.

3.5.3 Liquid Oxygen

Oxygen stored in its gaseous form is classified as Class 2a. Oxygen has a critical temperature of -118°C and therefore must be kept below this temperature in its liquid form by using vacuum insulated containers.

PART 4: MARKING AND LABELLING

4.1 General Requirements

Every cylinder must be marked in accordance with the specification to which it has been designed and manufactured. Every cylinder must also be marked in accordance with the following requirements and, if necessary, such markings shall be in addition to those required by the specification.

4.2 Regulations

4.2.1 Permanent Markings

Regulation 11 of the Dangerous Goods Regulations 1980 requires the following:

(1) Every cylinder and portable tank shall be permanently and clearly marked, either on a thickened portion of the cylinder or tank or on a suitably attached metal plate with characters not less than 6 mm high if space permits, but in any case not less than 3 mm high, displaying the following information:

  (a) The specification to which the cylinder was manufactured.

  (b) The manufacturer's name or mark, and the serial number of the cylinder or portable tank.

  (c) The date of the original and of any periodical hydraulic stretch test, and the identification mark of the person or firm who made each test. (d) The test pressure in megapascals.

  (e) The charging pressure of the cylinder at 15°C, if it is intended to be used for permanent gases.

  (f) The water capacity of the cylinder, if it is intended to be used for liquefiable gases.

  (g) The tare weight, being the weight of the cylinder and valve (excluding any valve cover), if it is intended to be used for liquefiable gases.

  (h) The identification mark of any independent inspection authority.

(2) Cylinders charged with dangerous goods of Class 2 shall be legibly marked or labelled by the person compressing the gas with:

  (a) the name of the gas; and

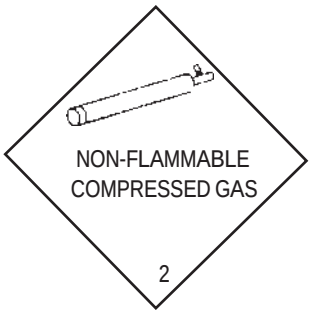
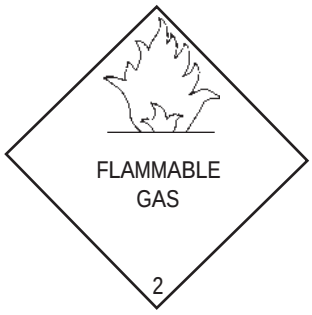
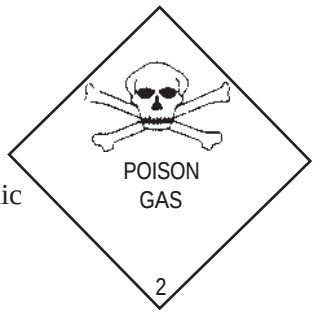
  (b) the name or approved identification mark of the charging station.

(3) No person shall obliterate, disfigure, remove or render illegible any identification label, marks, or colour scheme placed on or attached to any container by the person who compressed the gas into it for the purpose of designating the particular gas which the container contains.

4.2.2 Labels

The Dangerous Goods (Labelling) Regulations 1978 require the following labels:

GAS	MARKING	COLOURING
Nitrous oxide and oxygen of Class 2(a) Class 2(g)		Black lettering and symbol on yellow background

GAS	MARKING	COLOURING
Air, argon, helium, neon, nitrogen, carbon dioxide, non-flammable compounds of methane and ethane containing fluoride, chlorine, or bromine, and other non-flammable gases of Class 2(a)		Black or white lettering on green background
Acetylene, carbon monoxide, coal gas, ethane, ethylene, hydrogen, methane, butadiene, cyclopropane, and any other flammable gas of Class 2(b), 2(c) and 2(d)		Black or white lettering and symbol on red background
Carbon monoxide, coal gas, hydrogen chloride, hydrogen cyanide, hydrogen fluoride, hydrogen sulphide. methyl bromide, methyl chloride, sulphur dioxide and other toxic gases of Class 2.		Black lettering and symbol on white background

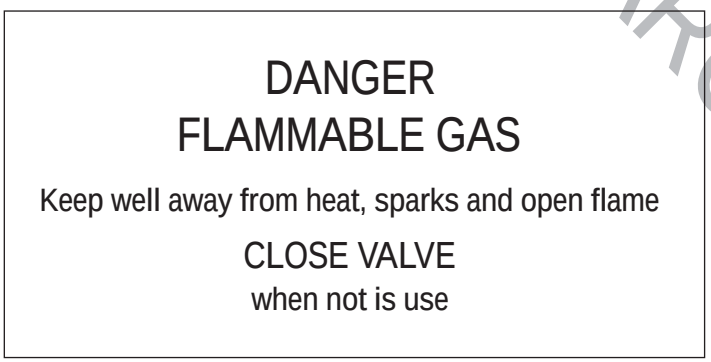
NOTE: For subsidary risk labels the Class number should be dropped from the bottom of the diamond.

Labels must be of such size as to readily attract attention. For cylinders of 20 litres capacity or greater, the minimum size is 100 mm x 100 mm.

Cylinders of 5 litres capacity or less used for class 2(d) (liquefiable gases, including LPG) are exempted from this requirement, but must comply with the following:

All cylinders for use with Class 2(d) gases must be labelled conspicuously and

legibly in the following form:



4.3 Interpretation of Regulations

4.3.1 Application

Regulation 11(1) and the following notes apply to all cylinders manufactured since March 1980. They do not apply to cylinders manufactured previously which had been approved, and which were marked in accordance with the approval. A general exemption has been granted by the Chief Inspector for cylinders that were approved under, or not covered by the 1958 Regulations, and which are not marked in accordance with the 1980 Regulations. Such cylinders may continue in service. This applies mainly to cylinders of less than 121b (5.4 kg) water capacity used for gases other than LPG.Cylinders that were not approved under the 1958 Regulations are still not approved.

4.3.2 Units of Pressure

The Regulation requires the test pressure to be marked in kPa and does not specify the units for the charging pressure for a permanent gas. The choice of kPa as the unit of pressure was intended to avoid the proliferation of units such as psi and kg/cm2. The use of MPa is deemed to be in accordance with this policy and is an acceptable alternative. Pressures in MPa are to be marked to one decimal place.

It is now a standard condition of approval that the charging pressure for a permanent gas be marked in kPa or MPa.

Test pressure is to be denoted by the abbreviation TP. Filling pressure for permanent gases to be denoted by WP. Also see the definition of working pressure.

4.3.3 Units of Capacity and Weight

For uniformity cylinders should be described by their water capacity in litres (rather than, for example, the gas capacity in m3 or the LPG capacity in kg). The cylinder marking of the water capacity should be in litres or kg (the units are effectively the same since 1 litre of water has a mass of 1 kg).

It is now a standard condition of approval that weights are marked in kg.

4.3.4 Marking of Tare and Empty Weight

Regulation 11 requires that cylinders for use with liquefiable gases be marked with “The tare weight, being the weight of the cylinder and valve”. This conflicts with the requirement of some standards, and may also present difficulties if the cylinder manufacturer has no control over the choice of valve.

The following definitions are to apply:

Tare weight means the weight of the cylinder shell, with all removeable fittings removed.

Empty weight means the weight of the cylinder complete with its valve and any other fittings or appurtenances that are normally on the cylinder when it is being filled.

It has been deemed acceptable for the empty weight to be marked on a loose "collar" retained by the valve. This collar and its markings must be durable, and protected from accidental damage in service; and must be easily read when installed.

The tolerance for empty weight shall be +1 %/-1 % and shall be worked to three significant figures unless specified to a tighter tolerance under the design specification.

4.3.5 Summary of Abbreviations and Units

INFORMATION	PREFERRED ABBREVIATIONS AND UNITS		PERMITTED ABBREVIATIONS AND UNITS	
Test Pressure	TP	MPa	T	kPa
Charging Pressure (filling pressure at 15°C)	WP	MPa	FP, F	kPa
Water Capacity	WC	kg	V	litres
Tare Weight (shell only)	TW	kg	T	-
Empty Weight (including valve, etc.)	EW	kg	E	-

4.3.6 Suffixes

If a design of cylinder has been approved for use with more than one category of permanent gas (see section 3.2) and is intended for such use, then the approved filling pressures must be stamped on with a suffix denoting the category.

The approved suffixes are:

CNG	denotes the filling pressure for CNG only
AIR	denotes the filling pressure for atmospheric air only
OXY	denotes the filling pressure for any permanent gas other than CNG or methane

4.3.7 Labelling by Filling Station

Part of the filling procedure for all gases includes ensuring that the name of the gas and the name or approved mark of the filling station are stated on the cylinder. The preferred method is by means of an adhesive label, which may, if desired, incorporate both requirements.

4.3.8 Marking and Labelling by Testing Station

4.3.8.1 After Inspection

Section 8.1.1(v) requires a cylinder to be tagged or labelled if it is inspected but not tested. The tag or label shall clearly identify the testing station and the month and year of inspection (e.g. 8M90 in letters 6mm high). For small cylinders 3mm may be used. The tag or label must be durable, corrosion and abrasion resistant and not easily detached from the cylinder.

The tag or label may be one of the following:

(a) plastic non-removeable tag such as those available from the New Zealand Underwater Association;

(b) non-ferrous (preferably aluminium) loose "collar" retained by the valve;

(c) disc or label of non-ferrous metal or durable plastic fastened to the valve by a non-removeable plastic fastener or other approved method;

(d) approved adhesive label.

4.3.8.2 After Testing

Regulation 15 requires a cylinder to be stamped on the neck end with marks and figures indicating the testing agency and the date. For cylinders that do not have a thickened shoulder the stamping may be done on one of the following (in order of preference):

(a) Valve shroud (variously•called neck ring, valve protection ring, etc) if it is permanently attached.

(b) Foot ring, if it is permanently attached.

(c) A special plate fitted by the manufacturer for the purpose.

If none of the foregoing are possible, then the matter should be referred to the Chief Inspector.

The stamping must be legible and shall be in the form-month mark year (e.g. 8M90). The letters shall be 6 mm high, except that 3 mm letters are permitted for small cylinders.

4.3.9 Markings on Cylinder Wall

Some SCUBA cylinders manufactured circa 1982 were marked by the importer with their approval reference (LAB 137) on the side wall (cylindrical part) of the shell. This was discovered before all of those cylinders had been distributed, and samples were taken for examination by DSIR. The conclusion was that the depth of marking was such that the remaining wall thickness in every case exceeded the minimum design thickness; and the cylinders were therefore permitted to remain in, or to enter, service.

This is the only current exception to the general rule that marking (stamping) on the side wall is not permitted.

4.4 Contents Identification by Colour

The primary means of identification of the contents of a cylinder must be by means of a label. As a secondary means of identification the cylinders may be colour coded. The colour coding should conform to one of the following, in order of preference:

For industrial gas cylinders:

1. NZS 5807: 1980
2. AS 1943 - 1976
3. BS 349: 1973

For medical gas cylinders:

1. NZS 7101: 1981
   (being identical to BS 1319: 1976)
2. AS 1944 - 1976

NB: LPG cylinders over 5 litres water capacity are required to be finished in white paint or some other light-reflecting coating (Reg 41).

4.5 Alterations to Marks or Labels

Regulation 11(3) makes it an offence to tamper with marks or labels. The only current exceptions to this are:

4.5.1 BS 1045 cylinders may be upgraded to BS 1288 (see 10.11) by an approved testing station.

4.5.2 Weight and capacity markings may be corrected (or updated) by an approved testing station.

In each case original markings are to be deleted by a line running through them that does not render them illegible.

No other alterations to markings may be made without specific approval from an Inspector of Explosives.

PART 5: NECK THREADS, VALVES, FITTINGS AND LUBRICANTS

5.1 Cylinder Neck Threads

5.1.1 Preferred

Neck threads permitted or preferred are as follows. It should be noted that threads currently preferred may become a requirement in the future.

1. 0.715", 1", 1.25" 1 in 8 taper on diameter to BS 341 or AS B240, AS 2473	First preference for all cylinders
2. 3/4" - 14 NGT (NPT, NPTF)	Permitted for LPG, acetylene cylinders
3. 3/8" - 18 NGT	Permitted for small acetylene cylinders
4. 3/4" - 14 NPSM	Permitted for cylinders used for underwater breathing apparatus
5. M14 x 1.5	Permitted for PRIMUS LPG cylinders
6. 3/8"	Permitted for CADAC LPG cylinders

NOTE: The above policy may be subject to annual review. Representations, complete with supporting evidence, should be made to the Chief Inspector.

5.1.2 Non-preferred

Non-preferred threads may be permitted in accordance with the following guidelines. All such cases, if approved, must have the neck thread identified on a perforated disk of aluminium or stainless steel retained by the valve.

(a) Normally fitted to or forming part of a specific distribution system which requires special purpose valves, e.g. large diameter quick acting.

(b) Normally fitted as an integral part of a special purpose item of plant or machinery. “Normally” in the foregoing means that the cylinder is not used for any other purpose, and is only removed for filling or testing.

(c) Used with special purpose equipment for which interchangeability is essential, and the use of which is well established in New Zealand or internationally.

Non preferred neck threads have been permitted in the following cases:

THREAD	REFERENCE	USE
1“ NGT	LAB 092	Large LPG cylinders for marine lights. Installed C02 fire extinguishing systems
3/4" NGT	LAB 015, 019a, 025	CNG cascade cylinders imported before 1981
	LAB 388	Composite steel/fibreglass cylinders for CNG bulk transportation
	LAB 142	Ex-CNG cylinders for helium and helium/air mixtures

1/2" NGT	LAB 279	Small steel cylinder for resuscitation kits
1/4" NGT	LAB 199	Ammonia cylinder normally fitted to plan printing machine
1.125" UNC	LAB 282,283	Composite aluminium/fibre glass cylinders for CNG bulk transportation
1.125" UNF	LAB 181	Composite aluminium/fibre glass cylinders for BA
0.875" UNF	LAB 180	Composite aluminium/fibre glass cylinders for BA
3/4" UNF	LAB 160	Small aluminium cylinders for resuscitation kits
	LAB 250	Small aluminium cylinders for beverage dispenser
DIN 477	LAB 292	Oxygen cylinders for Draeger BG 174 mines rescue sets
	LAB 093	Oxygen cylinders for Laerdal resuscitation sets
	LAB 377	C02 cylinders for Firefly explosion suppression system at AFFCO
1 “ NGT	LAB 266	Showakoatsu C02 cylinders. Installed C02 fire extinguishing systems

5.2 Valve Specifications

Accidentally connecting a compressed gas cylinder valve outlet with equipment not designed for the gas contained in the cylinder may result in serious hazards. Because of this, standard valve outlet connections have been established for valves used with cylinders containing the different gases. These standard connections are made so that the valve connection for one gas will not fit the connections prescribed for other incompatible gases. Standard valve outlet connections thus help to protect personnel and equipment.

5.2.1 Inlet (Stem) Specifications

Cylinder valve stem threads must conform to the criteria for cylinder neck threads set out in section 5.1.

5.2.2 Outlet Specifications

Except as specified in 5.2.3, outlet connections must comply with one of the approved specifications listed in section 9.4.

5.2.3 Alternative Outlets

5.2.3.1 Specialised designs of valve outlets have been developed for certain types of use. Valves conforming to standard practices for each type of use are deemed approved. Such types of use include:

- portable fire extinguishers;

- resuscitation kits and other portable medical uses; and
- cylinders which are part of installed systems.

5.2.3.2 Right hand external threads are permitted on small acetylene cylinders, in accordance with CGA Connections No. 200 and No. 520.

5.2.3.3 LPG cylinder valves as specified in 5.2.4.

5.2.4 Permitted Outlet Connections for LPG Cylinder Valves

5.2.4.1 Cylinders manufactured or imported after March 1980. The only outlet connections permitted are:

M14 x 1.5 RH Internal (Primus)	} For cylinders of
(14 mm ISO metric)	} less than 25 litres
3/8" BSP RH Internal (Cadac)	} water capacity only
3/8" BSP LH External (Companion	}
Snap-on connector (Kosangas type	}
or similar approved adaptor)	}
.885" - 14 NGO LH Internal (POL)	All sizes of cylinder
1-1/4" - Acme RH External	Forklift cylinders only

5.2.4.2 Cylinders manufactured and imported before March 1980.

The outlet threads listed above are the preferred threads. The Chief Inspector has now granted a dispensation permitting the use of other outlet threads on cylinders of less than 25 litres water capacity. Such cylinders and their valves must be in good condition, and must meet the other approval criteria set out in this publication. The use of non-preferred outlet threads is to be discouraged, and the wording of the dispensation does not permit the installation of new valves with non-preferred outlet threads, even as a replacement for similar worn-out valves.

5.2.4.3 Cylinder Valve Adaptors

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

(a) the adaptor is permanently fitted to the valve in a tradesmanlike manner in accordance with approved manufacturers' installation instructions; and

(b) the adaptor outlet connection is one of those listed in section 5.2.4.1 above.

The manner of fitting an adaptor should not prevent removal of the valve from the cylinder. Testing stations should accept no liability for damage to valves fitted with adaptors, when they are removed for internal inspection of the cylinder.

5.3 Valve Protection

Appropriate precautions must be taken at all times to protect valves against damage.

Burst discs and other pressure relief devices should operate at a pressure not less than the developed pressure, and not more than the test pressure when tested in range 60°F - 160°F, (and preferably less than 90% of test pressure).

In cases not covered by the foregoing, safety devices may be fitted in accordance with AS 2030 or CGA Pamphlet S-1.1, when tested in range of 60°F - 160°F safety devices may be fitted to the cylinder itself or incorporated in the cylinder valve.

5.4 Valve Removal and Replacement

Valves should only be removed and replaced by persons who have sufficient competence and experience and who have purpose-designed equipment for doing so. Lubricants must not be used unless they have been approved, see section 5.7.

On replacement, valves should be torqued to the figure recommended by the manufacturers. If this cannot be ascertained, a value determined by consensus between experienced persons may be used. Failing this, the Chief Inspector should be consulted.

A guide to suitable torques is given in Section 5.4.1.

5.4.1 Cylinder Valving Torques

The following table of valving torques is offered for guidance only. It has been compiled from various sources and should only be used when no other information is available.

THREAD	TORQUE			
	MINIMUM N-rn	Ft-lb	MAXIMUM N-rn	Ft-lb
Steel Cylinders, 2-1/2 turns PTFE tape				
1/2" NGT	108	80	122	90
0.60" BS 341	136	100	149	110
0.735" BS 341	136	100	149	110
3/4" NGT	200	150	312	230
1.0" BS 341	325	240	380	280
27.8 DIN	352	260	380	280
27.2 S.I.	352	260	380	280
1"NGT	339	250	352	260
1-1/4" BS 341	488	360	515	380
Aluminium Cylinders				
All threads	100	75	110	80

5.5 Safety Devices

5.5.1 Requirements

The Chief Inspector requires acetylene, LPG and CNG cylinders to be fitted with safety devices. It is now recommended that all cylinders used for non-toxic gases be fitted with a safety device, and requirements may be introduced as a result of a future review.

If a safety device is fitted, it is extremely important that it be fitted correctly; using matched components from the same manufacturer and fitting in the correct order and with the correct torque. Ideally, safety devices should be pre-assembled by the manufacturer. Any variation from the correct assembly can result in gross variations from the intended operating conditions.

- they must not release the cylinder contents under normal conditions;
- maximum operating pressure shall be below the test pressure;
- they must operate in case of excessive heat and/or pressure to prevent the cylinder bursting.

5.5.2 Suggested Parameters

(a) Fusible plugs (whether alone or in combination with burst discs) should have an effective operating temperature not greater than 105°C.

(b) Burst discs and other pressure relief devices should operate at a pressure not less than the deleoped pressure, and not more that the test pressure when tested in range 60^0F - 160^0F (and preferably less than 90% of test pressure).

In cases not covered by the foregoing, safety devices may be fitted in accordance with AS 2030 or CGA Pamphlet S-1.1, when tested in range of 60^0F-160^0F. Safety devices may be fitted to the cylnder itself or incorporated in the cylinder valve.

5.6 Marking of Valves and Fittings

(i) Valves must be permanently marked in accordance with the standard to which they have been designed and manufactured.

(ii) Safety devices must have marked on them the pressure or temperature at which they have been designed or set to operate.

(iii) Alternatively safety devices may be identified by a code letter, number or symbol, or by some similar means; provided that the key to such code be made available to approved cylinder testing stations. Supply of this key shall be the responsibility of the importer.

5.7 Lubricants

Lubricants must not be applied to any valves unless they have been approved. The application of incorrect lubricants could cause accelerated corrosion of the valve or cylinder or a violent reaction with the gas. Approved lubricants are listed in section 9.5.

PART 6: TRANSPORTATION, STORAGE AND USE

6.1 General

Cylinders must at all times 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. In addition some gases store a considerable amount of chemical energy, and may react chemically with the environment. In either case the chemical energy will augment the mechanical energy and increase the violence of the release.

6.2 Cylinder Attitude

Cylinders should be stored, handled and used in an upright attitude wherever possible, unless they have been specifically designed for horizontal use. Most general purpose LPG cylinders are designed for use in an upright attitude, and must be used in this way.

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

Cylinders must be secured when transported. The preferred method is by retaining them using straps, in suitable baskets, standing upright. Adequate precautions must be taken to protect valves during all handling and transportation.

Cylinders that are transported in a horizontal attitude must be securely chocked or otherwise restrained to prevent them from rolling. No part of the cylinder or valve should project beyond the edges of the transporting vehicle. The vehicle must have side and end panels or gates, and cylinders shall not be stacked higher than these panels or gates.

6.4 Care and Maintenance

The regulations prohibit the charging of a cylinder unless it is in good condition. Adequate precautions must be taken to prevent damage to cylinders during transportation, handling, storage or use.

NOTE: Where the cylinder design caters for valve protection caps, these must be fitted. Protective coatings must be maintained in good condition.

6.5 Storage

Cylinders shouldd be stored with their valves closed and should be protected from the weather. There are a number of restrictions on the quantity and types of gas that may be stored, advice on which is available from Explosives and Dangerous Goods inspectors, Occupational Safety and Health Service.

6.6 Repairs to Cylinders

Repairs to cylinders must be approved in writing by the Chief Inspector of Dangerous Goods. In this context, ‘repairs’ means any work on the cylinder shell including mechanical manipulation (e.g. removal of dents), application of heat, re-cutting of neck threads,

etc. If such repairs are contemplated, full details of the proposed procedure must be submitted to the Chief Inspector.

Provision for repair in some specifications generally applies to repair of defects discovered during manufacture. Where the provision can be interpreted as meaning repair after a period in service, such repair must comply with all other provisions in the specification, including inspection by an approved agency.

PART 7: FILLING OF CYLINDERS

7.1 General

7.1.1 Preliminary Examination

Before filling a cylinder, the person doing so must ensure:

(a) the cylinder is approved and has been tested within the specified period;

(b) the cylinder marking and labelling are clear and correspond to the gas to be filled;

(c) the test pressure is appropriate for the filling conditions;

(d) the valve is suitable and in good condition;

(e) the safety devices are in good condition; (f) the cylinder is in good condition.

7.12 Non-approved cylinders

A cylinder that has not been approved by the Chief Inspector may be filled provided that the following conditions are complied with:

(a) The cylinder is to be used on a vessel or aircraft and is acceptable to Marine or Civil Aviation Division of Ministry of Transport; or is to be used in a Defence Area by Defence personnel.

(b) The cylinder is currently in test within the period required by New Zealand Regulations.

(c) Conditions 7.1.1(b) to (f) inclusive are complied with.

(d) The person responsible for filling the cylinder must be satisfied that the cylinder, when filled, will be taken immediately to a ship, boat or plane.

7.1.3 Post-filling Procedure

Regulation 11 (2)(b) requires the cylinder to be labelled with the name or approved identification mark of the charging station. See section 4.2.1 and 4.2.2.

Regulation 64 requires containers for Class 2(d) (which includes LPG) to be checked for leaks by soaping the valves or immersing the cylinder and valves in a water bath. Welds should also be checked for leaks.

7.2 Filling Conditions for Permanent Gases

7.2.1 Filling Pressure

Cylinders approved for use with permanent gases must have the filling pressure marked on them. This filling pressure is the maximum permitted pressure in the cylinder when the cylinder, gas and ambient temperatures are all at 15°C. Such an event will rarely occur in practice and the pressure should be adjusted to compensate.

In addition to this adjustment, a further adjustment is necessary to compensate for the pressure increase resulting from the heat of compression during filling. In order to make these compensations and comply with the Regulations, the following procedure should be carried out periodically.

1. Check the ambient temperature.
2. Fill a cylinder to a pressure, based (by experience) on this temperature and the permitted filling pressure.

3. After filling, put the selected cylinder to one side after recording the ambient temperature and filling pressure.
4. After a lapse of at least 24 hours check the ambient temperature and the cylinder pressure.
5. Convert the pressure to the corresponding pressure at 15°C using table 7.2 for air or similar tables for other gases.
6. The difference between the figure thus obtained and the permitted filling pressure represents the under or over-filling. The variations should be recorded and used to build up the experience required in Step 2.
7. Check the temperature of the shell of the cylinder with a probe thermometer and check the cylinder pressure. Convert to the corresponding pressure at 15° C.

Table 7.2: Settled Pressure of Air

FILLING PRESSURE		PERMITTED FILLING PRESSURE TEMPERATURE °C					
psi	MPa	5.0	10.0	15.0	20.0	25.0	30.0
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

7.3 Filling of Cylinders with Liquefiable Gases

7.3.1 Weight Control of Filling

Regulation 17 requires the filling of cylinders with liquefiable gases to be controlled by weight unless the Chief Inspector has approved otherwise (see 7.3.2). The final check required is to weigh the cylinder on scales which have been approved under the Weights and Measures Act and by an Inspector of Dangerous Goods. The gross weight (as read on the scales) minus the tare weight (as marked on the cylinder) divided by the water capacity must be equal to or less than the permitted filling ratio, i.e:

Gross weight must be less than or equal to

(Filling ratio x water capacity) + tare weight (as defined in 4.2.1 (g))

The foregoing requirements on controlling the filling by weight does not prevent the use of a dip tube or fixed ullage gauge as an additional aid for cylinders of 25 litres or less. Similarly a continuous check on the weight during the filling process must be carried out with the filling line and fittings accurately counter-balanced.

7.3.2 Ullage Control of Filling

The only currently approved conditions under which the filling of cylinders may be controlled by dip tube or fixed ullage gauge are as follows:

1. (a) The cylinder is of the forklift type*;

   (b) The cylinder is properly mounted on the vehicle, which is standing on level ground; or

   (c) Filled in a manner which has been approved in writing by the Chief I Inspector.

*Forklift cylinders are defined in section 3.5

2. Any approved fixed installations complying with the Regulations.

7.3 3 Requirements for Particular Gases

(i) Carbon dioxide

A maximum filling ratio of 0.75 and a minimum cylinder test pressure of 22 MPa are specified in Regulation 19. Dispensations have been granted for the filling of some cylinders which were imported before March 1980, which have a lower test pressure. This has included the condition that the filling ratio be a maximum of 0.667 (see 10.7). Cylinders that are to be used outside New Zealand (e.g. on board ships) should generally be filled to a filling ratio of 0.667. This is because they may experience temperatures far higher than those in New Zealand.

(ii) LPG

The composition of LPG has varied in the past and may vary again. Therefore, the filling ratio for propane (0.444) is to be used as a standard. The only permitted depar ture from this is where 100% butane is being filled, in which case the filling ratio for iso-butane (0.508) may be used.

7.3.4 Consequence of Over-filling

If a cylinder is over-filled, then the expansion of the liquid as the temperature increases may cause the cylinder to become “liquid-full”, i.e.with no remaining ullage space. If the temperature continues to rise, the pressure in the cylinder will rise disproportionally. If there is no safety relief valve, or it fails to operate, the cylinder may burst after only a small rise in temperature.

7.4 Filling Stations

The persons in charge of a filling station must ensure that the requirements of the Regulations and this publication are complied with.

The filling and storage areas must be kept orderly and tidy and must comply with any specific requirements. For example, Regulation 60 sets out requirements for liquefiable flammable gases, which includes LPG.

In order to comply with the requirements for preliminary examination each filling station will need to have a copy of each of the following:

(i) The list of approved cylinders.

(ii) The list of approved testing stations and their registered marks.

(iii) The list of currently approved and previously approved specifications.

In addition, it is recommended that every filling station have a copy of the Regulations readily available.

PART 8: PERIODIC INSPECTION AND TESTING

8.1 Required Procedures

For the purposes of this part, the following descriptions apply.

8.1.1 An inspection is to be carried out at an approved testing station and consists of the following:

(i) Identification of the cylinder (see section 8.7).

(ii) Removal of any external attachments such as mounting straps. (iii) External examination in accordance with AS 2337.

(iv) Unless otherwise specified, removal of the valve* and internal examination in accordance with AS 2337.

(v) Unless the inspection is followed by a test, the cylinder shall be tagged or labelled (see section 4.3.8).

(vi) Preparation of a test report for the owner (see section 8.6.2).

8.1.2 A test is to be carried out at an approved testing station and consists of the following:

(i) An inspection as described above, including removal* of the valve without exception.

(ii) A hydrostatic stretch test in accordance with the cylinder specification or with AS 2337 and AS 2030. Unless otherwise instructed, the test is to be at the marked test pressure.

(iii) Stamping of the cylinder (see section 8.6.3).

(iv) Preparation of a test report for the owner (see section 8.6.2).

If, when the valve is replaced, there is any cause to suspect the tightness of the seal or joint, a leak test should be carried out using soapy water.

*NOTE: Removal of the valve is to be done at the testing station, unless otherwise approved by an Inspector of Explosives and Dangerous Goods.

8.2 Inspection and Testing Periods

All cylinders are required to be inspected and tested after manufacture and then at intervals throughout their life. The original inspection and test confirm that the cylinder complies with its stated specification. Copies of the certificates are checked to ensure that the cylinder also complies with the approved design.

Subsequent periodic inspections and tests check that the cylinder is still in good condition. These inspections and tests must be in accordance with the cylinder specification or with AS 2030.

Notwithstanding anything to the contrary in the cylinder specification or AS 2030, the following maximum intervals between tests must be observed (refer Regulation 15).

CONTAINED GAS, OR USE OF CYLINDER	PERIOD
LPG (see Note 1)	10 years
Breathing apparatus (except Scuba) (Note 2)	5 years
SCUBA cylinders	1 year (Note 3)
Fire extinguishers	(see 8.3)
Cylinders not more than 40 years old and used exclusively for the gases listed below in a dry state	(Note 4)
Air Argon Cyclopropane }	
Ethylene Helium Hydrogen }	
Krypton Neon Nitrogen }	10 years
Nitrous oxide Oxygen Xenon and mixtures of the above containing less than 30% by volume of carbon dioxide }	
Any cylinder not included above	5 years
Fibre-wrapped composite cylinders	(Note 3)

NOTE 1: Automotive LPG fuel tanks are required by the Ministry of Transport to be tested every 10 years (under review).

NOTE 2: Self contained portable breathing apparatus for use in hostile atmospheres.

NOTE 3: Dive (SCUBA) cylinders and fibre reinforced plastic (FRP) aluminium alloy hoop overwrapped cylinders must be inspected annually and hydraulically tested not less than once every two years (see section 11).

NOTE 4: Regulation 15 defines a dry gas as having a dew point below -40°C.

8.2.1 Date of First Retest

Irrespective of the type of service, and therefore the required retest period, the interval before the first retest starts from the date of manufacture. For example, an aluminium SCUBA cylinder manufactured in June 1983 is due for retesting June 1985 even if it is not used until (say) December 1984.

The practice of restamping unused cylinders at the time of their sale is not permitted.

8.2.2 Air Storage Cylinders - Retest

The 10 year retest cycle permitted under Regulation 15 and described in Section 8 of the Guide to Gas Cylinders is applicable only to LPG and to dry gases. Atmospheric air compressed into any cylinders, incln ring those used by BA and SCUBA filling stations, is n i a dry gas; and such cylinders must therefore be retested in accordance with section 8.2.

The only exception would be if a drier is incorporated between compressor and cylinders, and regular checks for dryness are carried out.

8.2.3 CNG Cascade Cylinders

For the same reasons as in 8.2.2 CNG cylinders are to be retested at 5 yearly intervals. 8.3 Fire Extinguishers

8.3.1 General

CO2 fire extinguisher cylinders are to be hydrostatically stretch tested in accordance with the requirements of section 8.1.2 of this guide.

Fire extinguishers other than CO2 types, such as dry chemical, halon, (refer NOTE be low) water and foam units, are approved for proof testing with all other aspects (e.g. reports) in accordance with the requirements of this guide.

Existing test stations are required to be approved with respect to proof testing, by TELARC, before they can carry out this type of test.

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

Similarly, there are no legal requirements for pressure testing hoses and operating heads that make up the completed extinguisher. These components come under similar pressure as the extinguisher cylinder and therefore, in the interests of safety, it is recommended they are tested in the same manner.

For extinguishers that are used in marine vessels or on aircraft, refer to section 10.1 and the Shipping Fire Appliance Regulations 1969. Note, the ship fire extinguishers are required to be tested at no greater than 4-yearly intervals.

If there is no apparent manufacturing or previous test date, the cylinder shall be considered due for test.

If there is no unique identifying mark (e.g. a serial number), a recorded sequence must be set up and used to identify the cylinder. This serial number shall be permanently marked on the cylinder and may be the test report number prefixed by the authorised test station mark.

8.3.2 Scope

The extinguishers included in this section are of the sizes and types described in NZS 4508, NZS 4551 and NZS 4506.

Refer to the following documents:

NZS 4503	*Specification for the distribution, installation and maintenance of hand-operated fire fighting equipment.*
NZS 4506	*Specification for portable fire extinguishers of the water, foam and dry powder type*
NZS 4508	*Specification for portable carbon dioxide fire extinguishers.*
NZS 4551	*Specification for portable fire extinguishers of the halogenated hydro carbon type (See NOTE: Ref 8.3.1)*
AS 2030.1:	*Cylinders for compressed gases other than acetylene.*
AS 2337.1:	*Gas cylinders test stations, inspections and tests*

The following definitions apply:

Portable Fire Extinguishers

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

Fixed Extinguishers

An extinguisher that forms part of a fixed system and is only required to be removed for servicing purposes. It may be stored pressure or gas cartridge operated.

Gas Cartridge

A vessel containing, under pressure, a charge of suitable gas sufficient to expel the extinguishing medium. The gas may be of liquefiable or non-liquefiable type. The cartridge is normally fitted into the discharge head of the extinguisher.

Stored Pressure Extinguisher

An extinguisher with expellant gas and extinguishing agent stored in a single chamber such that the extinguisher is always under pressure, discharge being controlled by the shut off valve.

Cartridge Operated Extinguisher

An extinguisher where the expellant gas is stored in a separate gas cartidge located within or adjacent to the cylinder shell containing the extinguishing agent. This gas is only released when the extinguisher is oeprated to expel the agent.

8.3.3 Testing

8.3.3.1 Test Periods

All cylinders are to be hydrostatically tested at intervals in accordance with the current legislation.

8.3.3.2 Stretch Testing

All CO_2 extinguisher cylinders (or CO_2 gas cartridges) over 500 cc shall be periodically hydrostatic stretch tested in accordance with this guide (see 8.1.2).

The above also applies to any other type of extinguisher cylinder (or gas cartridge) with a design specification that calls for hydrostatic stretch tests.

8.3.3.3 Proof Testing

All other fire extinguishers shall be periodically proof pressure tested in accordance with AS 2337.1, using a non-water jacket test rig.

If Test Pressure is not Marked on Cylinder

The periodic test pressure of the fire extinguisher cylinder shall be 1.5 times the working pressure or 2000 kPa, whichever is the greater.

If Test Pressure is Marked on the Cylinder

The periodic test pressure of the fire extinguisher cylinder shall be the lesser of:

(a) marked test pressure;

(b) 1.5 times working pressure, but in any case not less than 2000 kPa.

NOTE: The internal and external examination of the cylinder in accordance with AS 2337 shall be done prior to the proof test, or stretch test.

8.3.3.4 Safety Provisions

Because the fire extinguisher cylinders designed for proof testing are usually thinwalled, it is recommended that suitable safety provisions be provided.

Where operating heads, and hose assemblies are tested separately from the extinguisher, the same or similar safety measures, shall be provided to protect the operator.

8.3.4 Failed Extinguishers

8.3.4.1 General

An extinguisher cylinder that fails on inspection or test shall be rejected (refer section 8.9).

8.3.4.2 Repairable Cylinders Refer to section 6.6.

8.3.5 Passed Extinguishers

8.3.5.1 Extinguisher Cylinders

Cylinders that pass the proof pressure test shall have the test information recorded on an approved metallic adhesive label or equally durable material affixed to the cylinder. Marking shall be punched or impressed into this label. The label shall be self-destructive when removal is attempted. The label shall contain the following:

(a) Month and year of test.

(b) Test pressure used.

(c) Name and mark of test station.

(d) Cylinder serial number and/or test certificate number.

(e) Fill pressure.

Alternatively, the above information may be stamped on any permanent part of the cylinder that does not come under pressure, such as a foot ring or protective shroud.

WARNING: Never stamp any part of the extinguisher cylinders shell that come under pressure on these types of extinguishers. Their walls are generally thin and any deep impression will render them condemned.

Carbon dioxide cylinders that have passed the stretch test — refer section 8.7.

8.3.5.2

All extinguishers of the Dry Chemical and BCF types (refer NOTE: 8.3.1) shall have their cylinder operating head or cap, and hose assembly, thoroughly dried out internally before being returned for service. If a heated air stream is used, the temperature shall not exceed 150°F (66°C).

8.3.5.3

After testing, the extinguisher should have its operating head or cap, re-fitted. If there is any anticipated delay in getting this done, the extinguisher cylinder should be protected from entry of any foreign matter that could affect the extinguisher operation.

8.3.6 Approved Cylinders

8.3.6.1 Cylinders Subject to Proof Testing

In due course it is intended that a full list of approved specifications for these types of cylinders will be issued. Presently approved specifications are as follows:

New Zealand Standards

NZS 4506 *Specification for portable fire extinguishers of the water, foam and dry powder types.*

NZS 4551 *Specification for portable fire extinguishers of the halogenated type.*

Australian Standards

AS 1841 *Portable fire extinguishers — Water (gas container) type.*

AS 1842 *Portable fire extinguishers — Water (stored pressure) type.*

AS 1844 *Portable fire extinguishers — Foam (gas container type).*

AS 1845 *Portable fire extinguishers — Foam (stored pressure) type.*

AS 1846 *Portable fire extinguishers — Powder type.*

AS 1848 *Portable fire extinguishers — Halon type (NOTE: 83.1)*

British Standards

BS 5423 *Portable fire extinguishers.*

CAN Publications - Standards Council of Canada

CAN 4-S504-77 *Standard for Dry Chemical and Dry Powder Hand and Wheeled Fire Extinguishers*

CAN 4-S507-M83 *Standard for 9 Litre Stored Pressure Water Type Fire Extinguishers*

ULC Publications — Underwriters Laboratories of Canada

ULC S504-77 *Standard for Dry Chemical and Dry Powder Hand and Wheeled Fire Extinguishers*

ULC S512-77 *Standard for Halogenated Agent Fire Extinguishers*

UL Publications - Underwriters Laboratories, IL

ANSI/UL 8-1983 *Foam Fire Extinguishers*

ANSI/UL 299-1982 *Standard for Dry Chemical Fire Extinguishers*

ANSI/UL 626-1982 *Standard for 2 1/2 Gallon Stored Pressure Water Type Fire Extinguishers*

ANSI/UL 1093-1982 *Standard for Halogenated Agent Fire Extinguishers*

The Standards Institution of Israel Nov 1982

Standard 614.845 *Portable fire extinguishers dry powder stored pressure-type extinguisher*

NOTE: If there is any conflict between the above Standards and the requirements of the *Guide to Gas Cylinders* or the Dangerous Goods Regulations, the Guide or Regulations are to be complied with.

Future approvals of specifications will be given in accordance with this section of the guide.

8.3.7 Disposable Fire Extinguishers

The requirements for the importation, sale and use of this type of extinguisher is no different to rechargeable fire extinguishers in that they must be designed, constructed and maintained to an approved specification, i.e. see the list of currently approved specifications in section 8.3, pages 42-43.

NB: Any agent/distributor wishing to recharge and/or service a previously designated disposable extinguisher must be able to:

(a) prove by way of providing the appropriate documentation that the specification it was constructed to allows the recharging and service; and

(b) comply with those requirements, e.g. BRK extinguishers built to UL229/65.1 1990 Eighth Edition allows disposable extinguishers to be serviced, recharged, etc. provided a service manual is produced by the manufacturer demonstrating how this can be achieved safely and correctly by a recognised agent.

8.4 Acetylene Cylinders

(a) Acetylene cylinders are not required to be hydrostatically tested apart from their original test before insertion of the porous mass. They are required to be inspected by New Zealand Industrial Gases or Liquid Air in accordance with AS 2030 as follows:

  (i) for granular mass cylinders (e.g. charcoal) and any cylinders with a mass other than monolithic, annually;

  (ii) for monolithic mass cylinders 1 year after initial entry into service, and subsequently every 10 years thereafter.

(b) Each time a cylinder is received at a point for refilling, its safety devices shall be examined in accordance with AS 2030.

8.5 Cylinders that Cannot be Inspected Internally

Cylinders that are so constructed that an internal examination is not possible, (e.g. primus cylinders with the recessed valve) are to have the hydrostatic stretch test performed using a water jacket apparatus, with air or nitrogen as the pressurising medium. If air is used, then it must be dried.

The method set out in Amendment No. 1 to AS 2030: 1977 and included in AS 2030 - 1985 is not a permitted alternative method.

8.6 Approved Testing Stations

8.6.1 General

All inspections and tests required by the Regulations and this publication must be carried out at authorised testing stations. "Authorised" means approved by the Chief Inspector (as defined in this publication).

Approval will be given once a testing station has met one of the following criteria:

(i) Approved by Telarc for cylinder testing; or

(ii) Approved by the Technical Committee of New Zealand Underwater.

Approval in case (i) will be subject to any conditions imposed by Telarc.

Approval in case (ii) will be only for cylinders used as part of a self-contained underwater breathing apparatus (SCUBA or dive cylinders).

Approval in either case is subject to continuing compliance with the original conditions and still leaves approved testing stations liable to be inspected at any time by Inspectors of Dangerous Goods. A list of approved testing stations is given in Supplement No. 3, which will be updated from time to time.

8.6.2 Additional Requirements

Approved testing stations are required to have the following, whether or not they are mentioned during the process of approval:

(i) A stamp with a unique design that has been approved (see 8.6.3).

(ii) A list of specifications approved for cylinders manufactured before March 1980.

(iii) A list of designs approved for cylinders manufactured since March 1980.

(iv) Copies of the Regulations, Australian Standards 2030 and 2337, and copies of the specifications for cylinders normally tested.

(v) A record of all cylinders inspected and tested.

(vi) Customised test reports, which are to be completed for every inspection or test performed unless the cylinder owner has clearly indicated that a report is not required.

8.6.3 Approval of Testing Station Marks

Section 8.6.2 (i) requires that approved testing stations have a stamp with a unique design that has been approved. The criteria for approval are:

1. The mark must be:
   - simple
   - unique
   - not readily reproducible

   The design must be simple so that:
   - the stamps can be manufactured;
   - the mark can be made readily with one hit;
   - the stamp will have a reasonable life.

   The design must be unique so that it may be distinguished from any other marks on a cylinder. The mark must not be reproducible with stamps that are readily available. This means that although ordinary letters or numbers may be incorporated in the design, some part of the design must include an unusual shape.

2. A dimensioned drawing of the mark must be submitted to the Chief Inspector of

Dangerous Goods. A copy of this drawing must be retained by the testing station, so that when existing stamps need replacing, the new stamps will be the correct shape and size.

It is recommended that approval of a design be obtained before stamps are manufactured.

Prior to stamps being used a sample stamped aluminium billett (25 mm x 35 mm x 6 mm thick) must be submitted to the Office of the Chief Inspector for record purposes.

NOTE: Regulation 11(1) states "... with characters not less than 6 mm high if space permits but in any case not less than 3 mm high ..."

Further guidance on choice of size may be obtained from AS 2030 Appendix A.

8.7 Identification and Marking of Approved Cylinders

8.7.1 General

Before a cylinder is tested it must be identified as being approved or exempt, under the provisions of Part 9. Cylinders that cannot be identified as approved or exempt shall not be tested until notification of approval (or of dispensation) is received. After testing and passing a cylinder the tester must ensure that the cylinder is correctly marked as set out in 8.7.2.

8.7.2 Marking and Labelling After Testing

8.7.2.1

All cylinders passing the inspection and/or test are to be marked or labelled in an approved manner as set out in section 4.3.8. Test stampings are to be highlighted in accordance with section 8.8.

8.7.2.2

Cylinders covered by the Dangerous Goods Act and Regulations are to be marked as follows:

(a) LAB number - must be stamped on every cylinder manufactured or imported after March 1980. Identification must be positive (no guessing).

(b) Test pressure - must be stamped on every cylinder. If the test pressure is not marked, it must be marked in MPa (see section 10.14). Post 1980 cylinders - if test pressure is marked in other units, it must also be marked in MPa (or kPa).

(c) Filling pressure — to be marked on all cylinders for permanent gases; must be in MPa (or kPa) for post 1980 cylinders.

(d) Water capacity — must be marked on all cylinders for liquefiable gases. Must be in litres or kg for post 1980 cylinders. It is recommended that it be marked on all other cylinders.

(e) Empty weight (including valve and fittings — see 4.3.4) must be marked on all cylinders for liquefiable gases. Must be in kg for post 1980 cylinders. If the empty weight is already marked (possibly called tare weight) and is correct, it need not be re-marked. If incorrect, it is to be deleted without making it illegible, and is to be re-marked EWXXX kg to three significant figures.

8.8 Colour Code for Identification of Re-test

As an aid to the identification of cylinders due for re-testing coloured plastic rings may be used, retained by the valve. Use of such a method is optional, but if one is used, the colours must comply with the system set out below.

After being tested at an approved testing station, the date and mark on the cylinder shall be highlighted by painting with a rectangle of aluminium paint, or paint of a colour in accordance with the system set out below.

YEAR OF TEST	CYLINDERS TO BE TESTED	COLOUR OF PLASTIC RING OR HIGHLIGHT PAINT			
		1 YEAR CYCLE	2 YEAR CYCLE	5 YEAR CYCLE	10 YEAR CYCLE
1982	Lime Green	Pink	Dark Brown	Royal Blue	Grey
1983	Pink	Dark Brown	Black	Red	Dark Green
1984	Dark Brown	Black	Claret	Light Blue	Mauve
1985	Black	Claret	Royal Blue	White	Yellow
1986	Claret	Royal Red	Light Brown	Lime	Green
1987	Royal Blue	Red	Light Blue	Grey	Pink
1988	Clear & Red	Light Blue	White	Dark Green	Dark Brown
1989	Light Blue	White	Light Brown	Mauve	Black
1990	White	Light Brown	Grey	Yellow	Claret
1991	Light Brown	Grey	Dark Green	Lime Green	Royal Blue
1992	Grey	Dark Green	Mauve	Pink	Red
1993	Dark Green	Mauve	Yellow	Light Blue	Dark Brown
1994	Mauve	Yellow	Lime Green	Black	White
1995	Yellow	Lime Green	Pink	Claret	Light Brown
1996	Lime Green	Pink	Dark Brown	Royal Blue	Grey
1997	Pink	Dark Brown	Black	Red	Dark Green
1998	Dark Brown	Black	Claret	Light Blue	Mauve
1999	Black	Claret	Royal Blue	White	Yellow
2000	Claret	Royal Blue	Red	Light Brown	Lime Green
		Steel SCUBA cylinders	Aluminium SCUBA cylinders	All cylinders not otherwise specified	As defined in section 8.2

8.9 Rejected Cylinders

Any cylinder that fails a test is required by regulation 16(2) to be rendered unservicable (see section 8.9.1).

Under certain conditions a cylinder that has failed a test may be re-tested (see section 8.9.2).

8.9.1 Disposal of Rejected Cylinders

The following guidelines should be adhered to unless otherwise advised by an Inspector.

(a) Do not render a condemned cylinder unserviceable without the owner's permission.

(b) Keep failed cylinders in a secure place, away from the testing area for a minimum of four weeks, unless the reason for failure is obvious to even an inexperienced layman.

(c) Do not return a failed cylinder to the owner without either rendering it unservicable or notifying an inspector.

(d) Rendering unserviceable may be accomplished in any of the following ways:

(i) Flattening.

(ii) Cutting into two pieces.

(iii) Cutting at least half-way through the cylinder, away from any welds.

(iv) Cutting a hole, preferably irregular, of at least 25 mm diameter.

(v) Destroying the neck thread at least down to the root of the thread over a minimum of 6 mm of the thread circumference.

8.9.2 Retesting of Rejected Cylinders

A cylinder that fails the inspection and test is to be condemned without re-testing, except as covered below. In general the equipment and procedures of the testing station should make a re-test unnecessary.

If the tester believes that a fault in his equipment or procedure may have invalidated a test result, then the cylinder should be retested once the fault has been corrected.

If the owner of the cylinder believes that the test result is not valid then he or she may ask an Inspector to authorise a re-test (but see below). The retest shall be carried out at the owner's expense and under any conditions specified by the Inspector, and if the cylinder fails the retest, it is to be rendered unserviceable immediately. Inspectors will only authorise such retests under exceptional circumstances.

NOTE: A cylinder should not be subjected to its test pressure more than once in any 24 hour period unless otherwise approved by the Chief Inspector.

8.9.3 Failure Criteria

In addition to the criteria set out in AS 2030/2337 and the NZUA Code, the following criteria are cause for automac tic rejection, unless otherwise advised in writing:

(a) Wire-wound cylinders (but see 10.11.4 for MKV cylinders).

(b) Re-cut neck threads, i.e. where the thread has been machined out and a new thread cut. Does not include cleaning up of original threads, provided thread tolerances are not exceeded.

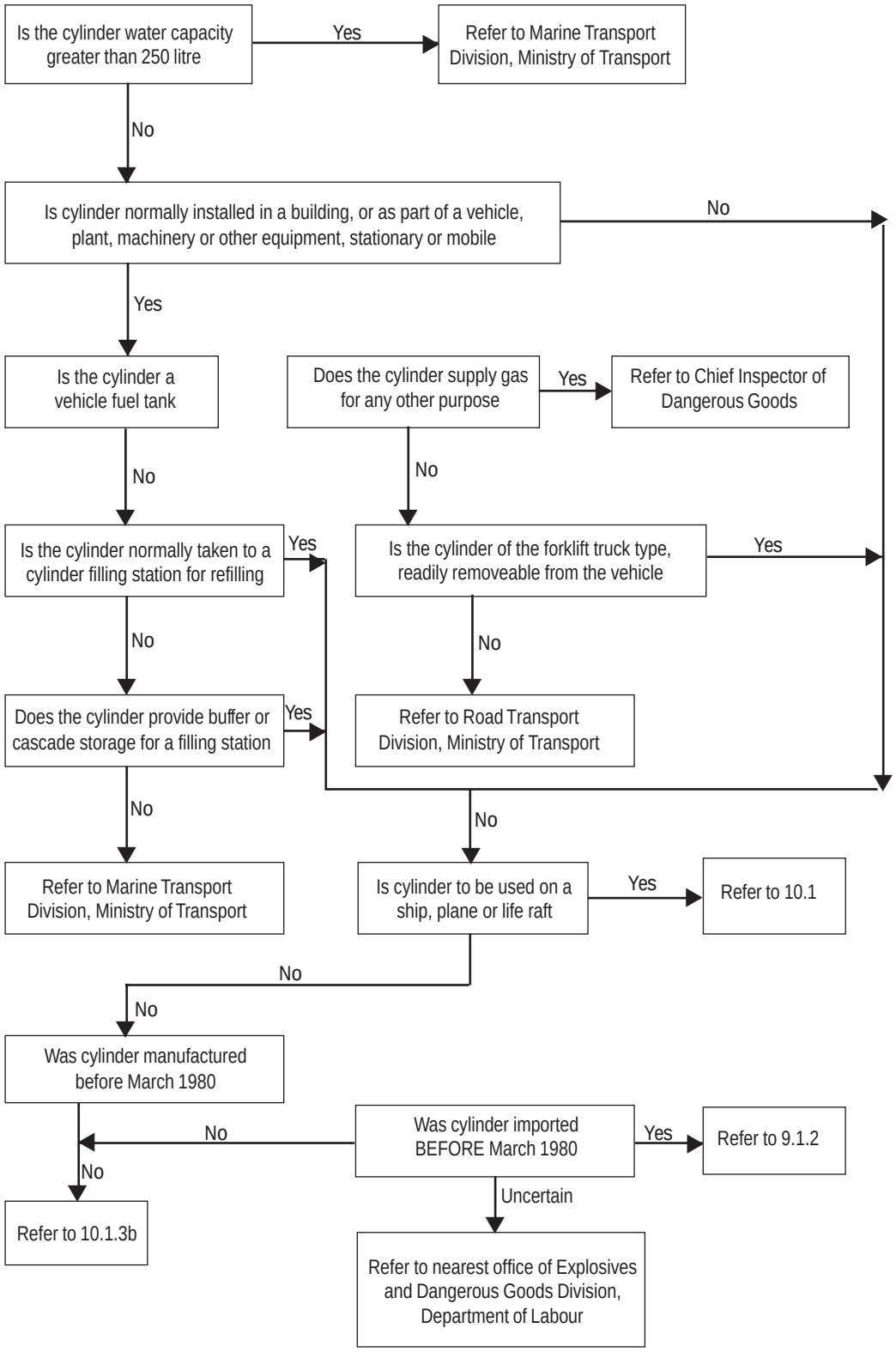
(c) Neck thread inserts, otherwise known as spacers or reducers, i.e. where the basic neck thread is effectively reduced in size by an insert threaded to take the valve.

(d) Cylinders. that have had markings obliterated, e.g. by grinding out.

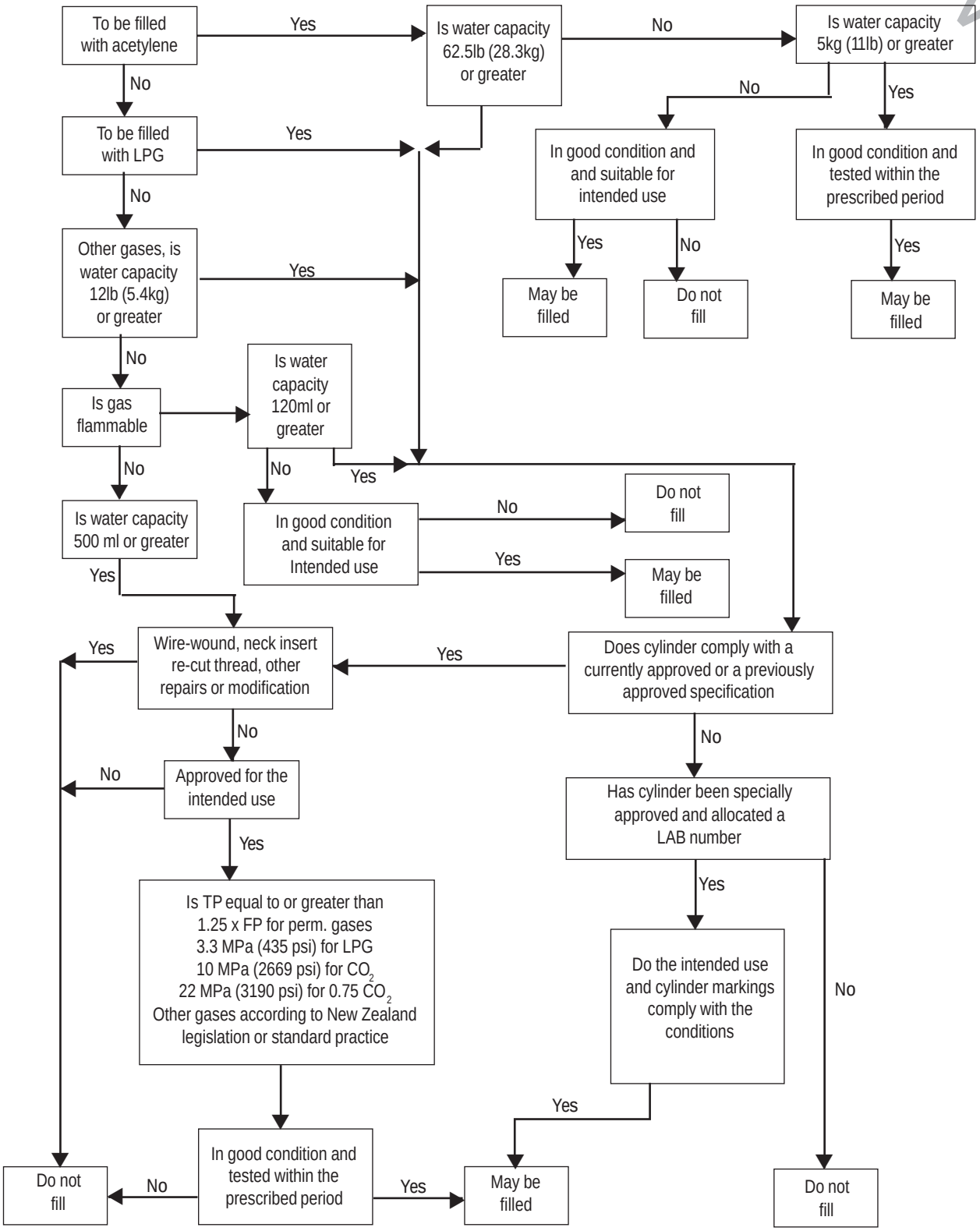
PART 9: IDENTIFICATION OF CYLINDERS

9.1 Identification of Approved Cylinders

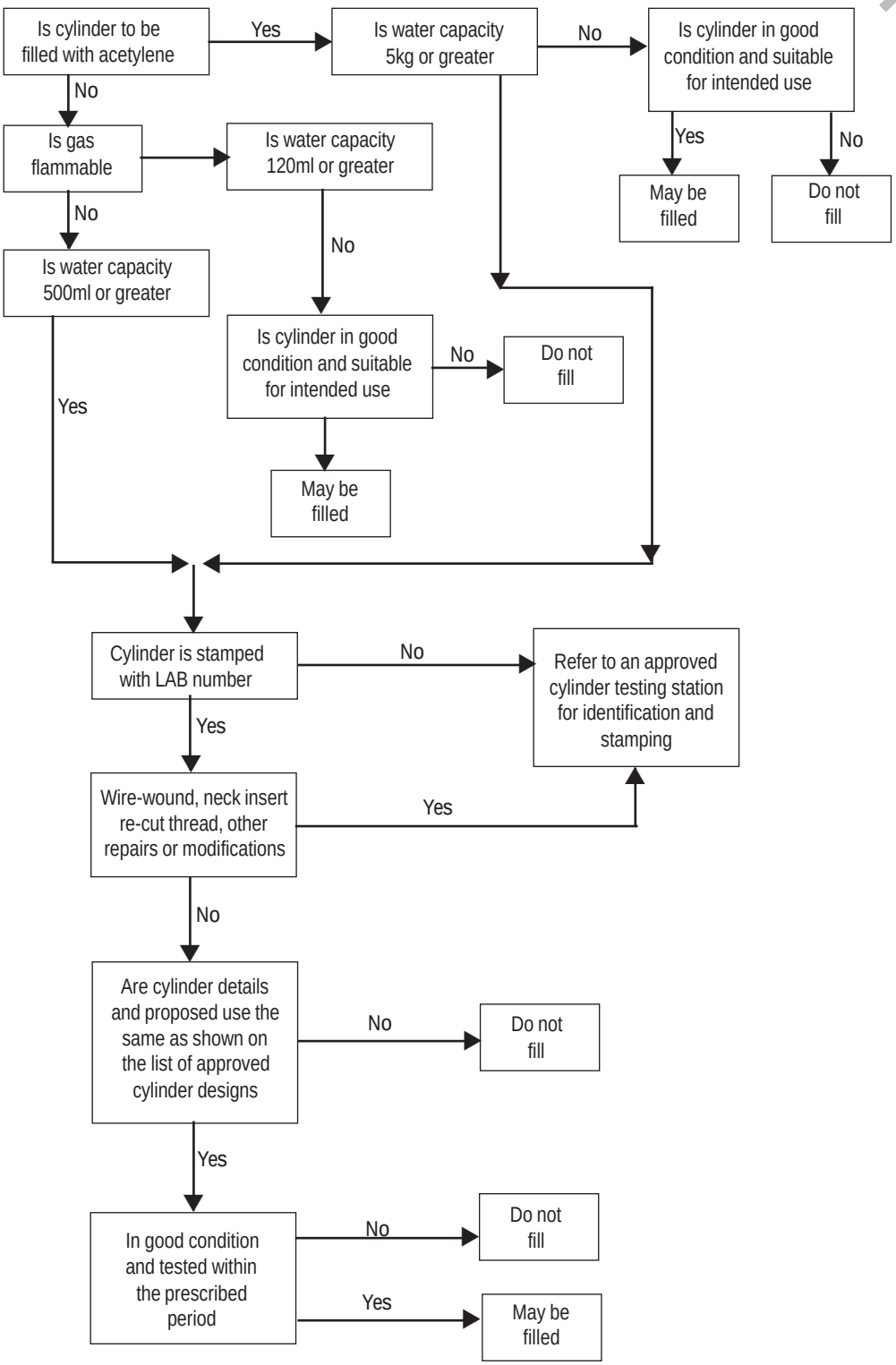
9.1.1 General



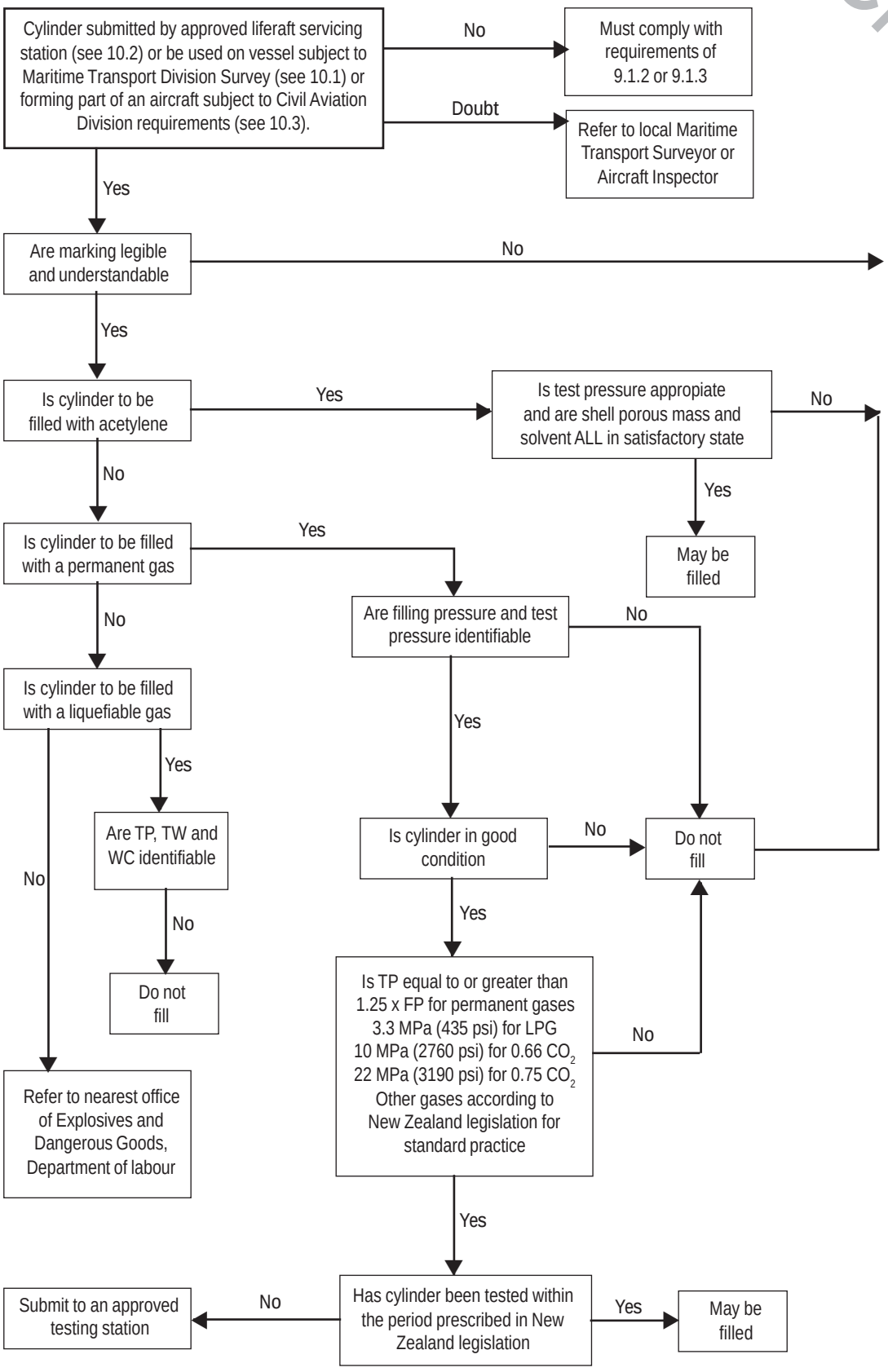
9.1.2 Identification of Approved Cylinders Imported Before March 1980



9.1.3 Identification of Approved Cylinders Imported After March 1980



9.1.4 Identifcation of Acceptable Cylinders Which Are to Be Used On Boats, Ships, Planes and Liferafts



9.2 Currently Approved Standards and Specifications for Gas Cylinders (Including Current Amendments)

9.2.1 British

BS 5045.1:1982	Seamless steel	
BS 5045.2:1982	Welded steel	Up to 130 litres
BS 5945.3:1984	Seamless aluminium alloy	WC above 0.5 litres FP to 30 PMa
BS 5045.6: 1981	Seamless steel or aluminium	Up to 0.5 litres. Applicable under Regulations Class 2(d) only
HOAL 2	Seamless aluminium alloy	BA, aircraft, SCUBA up to 13.6 litres
HOAL 3	Seamless aluminium alloy	
HOAL 4	Seamless aluminium	Suitable for alloy SCUBA
LASW 1	Fusion welded alloy steel	BA — not SCUBA
LASS 1	Seamless alloy steel	
BS 1319:1976		Medical gas cylinders

9.2.2 Australian

AS B115 - 1966	Welded or brazed steel	Partially superseded by AS 2468 - 1981 and AS 2469 - 1981. WC 113.6 ml to 250 Litres. Now applicable only to cylinders larger than 150 litres.
AS 1777 - 1975	Seamless aluminium	WC 0.10 to 1340 litres
AS 2278 - 1979	Metal aerosol	Non-fillable containers up to 1400 ml and 85 mm diameter
AS 2468 - 1981	Brazed steel	WC 0.1 to 11 litres
AS 2469 - 1981	Welded steel	WC 0.1 to 11 litres
AS 2470 - 1981	Welded steel	WC 11 to 150 litres
AS 2527 - 1982	Acetylene cylinders	
AS 1210 - 1982	LPG tanks for vehicles	Approved for stainless steel only
AS 2873 - 1986	Seamless - Carbon Mn Steel	0.1 kg - 500 kg superseded B110 and B111
AS 2874 - 1986	Seamless - Carnon Mn Steel (high tensile)	0.1 kg - 500 kg - supersedes B113
AS 2875 - 1986	Seamless - alloy cylinders	0.1 kg - 500 kg - supersedes B 114

9.2.3 American and Canadian (see also 10.8)

DOT 2P	Non-refillable	LPG, to 787 ml, id to 80 mm
DOT 3A	Seamless steel	Service pressure from 1.03 MPa. Permitted for SCUBA

DOT 3AA	Seamless steel	Service pressure from 1.03 MPA. Permitted for SCUBA
DOL 3AL	Seamless aluminium	Suitable for SCUBA alloy
DOT 3B	Seamless steel	Service pressure 1.03 MPa to 3.44 MPa
DOT 3E	Seamless steel	Dia to 50mm, length to 0.6m
DOT 4A	Forged welded steel	1.03 MPa to 3.44 MPa
DOT 4AA 480	Welded steel	Service pressure (480 psi) 3.3 MPa
DOT 4B	Welded and brazed	Service pressure 1.03 MPa to 3.44 MPa
DOT 4BA	Welded or brazed	Service pressure steel 1.5 MPa to 3.44 MPa
DOT 4B W	Welded steel with longitudinal seam	Service pressure 1.5 MPa to 3.44 MPa
DOT 4E	Welded aluminium	Service pressure 1.5 MPa to 3.44 MPa
DOT 4L	Welded, cylinders	Service pressure insulated 0.27 MPa to 3.44 MPa
DOT 8	Steel, with porous filling	Service pressure 1.7 MPa Acetylene
DOT 8AL	Steel, with porous	Service pressure filling 1.7 MPa Acetylene
DOT 8WC	Welded steel with porous filling	Acetylene
DOT 39	Steel	Non-reusable, non-refillable
DOT SP6024	Seamless, welded or brazed, steel or aluminium	Refrigerant gas, disposable, non-reusable, non-refillable cylinders
DOT E7542	Welded steel with porous filling	Acetylene
DOT SP6517 (9CTC SP957)	3 piece welded steel with porous filling	Acetylene
DOT SP6668 (DOT 4L)	Insulated, welded steel	Oxygen. Life support system
DOT E7638	Cryogenic	
DOT E8063	Cryogenic	
DOT E8725	Aluminium/fibreglass	
ASME Code	Welded steel	Test pressure must be marked.
Section 8 Div 1		Date of original test must be marked. Supporting calculations must quote clauses (see section 2.3.3)

9.2.4 Other

Hungarian		
MK 231/85	Welded aluminium	LPG

New Zealand

RI 1415

9.3 Previously Approved Specifications

The specifications listed in this section were approved up until the date shown or have been retrospectively approved since. Cylinders manufactured before March 1980 to any of these specifications may continue in use (subject to criteria set out elsewhere such as minimum test pressures). Cylinders manufactured after March 1980 to any of these specifications must also be to a design that has been approved and is listed in Supplement No. 1.

9.3.1 British

SPECIFICATION	DESCRIPTION	REMARKS	APPROVAL WITHDRAWN
BS 399	High C Steel	SCUBA	March 1980
BS 400	Low C Steel	SCUBA	March 1980
BS 401	Steel		March 1980
BS 740	Foam Fire Ext's	SCUBA	March 1980
BS 1045	Mn Steel	SCUBA	March 1980
BS 1287	High C Steel	SCUBA	March 1980
BS 1288	Mn Steel	SCUBA	March 1980
BS 1382	Water Ext's	SCUBA	March 1980
BS 1721	Halogenated Hydrocarbon Ext's	SCUBA	March 1980
BS 3465	Dry Powder Ext's	SCUBA	March 1980
HOAL 1	Al Alloy	Sup by HOAL 4 SCUBA	March 1980
HOS	Steel	SCUBA	March 1980
HOT	Seamless alloy steel	BA, SCUBA up to 11.3 litres	March 1980
HO AC 1	Welded steel	Acetylene	March 1980
Admiralty	Steel comp.	Air	March 1980
RT 9622830 and 4652		3000 psi	March 1980
BOC DA2A	Steel	Acetylene	March 1980
Calor	Steel	LPG	March 1980
HO 876365		Max Cap 20 lb	March 1980
LUXINT	Seamless aluminium	SCUBA	March 1980
MoD 0.133	Mark 5	See section 10.11	March 1980
DEF-168	Mark 12A	See section 10.11	March 1980
MoS 0.97	Mark 7A m	See section 10.11	March 1980

9.3.2 Australian

AS B10	High C Steel	Obsolete	March 1980
AS B 11	High C Steel	Obsolete	March 1980

AS B189	Welded	Acetylene	March 1980
AS 1210	Steel	Vehicle fuel tanks only	Nov 1981
AS Z42	Steel container	Aerosol containers, instrument-grade propane	January 1985
AS 2030/6	Welded steel	Acetylene	1985
AS B239	Welded steel	Sup by AS 2470 - 1981	1985

9.3.3 American and Canadian

DOT E6498	Al alloy Luxfer SP6498	Superseded by 3 AL SCUBA	1983
DOT E7042	Al alloy Walter Kidde		
DOT SP6688 .	Al alloy, Norris	Restricted see 10.11	
CTC SP922	Al alloy	SCUBA	March 1980
DOT 7072	Al alloy	SCUBA and N_2O	March 1980

9.3.4 Other

Apragaz 72/5 (Belgium)	Welded steel	LPG auto only	Nov 1981
JIS B8241 (Japan)	Seamless steel	Auto	Nov 1981
DIN 4665	Seamless steel	CO_2	March 1980
TRG (German Compressed Gas Regs)	Seamless steel	See 10.9	March 1980
MF 008170 }	Hungarian	LPG	March 1980
MF 008172 }	Welded Al alloy	LPG	March 1980
MK 217/76 }			
ANCC Italian National Rules	Seamless steel	Auto	Nov 1981

Miscellaneous

Optimus	802, 803, 804, 805	LPG TP 3.45 MPa	March 1980
Sievert	3962S,3967S, 3965S	LPG TP 3.3	Match 1980
Primus	2000, 2005, 2006	LPG PF 7405	
PF 7405	2007, 2012, 2010, 2916, 2960	Min TP 3.0 MPa	Sept 1983
“Nordgas”	John Klinger of Heide, Germany	LPG Min TP MPa	March 1980
N 393-397	Seamless steel	FP 150 Atm (2204 psi) TP 250 Atm (3673 psi) Argon, nitrogen Carbobn dioxide	March 1980

ABS	Welded or brazed cylinders.	March 1980

NOTE: Cylinders to be condemned on testing of no pressure relief device fitted. New Zealand specifications previously listed were adopted British Standard Specifications. Idenification is by the BZ number.

9.4 Approved Specifications for Valves and Fittings

STANDARDS OR SPECIFICATIONS	DESCRIPTION	REMARKS
BS 341: 1962 - Pt 1	Valves with taper stems (excluding valves for breathing and medical purposes)	Adopted at NZS 696
BS 341: 1963 - Pt 2	Valves with taper stems for breathing apparatus (excluding medical)	
BS 1319: 1976	Medical cylinders, valves and yoke connections	
AS 2473 - 1981	Valve fittings for compressed gas cylinders	Supercedes AS B240 - 1966
ANSI B571		Non-preferred
JIS B8246: 1970 DIN 477		Threads must comply with requirements of section 4 in special circumstances approved by the Chief Inspector
AS 2472 - 1981	Pin-index medical valves	
AS 2473 - 1981	Valves for compressed gas cylinders (thread outlet)	
AS 2474 - 1981	Diameter - indexed valves	

9.5 Approved Lubricants and Sealants

1. “Dag” dispersion 709 — colloidal molybdenum disulphide in toluene. Notes on use:
   - Toluene is highly volatile and flammable.
   - Dilute one part of Dag 709 to two parts of toluene, brush sparingly on surfaces that have been thoroughly degreased with trichloroethane and dry in air.
   - Protect components from dirt and dust throughout operation, but use only in well ventilated place.
   - For further information apply to Explosives and Dangerous Goods Division.
2. PTFE tape, degreased and certified suitable for oxygen service. Other PTFE tape is NOT approved for any use.
3. Fluorolube S-30 Occidential Chemical Corporation.

9.6 Approved Porous Masses for Acetylene Cylinders

	1	2	3	4
Cylinder Manufacturer	Rheem (Australia)	Kanto Koatu Yoki	(Coyne Cyl Co, Canadian Cy Co)	Union Carbide
Cylinder Specification	AS 2030/6	AS 2030/6	DOT 8	DOT 8
Mass Manufacturer	CIG (Australia)	Kodama Shoji	(Canadian Cyl Co, Coyne Cyl Co)	Union Carbide
Mass Type	Linde		Coyne	Lind SL - 9
Composition	Calcium oxide Asbestos Silica	Calcium silicate Asbestos 18.8%	Lime 35.5% Silica 47.1% Cellite 17.5%	Calcium silicate
Porosity	90-92%	90-92%	90-92%	87-90%
Bulk density		.20 - .24 kg/litre		.28 kg/litre
Tests	ASB 1989 AS 2030/6	Japanese Ministerial Ordinance (deemed) equivalent to ASB189)		
Approvals from	DLI, NSW	DLI, NSW	BOE,USA CTC, Canada	BOE,USA
Cylinder Approval	LAB 038 LAB 061	LAB 083 LAB 083	LAB 063 } LAB 064 } Canadian	LAB 135
Reference	LAB 062	LAB 084 LAB 085	LAB 065 } LAB 066 LAB 087 } LAB 132 } LAB 133 } LAB 145 }	Cy Co Coyne Cyl Co

PART 10: NOTES ON PARTICULAR CASES

10.1 Cylinders Used on Vessels or Aircraft or for Life-Raft Inflation

10.1.1 Vessels

Many ships and boats are subject to survey (inspection) by Maritime Transport Division, Ministry of Transport, e.g. boats over l6ft long carrying fare-paying passengers, fishing boats over 35ft long, vessels travelling outside NZ waters. The cylinders used on such vessels are included in the survey, and are approved by Maritime Transport Division either directly or indirectly by reciprocal agreement with overseas authorities. Therefore, all cylinders used on vessels subject to survey have been exempted from the Dangerous goods (Class 2 - Gases) Regulations 1980, and are exempted from any of the provisions of the Regulations for the purposes of filling and transporting to and from the filling station.

Filling and testing of cylinders that are to be used on ships or boats is to be in accordance with the following:

1. Vessels subject to survey (if in doubt, check with local Maritime Transport Surveyor):
   (a) The filling station is to ensure that the cylinder is to be used only on a vessel subject to survey (e.g. submitted by a shipping agent).
   (b) The value and units of the cylinder test pressure must be clear and under standable. The test pressure must be appropriate for the proposed filling conditions.
   (c) The value and units of the cylinder filling pressure must be clear and understandable.
   (d) For liquefiable gases the cylinder empty weight and water capacity must be clearly marked; or must be measured and marked by a testing station.
   (e) The cylinder must be in good condition, and must have evidently been tested within the period required by the Dangerous Goods (Class 2 - Gases) Regulations 1980.
   (f) When cylinders are tested under the provisions of this section (i.e. would be deemed not approved under the normal provisions) the test certificates is to be annotated “Cylinder to be used on vessel subject to Marine Division Survey” or words to that effect.
2. Vessels not subject to survey (if in doubt, check with local Maritime Transport Surveyor):
   (a) Cylinders on such vessels are not the responsibility of Maritime Transport Division, Ministry of Transport, and therefore must comply with the requirements set out in the Regulations, and elsewhere in this publication.
   (b) Cylinders known to be used on such vessels should be subjected to an even more rigorous inspection than normal at filling stations; and must be in spected even more carefully than usual by testing stations.
   (c) It is recommended that only hot-dipped galvanised cylinders be used for LPG on boats or ships.

10.1.2 Life-Raft Inflation Cylinders

Life-rafts used on ships subject to survey (see section 10.1.1 (1)) are required to be

approved by Maritime Transport Division, Ministry of Transport either directly or by reciprocal agreement with overseas authorities.

Approval of the life-rafts includes approval of the inflation cylinders. The filling and testing of the inflation cylinders is done in conjunction with a servicing procedure for the whole raft, and may only be done at the following servicing stations which have been approved by the Maritime Transport Division.

Air New Zealand Ltd AUCKLAND	Bluff Engineering and Welding Co Ltd BLUFF
Den Ray Marine Services Ltd Panmure AUCKLAND	RFD (NZ) Ltd AUCKLAND
RFD (NZ) Ltd WELLINGTON	RFD (NZ) Ltd CHRISTCHURCH
RFD (NZ) Ltd NELSON	Safe Air Ltd BLENHEIM

Life-raft inflation cylinders submitted by any of the above servicing stations may be filled and tested under the conditions set out for cylinders to be used on ships subject to Maritime Transport Division Survey.

10.1.3 Cylinders for Use in Aircraft

Some cylinders are purpose designed and manufactured to be an integral part of the aircraft operating systems. Such cylinders are deemed to be part of the aircraft when assessing its airworthiness, and are covered by the New Zealand Civil Aviation Regulations (NZCAR) administered by the Civil Aviation Division of Ministry of Transport. Other cylinders, such as those used for installed oxygen systems, may also be covered by NZCAR, even if they are normally removed for filling. Cylinders included in these categories are not necessarily required to comply with the Dangerous Goods Act and Regulations.

Other cylinders may be "carried on", such as portable fire extinguishers, portable oxygen cylinders. Such cylinders are required to comply with the Dangerous Goods Act and Regulations and this publication.

1. Any cylinder presented to a filling or testing station is initially to be considered as a normal transportable cylinder, and filled or tested in accordance with the rules set out in section 9.1.
2. If a cylinder cannot be deemed to be filled or tested according to section 9.1, then it may only be filled or tested if:
   (a) it is certified by the owner as being for use in an aircraft; and
   (b) written confirmation, identifiable with the cylinder in question, is obtained from Civil Aviation Division of Ministry of Transport that it is an approved cylinder under NZCAR.

In this case the inspection and test is to conform to the requirements of the Guide to Gas Cylinders unless specifically advised otherwise by Civil Aviation Division. Note that special requirements may apply to cylinders of unusual shape or construction.

Test certificates are to be endorsed "Approval by Civil Aviation" or words to that effect, and a copy of the Civil Aviation Division letter should be kept in the testing station records.

10.2 Hydraulic Accumulators and Cylinders Connected to Compressing Systems

10.2.1 Hydraulic Accumulators

(a) Definition

Hydraulic (or hydro-pneumatic) accumulators are pre-charged, usually with nitrogen, and usually to high pressures (20 MPa upwards) and are then connected into the operating circuits of oil-hydraulic machinery. The oil and gas are separated by a bladder and the gas acts as an energy storage or shock-absorbing "spring„

The pressure container may or may not be manufactured to a specification normally used for transportable gas cylinders.

(b) Responsibility

Hydraulic accumulators differ from transportable gas cylinders in a number of respects:

(i) They are refilled very rarely (e.g machine overhaul periods).

(ii) Except for filling and/or testing purposes they are part of an oil hydraulic system or machine.

(iii) They may be subject to very rapid, very frequent pulsations.

For these reasons they care considered to be under the jurisdiction of the Marine Division, Ministry of Transport.

(c) Filling and Testing

Refer to local Marine Surveyor.

10.2.2 Cylinders Connected to Compressing Systems

(a) Classification

Containers of less than 250 litres, of a type normally used as transportable gas cylinders (e.g. to BS 5045: Pt 1) are considered to be under the jurisdiction of the Explosives and Dangerous Goods Division, Department of Labour. Other containers (e.g. ASME 8) are under the jurisdiction of the Marine Division, Ministry of Transport.

(b) Air Storage Cylinders Supplied by Grid Wholesale

A number of cylinders manufactured by Showa Koatsu were imported around 1978-79. Some or all of these cylinders are incorrectly marked, and have been used at too high a pressure, mostly by SCUBA filling stations. The confusion appears to have arisen because the drawings showed a maximum service pressure of 21.2 MPa which referred to the developed pressure at 65°C, not the normal filling pressure. These cylinders may be identified by the following markings on the shoulder:

SHP NO. XXX	**AIR**
V49.5	AS B114
W 61.2	MM - 78 "I"
where XXX	= serial number in range 001-076
V49.2	= water capacity (litres)
W61.2	= tare weight (kg)
MM	= month of manufacture (in 1978)

"I"	= f2 for inspection by FESC (serial nos. 001-046)
INTECO	= (serial nos 057-076)

The permitted filling pressure (for AIR) for these cylinders is 17.0 MPa (2466 psi). The pressure at which they have actually been used may be as high as 24.8 MPa (3600 psi) which is uncomfortably close to the test pressure, 26.5 MPa.

All of the cylinders described above are to be taken out of service and must be submitted to an approved testing station for testing and stamping before re-entering service. Provided each cylinder passes the hydrostatic stretch test the following markings are to be added alongside the station stamp and date-WP 17.0 MPa TP 26.5 MPa.

10.3 Vehicle Fuel Tanks and Forklift Cylinders

10.3.1 Identification

With the exception of forklift tanks (see 10.3.5), all vehicle fuel tanks must be approved by the Road Transport Division of Ministry of Transport, and should be identifiable on their published lists. Any vehicle fuel tank which is submitted for periodic testing, but cannot be identified from the MOT list is not to be tested until notification is received from MOT.

A few vehicle fuel tanks are included in Supplement No. 1, Approved Cylinder Designs. these were approved and allocated LAB numbers before the transfer of responsibility to MOT, and therefore are still listed for reference. This does not alter the previous statement that ALL vehicle fuel tanks must be identifiable from the MOT lists.

10.3.2 Testing

The Traffic Regulations require vehicle fuel tanks to be tested at cylinder testing stations approved by the Chief Inspector of Dangerous Goods. The method of testing and the criteria for passing or failing may be set, or varied, by MOT in conjunction with the Chief Inspector. In the absence of any such instructions, vehicle fuel tanks should be examined and tested in accordance with AS 2030/2337 including the hydrostatic stretch test.

10.3.3 Tandem LPG Vehicle Tanks

Ministry of Transport have directed that any such tanks which do not have an inspection port in the rear (or secondary tank) may pass their periodic inspection and test provided that:

(a) they pass all other parts of the inspection and test, including internal inspection of the front (or primary) tank;

(b) the certificate is endorsed "no internal inspection on rear tank" or words to that effect;

(c) the Chief Automotive Engineer, Ministry of Transport (Private Bag, Wellington) is advised of the serial numbers of all such tanks.

NOTE: That the test certificate must not be endorsed with the Telarc Stamp since the inspection does not comply with normal inspection methods.

Testing stations must ensure, to the best of their ability, that both tanks are thoroughly dried after the hydrostatic test.

10.3.4 LAB 018 Incorrect Marking

A number of vehicle cylinders were incorrectly marked by the NZ Post Office. LAB 018 pertains only to cylinders of 40 litres water capacity manufactured by Showa Koatsu to JIS B 8241. Such cylinders are included under MOT approval AF CO3B 015, Gazette 3

February 1983. Where LAB 018 has been incorrectly stamped on other cylinders such as those listed below, it must be deleted in a manner that leaves it still legible, e.g. by a series of oblique lines. Other Showa Koatsu cylinders to JIS B 8241 are included under MOT approvals AF CO3B 016 and AF CO3B 017, in the Gazette of 3 February 1983. Showa Koatsu cylinders to DOT 3AA 2400 are included under MOT approvals AF CO3B 018 for neck thread to BS 341 (Gazette 3 February 1983) and AF C03 C006 for neck threads to 3/4" NGT (Gazette 29 September 1983).

Other incorrect approval identifications should be treated in a similar way.

10.3.5 Forklift Cylinders

10.3.5.1 Definition

A forklift cylinder is a cylinder:

(a) constructed to one of the following specifications:

ASME VIII
AS B239
AS 2470
DOT 4BW
BS 5045/2

(b) with openings in the end only, suitable for.
  (i) fixed ullage screw (gauge);
  (ii) contents gauge;
  (iii) pressure relief valve;
  (iv) vapour connection;
  (v) liquid connection;

(c) approved by the Department of Labour.

10.3.5.2

All LPG forklift cylinders are to be retested at intervals of not more than 10 years and include a hydrostatic stretch test.

10.4 SCUBA Cylinders

10.4.1 General

Cylinders complying with the requirements below may be used with self-contained underwater breathing apparatus, and may be tested and filled accordingly.

Use of any other cylinders for SCUBA is not permitted, and anyone filling such cylinders commits an offence.

10.42 Cylinders Manufactured and Imported Before March 1980

Cylinders must be in good condition, must have been tested or inspected within the prescribed period, and must have been manufactured to one of the following specifications:

(a) British Standards

SPECIFICATION	FILLING PRESSURE	TEST PRESSURE
BS 399-1930 }		3000 psi 20.7 MPa*
BS 400-1931 }	1980 psi	3000 psi 20.7 MPa*
BS 1045-1942 }	13.7 MPa	2850 psi 19.7 MPa*
BS 1287-1946 }		3360 psi 23.2 MPa*

BS 1288-1946 }		3000 psi 20.7 MPa*
*Unless marked otherwise		
BS 5045: Pt 1:		
1976	As marked	As marked
LUXINT		

(b) British Home Office Specifications

SPECIFICATION	**FILLING PRESSURE**	**TEST PRESSURE**
HOS	As marked	As marked
HOT	As marked	As marked
HOAL 1	As marked	As marked
HOAL 2	As marked	As marked
HOAL 3	As marked	As marked
HOAL 4	As marked	As marked

(c) US and Canadian Specifications

ICC/DOT/BTCS/ CTC 3A	As marked (psi)	5/3 x Fill pressure
ICC/DOT/BTCS/ CTC 3AA	As marked (psi)	5/3 x Fill pressure
DOT E6498,SP6498	As marked (psi)	5/3 x Fill pressure
DOT E7042	As marked (psi)	5/3 x Fill pressure
DOT E7072	As marked (psi)	5/3 x Fill pressure
Conditional approval	(see 10.11.4)	
DOT SP6688	As marked (psi)	5/3 x Fill pressure
CTC SP 922	As marked	

(d) Australian Standards

AS B 10-1950 }		3000 psi 20.7 MPa*
AS B110-1952 }	1980 psi	3000 psi 20.7 MPa*
AS B 111-1952 }	13.7 MPa	3360 psi 23.2 MPa*
AS B113-1960 }		3360 psi 23.2 MPa*
AS B 114-1960 }		As marked
AS 1777-1975	0.65 x TP*	
*Unless marked otherwise		

(e) German Compressed Gas Regulations

IWK, Drager	As marked †	As marked †

† If not marked, refer to Chief Inspector of Dangerous Goods

10.4.3 Cylinders Imported After March 1980

Cylinders must be in good condition, must have been tested or inspected within the prescribed period, and must conform to one of the following approved designs:

REF	MANUF	SPEC	WATER CAPACITY (LITRES OR KG)	OUTSIDE DIA (MM)	FILL PRESS (MPa)	TEST PRESS (MPa)
LAB 056	CIG	AS 1777	2.85	117	15.6	24.5
LAB 137	CIG	AS 1777	8.6	175	20.7	32.0* 32.4
LAB 138	CIG	AS 1777	10	175	20.7	32.0* 32.4
LAB 139	CIG	AS 1777	11.2	185	22.4	35.2
LAB 143	Luxfer USA	DOT SP6498 DOT 3AL	11.1	183	20.7	34.4
LAB 148	Luxfer USA	DOT SP6498 DOT 3AL	10.0	174	20.7	34.4
LAB 193	Luxfer USA	DOT SP6498 DOT 3AL	6.95	175	20.7	34.4
LAB 261a	CIG	AS 1777	10.1	185	22.4	35.2
LAB 261b	CIG	AS 1777	10.2	185	22.70	35.8
LAB 261c	CIG	AS 1777	10.2	185	22.70	36.0
LAB 418	Luxfer	LUXINT	9.3	176	19.6	29.4
LAB 422a	Catalina	DOT 3AL3000	5.8	184	20.68	34.47
LAB 422b	Catalina	DOT 3AL3000	7.6	184	20.68	34.47
LAB 422c	Catalina	DOT 3AL3000	9.4	184	20.68	34.47
LAB 422d	Catalina	DOT 3AL3000	11.1	184	20.68	34.47
LAB 424	Luxfer	BS 5045/3	12	204	23.2	34.8
LAB 438a	Catalina	DOT 3AL3300	11.1	184	22.7	37.9
LAB 438b	Catalina	DOT 3AL3300	10.1	184	22.7	37.9
LAB 615	Catalina	DOT 3AL	10.8	184.15	22.8	38
LAB 616	Catalina	DOT 3AL	10.13	184.15	22.8	38
LAB 617	Catalina	DOT 3AL	9.55	184.15	22.8	38
LAB 618	Catalina	DOT 3AL	7.54	184.15	22.8	38
LAB 619	Catalina	DOT 3AL	5.0	184.15	22.8	38
LAB 625	CIG	AS 1777	11.40	185	24	36
LAB 626	CIG	AS 1777	10.20	185	24	36
LAB 627'	CIG	AS 1777	9.0	185	24	36
LAB 628	CIG	AS 1777	7.8	185	24	36
LAB 636	Asahi	BS 5045/1	11.5	188.7	24.5	36
LAB 643	Heiser	BS 5045/1	10.4	171	26	39
LAB 670	Asahi	BS 5045/1	10.1	188.7	24	36

*Lower test pressure approved up to October 1982.

10.4.4 Use Other Than SCUBA

Cylinders that have been or are to be filled with air, and which are fitted with valves of the type normally used for SCUBA are to be classed as follows:

(a) In the first instance all such cylinders are to be regarded as SCUBA cylinders and are to be filled and tested in accordance with the established regulations and policies for SCUBA cylinders.

(b) If, however, the owner of the cylinder provides sufficient evidence (see below) the cylinders may be classed differently, which will usually permit testing at five-yearly intervals. Examples of other uses are:

(i) "Survivair" breathing apparatus for hostile atmospheres, such cylinders must be painted grey with black and white quartering at the valve end;

(ii) for the operation of pneumatic tools.

Sufficient evidence, in this context, would be:

(i) no evidence of immersion in water and no other marks characteristic of use with SCUBA equipment;

(ii) a written declaration from the owner, quoting the cylinder serial number, and stating the use to which the cylinder will be put; and (iii) cylinder to be stamped at registered Telarc test station "NOT APPROVED FOR SCUBA".

In case of doubt refer to an Inspector of Explosives.

10.4.5 Visual Inspection of Aluminium SCUBA Cylinders

SCUBA cylinders must not be filled unless they have either:

(a) been hydrostatically stretch tested within the preceding 12 months;

(b) been hydrostatically stretch tested within the preceding 24 months AND been visually inspected within the preceding 12 months.

This means that in an extreme case, a SCUBA cylinder could be inspected 23 months

after its last hydrostatic test and then be filled. If, however, any cylinder is filled that does not comply with (a) or (b) above, this would constitute an offence. * See Section 11.

10.5 LPG Cylinders

10.5.1 Manufactured up to March 1980

(a) Must be to approved specification (see 10.5.3).

(b) Must have test pressure 3.0 MPa min. (c) Must have been tested within 10 years.

10.5.2 Manufactured After March 1980

(a) Must be to an approved design (current lists available from local Dangerous Goods Inspectors).

(b) Must have corresponding LAB number marked on them.

(c) TP must be kPa or MPa.

(d) TW, EW must be in kg.

(e) WC must be in litres or kg.

(f) Must have test pressure 3.3 MPa min.

10.5.3 Specifications Approved for LPG Cylinders Manufactured and Imported Before March 1980

ICC, BTC, DOT, CTC 3B 240

ICC, BTC, DOT, CTC 4A 240

ICC, BTC, DOT, CTC 4B 240

ICC, BTC, DOT, CTC 4BA 240

ICC, BTC, DOT, CTC 4BW 240

SABS 219 (Refer to NOTE 9.3.4)

AS B115

AS B239

Calor HO 876365 Min TP 3.0 MPa (435 psi)

Optimus, Primus and Sievert models
802, 803, 805
39625, 39675, 3965
2000, 2006, 2007, 2012
2916, 2960

'Nordgas' cylinders by John Klinger of Heide, Germany
Min TP 3.0 MPa (435 psi)

10.6 Exempt Cylinders

10.6.1 General

Stations may test cylinders that are used as receivers or compressing system not under the jurisdiction of this department or any other department under the following conditions:

(a) The cylinder to be tested in accordance with its design specification.

(b) The station may test cylinder at its own discretion, i.e. for reasons of safety or otherwise the station may decline to test.

(c) Results of the testing are for information only. The cylinder may be stamped with the date and test station mark.

(d) If the cylinder fails, it cannot be destroyed or disposed of without the owners permission.

10.6.2 Non-flammable Gases

Cylinders of less than 500 ml water capacity used for non-flammable gases are exempt from the Dangerous Goods (Class 2 - Gases) Regulations 1980 but must comply with some provisions of the Dangerous Goods (Labelling) Regulations 1978.

In addition any such container must be of appropriate construction and pressure rating.

Labels must specify the intended contents by technical or trade name, whichever best indicates their nature.

10.6.3 Disposable Gas Cartridges

Definition

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

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

10.6.4 Requirements

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

1. All cartridges must be manufactured to a specification and design approved by the Chief Inspector. The following information is required for approval of each design of cartridge:

   (a) Specification to which cartridge is designed and made.

   (b) Full drawings.

   (c) Details of manufacturing processes, including material specification.

   (d) Details of the inspection and testing procedures, including frequency and sampling techniques.

2. The liquid and solid contents of the completed cartridge as offered for sale to be such that they will not occupy more than 90% of the closed container at 55°C.

3. Cartridges to be tested and examined after manufacture for leakage and deformation or any other defect in accordance with the specification.

4. All cartridges must be accompanied by certificate as required by the specification. Copies to be retained by the importing agency.

5. Valves, if fitted, shall either:

   (a) require a special adaptor to operate such that removal closes the valve; or

   (b) be provided with adequate protection against discharge.

6. Marking and labelling to be in accordance with the Dangerous Goods (Labelling) Regulations 1978 for aerosols, or similar approved labelling, e.g:

   - Danger Extremely Flammable
   - Contents Under Pressure
   - Keep in Cool Place Away from Heat
   - Do Not Puncture or Throw in Fire

   plus the diamond as shown in the First Schedule to the Regulations.

   Any outer packaging shall be of a robust nature and must be labelled with the words “Flammable Cartridges” in block letters not less than 20 mm high.

7. Cartridges when approved will be given a reference “LAB XXX” which need not be marked on the container.

8. Cartridges must be stored in accordance with Regulation 116 of the Dangerous Goods (Class 2 - Gases) Regulations 1980.

10.6.5 Approved Specifications

BS 5329: 1976 (supersedes BS 3960: Pt 1: 1960)

AS 2278: 1979

DOT 2P

TRG 301

BS 3914

10.6.6 Approved Designs

LAB NO.	DESCRIPTION	SPEC	NET GM	DATE APPR	COMMENTS
200	Primus 2202	BS 5329	480	10.06.85	EEC 75/324/EEC
201	Primus 2201	BS 5329	220	10.06.85	EEC 75/324/EEC
202	Primus 2210	BS 5329	190	19.11.85	
203	Camping Gaz	BS 5329	190	07.06.85	C206
204	Camoing Gaz	BS 5329	90	07.06.85	GT106
207	Plein Air 200	TRG300	190	01.03.86	NSW N2427P
208 SVB	Caravan	TRG300	190	01.03.86	
	Jet Gaz 400			Not App	Agency relinquished
	Jet Gaz 200			Not App	Agency relinquished
	Cassette Feu			Not App	NSW N1375P
	Camping Gaz	190		Not App	
	Epigas 3722	185		Not App	
	Epigas 500	485		30.05.90	
	Epigas 100				
	Epigas 250				
	Newport 500	100		Not App	Lighter Fueller
	Gas-Pak	250		Not App	
	Plein Air	190		Not App	Tapered, not approved markings
	Plein Air 6200	190		Not App	AS 207 - Diff shape, also CTC SP1362

10.6.7 Stainless Steel Cylinders

There has been some concern over the corrosion of stainless cylinders. Problems occur and are serious if the corrosion is pitting. Therefore, we advise that if there is any doubt after visual testing, carry out a hydrostatic proof test, checking for leaks. Note that this corrosion may be caused by the welding of attachments or brackets which is undesirable (due to the high possibility of incorrect welding), and which may itself be cause for rejection (check the design specification).

10.7 Carbon Dioxide Cylinders

1. The Dangerous Goods (Class 2 - Gases) Regulations require the following for carbon dioxide cylinders:

Minimum Test Pressure	22 MPa (3190 psi 224 kg/cm2)
Maximum Filling Ratio	0.75

   This applies without exception to all cylinders (including fire extinguisher cylinders) manufactured after March 1980. Such cylinders must also comply with the Regulations in all other respects and must be stamped with LAB number.

2. Cylinders manufactured before March 1980, to an approved specification, which have test pressures of 22 MPa or greater and which otherwise comply with the Regulations may also be filled to a maximum filling ratio of 0.75.

3. Cylinders manufactured before March 1980, which have a test pressure of less than 22 MPa, may be filled with carbon dioxide in accordance with the following:

   (i) Cylinders which have been approved and allocated LAB number.

(ii) Other cylinders (except fire extinguisher cylinders) which comply with ALL of the following conditions may be filled to a maximum filling ratio of 0.667:

(a) Manufactured to an approved specification.

(b) A test pressure of not less than 19 MPa (2760 psi, 194 kg/cm2).

(c) Comply in all other respects with the Regulations.

(d) Are painted aluminium on the top (neck) half and black on the bottom half with the legend "Fill .667 CO2" stencilled in red letters at least 50 mm high, parallel with the longitudinal axis in two places on opposite sides of the cylinder.

(e) Have a collar retained by the valve, of a durable material, such as aluminium, stamped with the legend CO 2.667 in letters at least 6 mm high.

4. Except as otherwise approved in writing, portable fire extinguisher cylinders are to be filled to a maximum filling ratio of 0.667. Pre-1980 cylinders must have a test pressure of not less than 19 MPa.

10.8 DOT Cylinder Specifications and Test Pressures

10.8.1 Prefix

For most purposes, DOT, ICC, BTC and CTC may be taken as synonymous, e.g. ICC 3A 1800 is equivalent to DOT 3A 1800.

DOT = Department of Transportation (USA)

ICC = Interstate Commerce Commission (superseded by DOT in 1967) BTC = Board of Trade Commissioners (Canada) (superseded by CTC)

CTC = Canadian Transport Commission

10.8.2 Test Pressure

The test pressure is a multiple of the service pressure. The service pressure must be marked on the cylinder and is the number (in psi) following the specification, e.g. DOT 3A 1800 has a service pressure of 1800 psi.

Test pressures are as follows (for NZ approved specifications):

for DOT	3A	}	5/3 x service pressure	
	3AA	}		
	3B		2 x service pressure	
	4A		5/3 x service pressure	
	4B	}		
	4BA	}		
	4AA480	}	2 x service pressure 4L	}
	4BW	}	2 x service pressure 4E	}
	3AL		5/3 x service pressure	

NOTE: DOT 8, 8AL are for acetylene and are not subject to periodic pressure testing.

10.8.3 Non-approved DOT Specifications

The following DOT cylinder specifications are NOT approved for use in New Zealand:

DOT 3BN DOT 4Ds

3C	4
3D	4C
3E	4D
3A480X	4B240FLW
3HT	4B240ET
3T	4DA
	4BA240
	4BW240

10.8.4 Filling Pressures

Under DOT (USA) regulations some cylinders in some circumstances may be filled to 110% of their marked service pressure. The conditions under which this may be done are very restricted, and not generally applicable in New Zealand. The New Zealand Dangerous Goods (Class 2 - Gases) Regulations 1980 require cylinders for permanent gases to be marked with their filling pressure.

Except as otherwise approved in writing, DOT cylinders for permanent gases are not to be filled beyond their marked service pressure.

10.8.5 DOT Special Permits and Exemptions

These exemptions are specific to one manufacturer and specified design, manufacturing and testing requirements, and are for a limited period only (unless renewed).

If operating experience is satisfactory, the exemption is superseded by a formal specification (e.g. E6498 by 3AL).

Exemptions were previously referred to as Special Permits (SP). For practical purposes the two are identical, e.g. SP6498 is identical to E6498.

10.8.6 Dangerous Goods and Explosives Supplement to DOT 4BA 4BW

PRESSURE RETAINING JOINTS

The circumferential joint shall be welded by a machine process using automatic feed and weld guidance mechanisms or welded by a manual semi-automatic welding process subject to the inspection requirements of AS 1210, Section 6. Misalignment of mating butt edges shall not exceed 10% of the nominal shell thickness or 0.8mm, whichever is the lesser.

Circumferential joints shall be in the form of a butt joint with a removeable or retained backing or a joggle butt with one member offset to form an integral backing strip.

There shall be a uniform press fit between the members at the position of the weld root. The offset of a joggle butt joint shall be smooth and symmetrical. The weld shall fully penetrate the root, and the surface of the weld along and across the joint shall be reasonably smooth and free from sharp irregularities, grooves or depressions and shall merge smoothly into the plate surfaces.

CYLINDRICAL SECTIONS AND ENDS

Cylindrical sections and ends shall be examined for the following before the ends are attached:

(1) Thickness shall be in accordance with DOT 4BA-272 or 4BW-272 specification as applicable.

(2) Internal and external surfaces shall not have defects.

FINISHED CYLINDERS

Finished cylinders shall be examined for the following:

(1) Internal and external surfaces shall not have defects.

(2) Circularity shall not deviate from a true diameter by more than 1 % of the mean diameter.

(3) Welds shall not have undercutting, incomplete penetration, lack of fusion, cracks or excess offset.

10.9 German Compressed Gas Regulations

10.9.1 Approval

Cylinders to German Compressed Gas Regulations manufactured and imported before March 1980 are now deemed.approved. Identification of these cylinders is to include:

(a) date of manufacture prior to March 1980;

(b) date of importation (if this can be determined) prior to March 1980;

(c) made in Germany;

(d) either:

(i) manufactured by Jos Heiser, IWK (or IWKA), or Mannesman; and

(ii) be inspected by TUV (Technische Uberwachungs Vereine)

(e) marked in a manner similar to one of the examples shown on the following extracts of DIN 4671 and translation;

(f) a test pressure appropriate to the proposed service.

NOTE: For practical purposes ATU = BAR = MPa x 10, i.e. 200 ATU = 200 BAR = 20 MPa

10.9.2 Extracts from Translation of DIN 4671

Examples:

COMPRESSED PERMANENT GAS

123456 XYZ 49/3776

DOMAG DORTMUND V77 44Cr6-5.3-50.2

4OLTR-SAUERSTOFF-200 ATU

*5.52 #6.57

Owner's cylinder No:	123456	Manufacturer's mark:	XYZ
Owner's mark:	DOMAG DORTMUND	Year and serial No:	49/3776
Type of gas:	OXYGEN	Type of heat:	V
Filling pressure:	200 ATU	Designed yield strength in kg/mm2:	77
Inspection agency:	*5.52	Symbol of material:	44 Cr 6
Testing station stamp:	#6.57	Wall thickness mm: 5.3	
Capacity in litres:	30 LTR	Tare weight kg:	50.2

LIQUEFIED GAS

123457		XYZ 49/4947	
DOMAG DORTMUND		S20HI-4-48.5	
SCHWEFLIGE SAURE	60.2 KG	PRUF 25 ATU	
LEER	51.2 KG	*5.49 #6.54	
Owners cylinder	No: 123457	Manufacturer's mark:	XYZ
Owners mark:	DOMAG	Year and serial No:	49/4947
	DORTMUND	Type of heat treatment:	S
Type of gas:	SULPHURIC ACID	(Note 1) Designed yield strength in kg/mm_2:	20
Max permissible contents in kg:	60.2 kg	Symbol of material:	HI
Empty weight:	EMPTY 51.2 kg	Wall thickness, mm	4
		Tare weight kg:	48.5
		Test pressure:	PRUF 25 ATU
		Inspection agency:	*5.49
		Testing station stamp:	#6.54

NOTES:

1. Abbreviations for heat treatment as laid down in the Technical Rulings of the Regulation on Pressure Gas stand for the following:

   N = normalised vessel

   V = heat-treated vessel

   S = stress-relieved vessel

   U = unannealed vessel

2. The specific date for the type identification markings are to be given in the order above, e.g. V77 44 Cr 6 - 5.3 - 50.2.

10.10 Primus Cylinders

10.10.1 Primus Cylinder With Two Test Pressures

Some LPG cylinders manufactured by Primus circa 1984 and imported into New Zealand are marked with two test pressure, namely 3,000 kPa and 3,300 kPa.

According to the manufacturer, all cylinders are tested to 3,300 kPa, but for export to some countries are required to be marked 3,000 kPa.

Unless otherwise advised, Primus cylinders marked with two test pressures are to be tested at 3,300 kPa.

10.10.2 ZIP/CompanionlPrimus LPG Cylinders

Some 4.8 litre LPG cylinders were imported late 1984/early 1985 by ZIP from Companion. The cylinders were manufactured by Primus of Sweden to AS 2468 and are similar to LAB 156 but with a "companion" valve and valve protection. These cylinders were not approved at the time of importation, and had no LAB reference number on them. Other markings are believed to be satisfactory.

These cylinders have now been approved under the reference LAB 36, and are required to be marked at an approved testing station. Testing stations should ensure that the other markings comply with Part 4 of the *Guide to Gas Cylinders*.

10.10.3 Integral Relief Valve

All Primus cylinders are to be fitted with a suitably rated pressure relief valve or fusible plug.

10.11 Notes on Some Specifications and Restricted Approvals

10.11.1 AS B115A

This is not a separate specification; the suffix "A" was used approximately 1966-72 for cylinders made to AS B 115 from a particular grade of steel.

10.11.2 BS 1045 and BS 1288

These specifications are almost identical, and approval was given some years ago by the then Chief Inspector for upgrading of cylinders to BS 1288.

(a) they are to have the specification marking altered to read BS 1045/1288;

(b) the original test pressure is to be deleted by marking a line through it, and the new test pressure of 23.2 MPa added.

10.11.3 Fibre-wound Cylinders

Four designs of fibreglass wound aluminium cylinders and one design of fibreglass wound steel cylinder have been approved (LAB 180, 181, 282, 283). Periodic inspection and testing of these, and any other composite designs that may be approved, is to be at two-year intervals unless otherwise advised.

10.11.4 MK5 and MK12A Cylinders

1. Identification must include:

   (a) manufacture by Chesterfield;

   (b) MK5 (or MKV) or MK12A as appropriate;

   (c) manufactured (and imported if known) before March 1980.

2. *(a) Mark V:*

   (i) Stamping or other permanent marking is not permitted on the cylinder shell, including the shoulder and base except markers applied on the base by the manufacturer.

   (ii) Periodic test marks are to be applied to the brass "collar" around the neck boss. If there is insufficient room to do so, the cylinder is either to be condemned, or the brass collar replaced by an authorised person. There are no persons so authorised in New Zealand.

   (iii) Filling pressure for permanent gases is 12.4 MPa (1800 psi). Cylinders may be filled with all permanent gases except CNG or methane.

   (iv) Any wire-wound Mark V cylinders presented for filling are to be submitted to a cylinder testing station. The wire is to be stripped and the solder cleaned off. The temperature of the cylinder during this process must not exceed 275^0C. The cylinder must then be inspected and tested. The wire winding is not replaced.

   (v) Test pressure is 18.6 MPa (2,700 psi).

(b) Mark 12A:

(i) Filling pressures 24.8 MPa (3,600 psi) for oxygen, 27.5 (4,000 psi) for air or nitrogen.

No other gases authorised without written approval from the Chief Inspector.

(ii) Test pressure 45.5 (6,600 psi).

(iii) Markings are to be updated by testing stations thus:

TP 45.5 MPa

WP 24.8 MPa OXY or WP 27.5 MPa AIR

TW kg

WC kg

10.11.5 DOT SP6688

Special permit granted to Norris Industries of Los Angeles, California in November 1972, expired in November 1975, was not renewed after that date and is not included in those specifications superseded by DOT 3AL.

Cylinders to DOT SP6688 manufactured between November 1972 and November 1975, and imported into New Zealand before March 1980, may continue to be used for SCUBA until further notice.

All failures of cylinders to DOT SP6688 during service or at periodic inspection and test are to be reported to the Chief Inspector.

10.11.6 Mannesmann Carbon Dioxide Cylinder

Cylinders conforming to the following description:

Manufacturer:	Mannesmann
Inspection:	TUV or BV
Water capacity:	33-35 litres
Outside diameter:	204 mm
Test pressure:	250 ATU
Date of manufacturer:	Pre 1980 (probably 1956-70)

Imported by Carbonic Ice and used for carbon dioxide are approved after stamping with: DIN 4665 TP 25 MPa and will then be deemed approved under the provisions of Part 9 of the *Guide to Gas Cylinders*.

10.12 Prohibited Cylinders

This publication gives rules for the identification of approved cylinders. By implication, any cylinder not so identifiable is not approved. Additionally, the following types of cylinders are known to have entered New Zealand at various times, but are not approved for use in New Zealand. They are not to be filled or tested, but must be rendered unserviceable unless otherwise stated below or advised by an Inspector of Explosives.

1. GAZ refillable cylinders (unsuitable for NZ LPG); (If cylinder manufactured or imported before March 1980 and is to an acceptable specification the cylinder is approved.)
2. Spirotechnique cylinders imported before March 1980 and manufactured to an approved specification (and correctly stamped) are approved and may be tested. Cylinders imported post-1980, manufactured to an approved specification (and correctly stamped), are to have their details submitted to the Department of Labour, Head Office for consideration under the exemption scheme.

3. Malaysian LPG cylinders manufactured after March 1978.
4. Cylinders reputedly to DOT 4BW 240 by Pressure Container Industries of Thailand.
5. Any cylinder without a date of manufacture.
6. Any LPG cylinder with a test pressure of less than 3.0 MPa (435 psi) (pre 1980), 3.3 MPa (post 1980).

10.13 Verification of Testing Mark

The present system of approved unique marks set out in supplement No. 4 did not become fully established until 1984. Therefore, during or before 1983, after a bona fide test, cylinders were often marked with ordinary letter stamps. These markings have occasionally been fraudulently copied and ordinary letter markings must therefore always be regarded cautiously.

Acceptance of such markings must be based on a combination of judgement and experience, aided by reference to the station reputed to have conducted the test. Points to consider are:

- Is the marking a familiar one, and does it correspond in all respects with the marks applied by a known testing station?
- Does the mark appear to have been made at the date shown?
- If in doubt refer to an Inspector of Dangerous Goods.

10.14 Test Pressures and Filling Pressures

Some specifications do not require the test pressure and/or filling pressure to be marked on cylinders. If they are NOT marked on the following, use the figures given:

SPECIFICATION	TEST PRESSURE	FILLING PRESSURE
DOT Specifications	See 10.8	See 10.8
BS 399	3000 psi 20.7 MPa	1980 psi 13.7 MPa
BS 400	3000 psi 20.7 MPa	1980 psi 13.7 MPa
BS 401	As marked	Liquefiable gases only
BS 1045	3000 psi 20.7 MPa	1980 psi 13.7 MPa
BS 1287		
BS 1288	3360 psi 23.2 MPa	CO_2, N_20, Ethylene only
ASME 8	1.5 x fill pressure	As marked
TRG	1.5 x fill pressure	As marked

10.15 Equivalent Metric and Imperial Pressures

The pressures given as equivalents are not exact, but have been rounded for practical purposes.

QUOTED PRES. psi	EQUIVALENT PRES. MPa	QUOTED PRES. psi	EQUIVALENT PRES. MPa	QUOTED PRES. MPa	EQUIVALENT PRES. psi
240.0	1.7	480.0	33	1.55	225
272.0	1.9	544.0	3.8	3.00	435
275.0	1.9	550.0	3.8	3.30	479
1800.0	12.4	3000.0	20.7	3.31	480
1980.0	13.7	3300.0	22.8	13.65	1980
2015.0	13.9	3358.3	23.2	1750	2538
2133.0	14.7	3555.0	24.5	17.60	2553
2265.0	15.6	3775.0	26.0	18.90	2740
2275.0	15.7	3791.7	26.2	22.00	3190
2400.0	16.6	4000.0	27.6	22.20	3220
2475.0	17.1			23.20	3365
2850.0	19.7			23.30	3379
3000.0	20.7	5000.0	34.5	24.30	3524
3300.0	22.8	5500.0	37.9	24.50	3553
3360.0	23.2			27.50	3989
3560.0	24.6			27.60	4003
3600.0	24.8	6000.0	41.4	28.50	4134
3840.0	26.5	6400.0	44.1	29.20	4235
5000.0	34.5	8333.3	57.5	29.40	4264
				31.90	4627
				32.00	4641
				32.40	4699
				34.20	4960
				34.50	5004
				35.20	5105

10.16 Ozone Layer Protection Act 1990

Halon 1211 (BCF) and halon 1301 (BTM) are both substances which damage the ozone layer. Halon 1211 is 3 times worse and halon 1301 is 10 times worse at depleting the ozone layer than the common CFCs. For this reason the Ozone Layer Protection Act 1990, section 34, makes it an offence, liable to a fine not exceeding $5000, to knowingly or without lawful excuse release a controlled substance (halons in this case) into the atmosphere while installing, servicing, modifying or dismantling any fire extinguisher. Furthermore, from 3 october 1990 it will not be possible to import halons without an exemption from the Minister of Commerce. At this stage, there is no intention to ban the sale of halons already in New Zealand or to require the removal of existing halons from service.

The safest place to store halons at present, is in the cylinders they are already in. There is no environmental benefit if halon fire extinguishers are removed and their contents simply released to the atmosphere. Until destruction of halons becomes possible, safe

storage is the only way to prevent damage to the ozone layer. Facilities for destruction of halons are unlikely to be available until around 1995.

When cylinders are due for testing or servicing, the halons should be decanted and reused or stored. Under no circumstances should they be vented to the atmosphere unless it is for an actual fire.

If you have any enquiries regarding this information, please contact the head office of either the Ministry for the Environment or the Minstry of Commerce.

PART 11:EVALUATION OF NECK CRACKING IN ALUMINIUM SCUBA CYLINDERS

11.1 Introduction

It has become apparent that room temperature intergranular creep cracking is a problem associated with the manufacture of aluminium alloy high pressure gas cylinders by the single stage head forming process (gas heated or induction heated).

In light of the continuing neck/shoulder cracking problems associated with 6351 alloy, the manufacturers have changed to 6061 alloy in accordance with the revised design standards. Although 6061 alloy may be prone to cracking as is 6351 alloy, bunker tests carried out by the manufacturers suggest much lower crack growth rates in the new alloy.

Recently several cylinders manufactured from 6061 alloy have been condemned for severe neck/shoulder cracks after only 18 months service and a batch of replacement cylinders were condemned for similar defects. It is debatable as to whether the cracks detected in the 18-month-old cylinders were active cracks or manufactured defects since this tends to contradict bunker test data pertaining to the new alloy. It is evident from the condemned replacement cylinders (different manufacturer) that the manufacturers are facing intitial difficulties in the heading operations. From discussions with the manufacturers it has been ascertained that they have revised the heading process and remachined their dies to cater for the differing characteristics of the new alloy and they state they have now overcome the initial “teething problems”.

If neck/shoulder cracks in aluminium alloy gas cylinders are permitted to grow in service, they tend to leak rather than rupture violently. Despite no practical evidence of ruptures in SCUBA cylinders being attributable to neck cracking, it is debatable from fracture mechanics of the data available on the cylinder geometry and KIC values quoted for the 6351 alloy, should a cylinder experience diametrically opposed cracks, there could be the potential for a violent rupture. This analysis is further compounded in that there are residual inbuilt stress levels from the heading and heat treatment of the cylinders which, at the time of the recall, were not quantifiable.

The University of New South Wales, in conjunction with CIG gas cylinders, are presently conducting research into fracture toughness tests and residual stresses in aluminium alloy gas cylinders. It has been subsequently confirmed that the aluminium alloy SCUBA cylinder that ruptured on fill in Queensland was attributable to multiple severe neck cracks (leaking).

It was established from test data on crack growth rates that with an efficient inspection procedure in place at the cylinder test stations, it would be highly improbable for a potential rupture situation to arise between the annual visual and the two-year hydro stretch test.

In addition to the efficient inspection procedures in place at the cylinder test stations, all SCUBA cylinder fill stations are required under the Dangerous Goods Act and Regulations to strictly adhere to the following conditions when charging air into aluminium gas cylinders:

(a) Ensure cylinder is approved.

(b) Before being charged, the cylinder has to have been tested or inspected by an approved testing station within the allowable test inspection period.

(c) The cylinder has been subjected to an external examination for any obvious defects.

(d) The cylinder is to be chaecked for leaks during fill and when at working pressure by filling in a water bath or by bathing in soapy water.

The above conditions apply to all aluminium alloy cylinders, however, it is good practice to leak test all cylinders on fill.

The following educational package defining cracks, cleaning procedures and evaluation equipment was then prepared to educate and standardise on the test procedures (refer to APPENDIX).

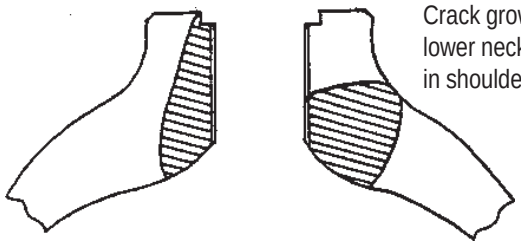
11.2 Brief History of Shoulder Cracking

1972-74	Neck cracks experiences in Luxfer UK cylinders.
1976	Mandatory shell trimming (cropping).
1976-80	Attention to valving (overtorque/thread mismatch).
1983	Ruptures of Luxfer USA composite cylinders.
1983	Role of lead (Pb) identified. Lead since controlled.
	Use of recycled material abolished.
1983-84	Induction heating for head closure in all plants.
1986-87-88	Widespread awareness of cracking problem.
	Intensive research by Alcan, Luxfer and CIG..
1987	Gas Cylinders issue alert notice for shoulder cracks in SCUBA and FRP cylinders.
1988	Luxfer USA change from 6351 to 6061 alloy.
1988	Rupture of Luxfer USA diving cylinder in Queensland, Australia.
1989	AS 1777 amended to include 6061 alloy.
	British Standards approve inclusion of 6061 alloy.
	DOT nominate 6061 alloy.
	Luxfer UK announce changing to 6061 alloy.

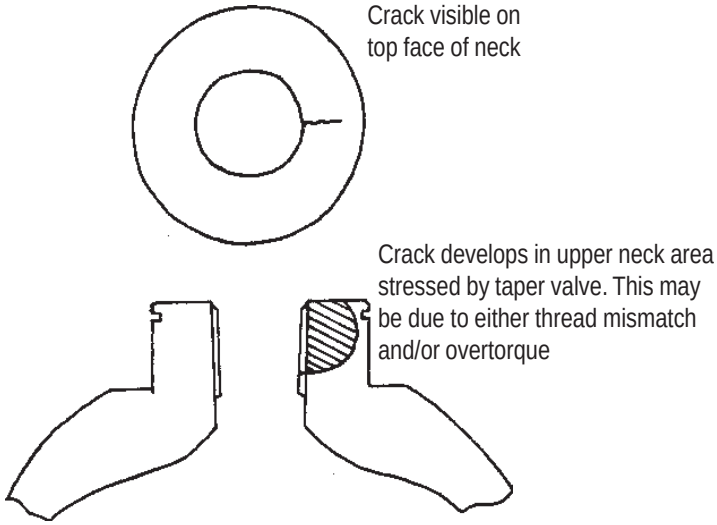
11.3 Research Carried Out on 6061 Alloy

Alcan Banbury Labs (UK)	Laboratory metallurgical tests
Luxfer USA	Whole cylinder pressure tests (bunker tests)
CIG/University of NSW	Fracture toughness tests Residual stresses
Linde USA	Duplication of Alcan Banbury tests
Group Technical Centre (GTC)	Corrosion tests
	Stress rupture tests
	NDT crack detection
Alusuisse	Laboratory metallurgical tests

11.4 Modes of Failure



Shoulder crack in parallel threaded neck



Neck crack in taper-threaded neck

11.5 Review of Tests Periods for Fibre Wrapped (BA) Cylinders

The provisional approval on FRP cylinders has been amended to:

- Annual visual
- 2-yearly hydrostatic stretch test.

This revision of the test period from a 3-yearly hydrostatic stretch test was introduced, with full agreement of NZFS, for the following reasons:

(a) These cylinders are all parallel thread aluminium alloy cylinders prone to shoulder cracking.

(b) This test period brings these cylinders in line with aluminium alloy SCUBA service which is subject to the same mode of cracking (i.e. parallel thread).

(c) Testing periods are now more in line with testing carried out overseas.

APPENDIX

ALUMINIUM ALLOY DIVE CYLINDER RECALL EDUCATIONAL PACKAGE

Definition of Cracks

There are some different interpretations or understandings of what constitutes an unacceptable defect or crack in aluminium cylinders as a basis for rejection. Until test stations are advised to the contrary, the following definition will apply:

- Examination
- Imperfections
- Neck Folds

Folds that are clearly visible as depressions, having rounded peaks and roots, shall not be demed to constitute a defect. A crack is determined as such that if there is a PARTING in the surface of the metal alloy so that in the examiner's opinion the structure, length and depth of the defect can be honestly described as a fissure/crack, which is NOT an imperfection that is allowable or tolerable at the time of manufacture.

Examination will be by an approved inspection aid. (Refer: Evaluation equipment) A scratch or groove, depression or fold as descibed above is not to be interpreted as a crack.

The exact extent of tolerable crack measurement is deliberately not quantified because it is unacceptable for any cracks to be present in high pressure cylinders.

Cleaning Procedure

During DSIR evaluation, a cylinder was found with a significant crack. The main reason for the crack being missed on selection was due to the fact that the upper neck and, in particular, the threads were unclean with dirt particles and thread lubricant/sealant obscuring good accurate visual examination. It is therefore necessary for all test stations to ensure cylinders are thoroughly cleaned by an approved method, keeping in mind the end use requirement is clean air.

At present there are only two chemical cleaners authorised by the Chief Inspector of Explosives and Dangerous Goods, i.e. Basol 88 and Transgleam.

Test stations are required to strictly adhere to the manufacturer's product data sheets and should mix the chemicals with clean water in the following proportions:

Transgleam

(1) Add water to 3/4 fill the cylinder.

(2) Add 10% by volume of Transgleam.

(3) Top up with water.

(4) Stand overnight.

(5) Drain and rinse twice.

(6) Thoroughly dry.

Basol 88

Basol 88 is prepared in a tank or other suitable container and made up to a 5% in water working solution, i.e. 200 gms to 4 litres of water. The water should be clean and as near boiling temperature as possible.

The powder or crystals are added to the water and stirred intil they are completely dissolved.

For effective degreasing, the solution should be maintained at a temperature of 82°C to 93°C during the cleaning operation.

NOTE: Both the above chemicals will degrease any skin with which it has prolonged contact. Operators should ensure that they have the necessary protective clothing.

Evaluation Equipment

At an early stage it became apparent that existing evaluation equipment (lights and mirrors, etc.) were not able to give consistent accuracy on visually determining cracking, particularly in the neck/shoulder area.

Various types of visual inspection equipment were evaluated and it is now a requirement that during an inspection from cracking in the neck/shoulder area specialised approved equipment is necessary, e.g. a magnified light probe.