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SOUTH AFRICAN NATIONAL STANDARD

Transportable pressure receptacles for compressed, dissolved and liquefied gases — Basic design, manufacture, use and maintenance

WARNING
This document references other documents normatively.

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Table of changes

Change No.	Date	Scope
Amdt 1	2023	Amended to update referenced standards, terms and definitions, the clauses on design and manufacturing requirements, valves, pressure relief devices, revalidation of pressure receptacles, marking, labelling, colour coding and certificates, filling of pressure receptacles, and on handling, storage, transport and use, and the annexes on list of acceptable manufacturing standards for gas pressure receptacles, frequency of inspections and tests for pressure receptacles, and on SCUBA and SCBA cylinder requirements.

Foreword

This South African standard was prepared by National Committee SABS/TC 058, *Vessels and systems under pressure*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in March 2023.

This document supersedes SANS 10019:2021 (edition 9).

A vertical line in the margin shows where the text has been technically modified by amendment No. 1.

This document is referenced in the Regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 3.2 and 7.4.2 to the "relevant national body". In South Africa this means the South African National Accreditation System (SANAS), established by the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act No. 19 of 2006).

Reference is made in the note 2 to 3.27 4.1.1, 4.1.2(d) and 8.7.1 to the "relevant national legislation". In South Africa this means the Pressure Equipment Regulations (PER) of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 3.6(a) and G.10.2.3(b) to the "relevant national legislation". In South Africa this means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 3.6(b) to the "relevant national legislation". In South Africa this means the Mine Health and Safety Act, 1996 (Act No. 29 of 1996).

Reference is made in 3.29 and in the note to G.11.1.1 to the "relevant national legislation". In South Africa this means the Diving Regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 4.8.1, 4.8.2, 4.8.7 and 4.9.2 to the "relevant national department". In South Africa this means the Department of Employment and Labour.

Reference is made in 4.8.7 and 8.5.2 to the "relevant national association". In South Africa this means the Liquefied Petroleum Gas South Africa (LPGSA), as approved by the Department of Employment and Labour.

Reference is made in 8.5.3.1 to the "relevant national association". In South Africa this means the Southern Africa Compressed Gases Association (SACGA).

Foreword *(concluded)*

Reference is made in 8.5.5.1, note 2 to table 10 and table 13 to the "relevant national association". In South Africa this means the South Africa Fluorocarbon Association (SAFA).

Reference is made in 8.6.4, 9.1.5.1, 9.2.1 and 9.3 to the "relevant national legislation". In South Africa this means the Legal Metrology Act, 2014 (Act No. 9 of 2014).

Reference is made in 8.8 to the "relevant national legislation". In South Africa this means the Consumer Protection Act, 2008 (Act No. 68 of 2008).

Reference is made 9.6 to the "relevant national department". In South Africa this means the Department of Employment and Labour.

Reference is made in 10.4.1.1 and 10.4.1.2 to the "relevant national legislation". In South Africa this means the National Road Traffic Act, 1996 (Act No. 93 of 1996).

Reference is made in 10.5.1 to the "relevant national legislation". In South Africa this means section 9a of the Regulations for Hazardous Chemical Substances of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 11.3 to the "relevant national legislation". In South Africa this means section 24 of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in B.2 to the "relevant national body". In South Africa this means the Aluminium Federation of South Africa (AFSA).

Reference is made in note 7 to tables F.1 and G.3 to the "relevant national authority". In South Africa this means the South African Maritime Safety Authority.

Annexes A, B, F, G and H form an integral part of this document. Annexes C, D and E are for information only.

Compliance with this document cannot confer immunity from legal obligations.

Contents

Transportable pressure receptacles for compressed, dissolved and liquefied gases — Basic design, manufacture, use and maintenance

1 Scope

1.1 This standard covers the minimum requirements for the design, manufacture, use and maintenance of refillable and non-refillable pressure receptacles of water capacity 0,5 L to 3 000 L and cartridges of water capacity greater than 0,5 L, and includes requirements over and above those contained in the pressure receptacles design and manufacturing standards (see table 1 and annex A).

1.2 In addition to industrial, refrigerant, medical and domestic type pressure receptacles, this standard also covers cylinders for self-contained underwater breathing apparatus (SCUBA) for recreational and professional diving, and self-contained breathing apparatus (SCBA). In the absence of specific areas addressed in the respective codes of practices for commercial diving, or the absence of SANOP 96 for military diving, this standard should apply, unless documented mitigations in line with best practices are in place.

1.3 This standard covers the design requirements for carbon dioxide (CO_2), hydrofluorocarbons (HFCs), and high-pressure inert gas mixtures used in portable and fixed fire-fighting systems.

1.4 This standard does not cover special pressure receptacles used in aircraft or air-brake reservoirs.

1.5 This standard does not cover cryogenic vessels (see EN 1251-1 for fundamental requirements, EN 1251-2 for design, fabrication, inspection and test and EN 1251-3 for operational requirements).

1.6 This standard does not cover pressurized road tankers, rail tankers, intermediate bulk containers (IBCs), ISO containers and mobile air receivers which are deemed to be pressure vessels as given in SANS 347.

1.7 This standard excludes cylinders used for aerosols, cartridges used for carbonated drinks, paint ball cartridges and other cartridges less than 0,5 L water capacity.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards.

2.1 Standards

ADR, *European agreement concerning the international carriage of dangerous goods by road.*

AHRI Guideline N, *Assignment of refrigerant container colours. Air-conditioning, Heating and Refrigeration Institute.*

AS 2030.1, *Gas cylinders – General requirements.*

AS 2468, *Steel cylinders for compressed gases – Brazed – 0, 1 kg to 11 kg.*

BS 341-1, *Transportable gas container valves – Specification for industrial valves for working pressures up to and including 300 bar*. **Amdt 1**

BS 341-3, *Transportable gas container valves – Valve outlet connections.*

CGA V-1, *Standard for compressed gas cylinder outlet and inlet connections.*

DIN 477-1, *Gas cylinder valves for cylinder test pressures up to 300 bar – Part 1: Valve inlet and outlet connections*.

DIN 477-5, *Gas cylinder valves – Part 5: For test pressure up to 450 bar max.; outlet connections.*

DOT 39, *Specification for welded steel – Non-refillable – Transportable pressure receptacles.*

EIGA IGC Doc. 33/06, *Cleaning of equipment for oxygen service – Guideline*.

EN 144-3, *Respiratory protective devices – Gas cylinder valves – Part 3: Outlet connections for diving gases Nitrox and oxygen.*

EN 10338, *Hot rolled and cold rolled non-coated products of multiphase steels for cold forming – Technical delivery conditions.*

EN 12245, *Transportable gas cylinders – Fully wrapped composite cylinders*.

EN 12257*, Transportable gas cylinders – Seamless, hoop-wrapped composite cylinders.*

EN 14208, *Transportable gas cylinders – Specification for welded pressure drums up to 1 000 litre capacity for the transport of gases – Design and construction*.

EN 14638-3, *Transportable gas cylinders – Refillable welded receptacles of a capacity not exceeding 150 litres – Part 3: Welded carbon steel cylinders made to a design justified by experimental methods.*

IATA, *International air transport association Dangerous Goods Regulations (DGR).*

IMDG, *International Maritime Dangerous Goods code.*

ISO 3807, *Gas cylinders – Acetylene cylinders – Basic requirements and type testing*.

ISO 5145, *Cylinder valve outlets for gases and gas mixtures – Selection and dimensioning*.

ISO 7225, *Gas cylinders – Precautionary labels*.

ISO 9809-4, *Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa.*

ISO 10297; *Gas cylinders – Cylinder valves – Specification and type testing*.

ISO 11114-1, *Gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 1: Metallic materials*.

ISO 11114-2, *Gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 2: Non-metallic materials*.

ISO 11117, *Gas cylinders – Valve protection caps and guards – Design, construction and tests.*

ISO 11118, *Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods.*

ISO 11119-1, *Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 L*.

ISO 11119-2, *Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with load-sharing metal liners*.

ISO 11119-3, *Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with non-load-sharing metallic or non-metallic liners or without liners*.

ISO 11119-4, *Gas cylinders – Refillable composite gas cylinders – Design, construction and testing – Part 4 Fully wrapped fibre reinforced wrapped composite gas cylinders up to 150 L with load-sharing welded metallic liners.*

ISO 11363-1, *Gas cylinders – 17E and 25E taper threads for connection of valves to gas cylinders – Part 1: Specifications.*

ISO 11372, *Gas cylinders – Acetylene cylinders – Filling conditions and filling inspection.*

ISO 11515, Gas cylinders – Refillable composite *reinforced tubes of water capacity between 450 L and 300 L – Design, Construction and testing.*

ISO 11439, *Gas cylinders – High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles.*

ISO 11621, *Gas cylinders – Procedures for change of gas service*.

ISO 13088, *Gas cylinders – Acetylene cylinder bundles – Filling conditions and filling inspection.*

ISO 13338, *Gas cylinders – Gases and gas mixtures – Determination of tissue corrosiveness for the selection of cylinder valve outlets.*

ISO 13341, *Gas cylinders – Fitting of valves to gas cylinders*.

ISO 13769, *Gas cylinders – Stamp marking*.

ISO 18119, Gas cylinders, *Seamless steel and seamless aluminium-alloy gas cylinders and tubes – Periodic inspection and testing.* **Amdt 1**

ISO 18172-1, *Gas cylinders – Refillable welded stainless steel cylinders – Part 1: Test pressure 6 MPa and below.*

ISO 18172-2, *Gas cylinders – Refillable welded stainless steel cylinders – Part 2: Test pressure greater than 6 MPa.*

ISO 21172-1, *Gas cylinders – Welded steel pressure drums up to 3000 litres capacity for the transport of gases – Design and construction – Part 1: Capacities up to 1000 litres.* **Amdt 1**

ISO 22434, *Transportable gas cylinders – Inspection and maintenance of cylinder valves*.

SANS 39/ISO 407, *Small medical gas cylinders – PIN-index yoke-type valve connections.*

SANS 162/ISO 10286, *Gas cylinders – Terminology*.

SANS 199, *Shut-off valves for transportable, refillable liquefied petroleum gas cylinders*.

SANS 277/EN 12021, Respiratory protective devices – Compressed air for breathing apparatus.

SANS 289, *Labelling requirements for prepackaged products (prepackages) and general requirements for the sale of goods subject to legal metrology control*.

SANS 347, *Categorization and conformity assessment criteria for all pressure equipment*.

SANS 1151, *Portable rechargeable fire extinguishers – Halogenated hydrocarbon type extinguishers*.

SANS 1274, *Coatings applied by the powder-coating process*.

SANS 1306-1/ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads – Part 1: Dimensions, tolerances and designation.*

SANS 1567, *Portable rechargeable fire extinguishers – CO_2 type extinguishers*.

SANS 1739, *Low pressure welded steel cylinders for fire extinguishers*.

SANS 1910, *Portable refillable fire extinguishers*.

SANS 1700-2-5/ISO 965-1, *Fasteners – Part 2: Screw threads – Section 5: ISO general purpose metric screw threads – Tolerances – Principles and basic data*.

SANS 1700-2-6/ISO 965-2, *Fasteners – Part 2: Screw threads – Section 6: ISO general purpose metric screw threads – Tolerances – Limits of sizes for general purpose external and internal screw threads – Medium quality*.

SANS 1700-2-7/ISO 965-3, *Fasteners – Part 2: Screw threads – Section 7: ISO general purpose metric screw threads – Tolerances – Deviations for constructional screw threads*.

SANS 1825, *Gas cylinder test stations – General requirements for periodic inspection and testing of transportable refillable gas pressure receptacles*.

SANS 4706/ISO 4706, *Gas cylinders – Refillable welded steel cylinders – Test pressure 60 bar and below*.

SANS 6406, *Gas cylinders – Seamless steel gas cylinders – Periodic inspection and testing.*

SANS 7866/ISO 7866, *Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing*.

SANS 9809-1/ISO 9809-1, *Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa*.

SANS 9809-2/ISO 9809-2, *Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa*.

SANS 9809-3/ISO 9809-3, *Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders*.

SANS 10006, *Colour marking and identification of medical gas cylinders and anaesthetic apparatus*.

SANS 10087-1, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 1: Liquefied petroleum gas installations involving gas storage containers of individual water capacity not exceeding 500 L and a combined water capacity not exceeding 3 000 L per installation*.

SANS 10087-3, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500 L*.

SANS 10087-4, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations – Part 4: The transportation of LP gas including the design, construction, inspection, fittings, filling, maintenance and repair of LP gas bulk vehicles and rail tank cars*.

SANS 10087-6, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations – Part 6: The application of liquefied petroleum and compressed natural gases as engine fuels for internal combustion engines.*

SANS 10087-7, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations – Part 7: Storage and filling premises for refillable liquefied petroleum gas (LPG) containers of gas capacity not exceeding 19 kg and the storage of individual gas containers not exceeding 48 kg*.

SANS 10087-8, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations – Part 8: Filling containers for LP gas operated fork lift vehicles in-situ*.

SANS 10228, *The identification and classification of dangerous goods for transport by road and rail modes*.

SANS 10229-1, *Transport of dangerous goods – Packaging and large packaging for road and rail transport – Part 1: Packaging*.

SANS 10231, *Transport of dangerous goods by road – Operational requirements.*

SANS 10234, *Globally Harmonized System of classification and labelling of chemicals (GHS)*.

SANS 10263-0, *The warehousing of dangerous goods – Part 0: General requirements*.

SANS 10263-2, *The warehousing of dangerous goods – Part 2: The storage and handling of gas cylinders*.

SANS 10297, *The reconditioning of external LPG cylinder valves*.

SANS 10461/ISO 10461, *Gas cylinders – Seamless aluminium-alloy gas cylinders – Periodic inspection and testing*.

SANS 11120/ISO 11120, *Gas cylinders – Refillable seamless steel tubes of water capacity between 150 L and 3 000 L – Design, construction and testing*.

SANS 11623/ISO 11623, *Gas cylinders – Composite construction – Periodic inspection and testing.*

SANS 17020/ISO/IEC 17020, *Conformity assessment − Requirements for the operation of various types of bodies performing inspection*.

SANS 20067/ECE R67, *Uniform provisions concerning: I. Approval of specific equipment of motor vehicles using liquefied petroleum gases in their propulsion system; II. Approval of a vehicle fitted with specific equipment for the use of liquefied petroleum gases in its propulsion system with regard to the installation of such equipment*.

SANS 20110/ECE R110, *Uniform provisions concerning the approval of: I. Specific components of motor vehicles using compressed natural gas (CNG) in their propulsion system; II. Vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) in their propulsion system*.

SANS 20703/ISO 20703, *Gas cylinders – Refillable welded aluminium-alloy cylinders – Design, construction and testing.*

2.2 Other publications

SANOP 96, *South African Naval Operations Publication Number 96.*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in the relevant manufacturing standards given in 4.1.2, annex A, SANS 162, and the following apply.

3.1
acceptable
acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant

3.2
accreditation body
relevant national body (see foreword)

3.3
approved
approved by the approving authority

3.4
approved inspection authority
inspection authority that is approved or recognized by the approving authority

3.5
approved test station
test station that is accredited in accordance with the requirements of SANS 1825 and SANS 17020

3.6
approving authority
appropriate of the following:

a) within the scope of the relevant national legislation (see foreword)

b) within the scope of the relevant national legislation (see foreword)

3.7
bundle
assembly of cylinders that are fastened together, that are interconnected by a manifold and are transported as a unit

3.8
certification
verification that a pressure receptacle complies with the relevant manufacturing standards given in 4.1.2

3.9
charging pressure
pressure that is stamped on a pressure receptacle for a permanent gas to indicate the maximum gauge pressure (measured or corrected to 20 °C that may be applied at the time of filling

3.10
class of pressure receptacle
category into which a pressure receptacle is placed based on whether the pressure receptacle is seamless, or of welded construction (the weld being fully or partially radiographed), refer to tables 4 and 11

3.11
compatibility
acceptable interaction of gas and cylinder or gas and cylinder equipment under conditions of use

3.12
competent person
person that has the knowledge, training and experience specific to the work or task being performed

3.13
compressed gas
gas that, when packed under pressure for transport, is entirely gaseous at −50 °C

NOTE This category includes all gases with a critical temperature less than or equal to −50 °C.

3.14
cylinder
transportable pressure receptacle (that may be seamless, welded or composite) with a water capacity of 0,5 L to 150 L

3.15
developed pressure
pressure that is achieved by the contents of a pressure receptacle, that is filled in accordance with this standard, when raised to the reference temperature given in table 5

3.16
dissolved gas
gas that, when packed under pressure for transport, is dissolved in a liquid phase solvent

3.17
filling ratio
ratio of the mass of gas in the cylinder to the water capacity of the cylinder, refer to tables 2 and 3

NOTE Filling ratio is expressed in kilograms per litre (kg/L).

3.18
flammable gas
gas which at 20 °C and a standard pressure of 101,3 kPa: **Amdt 1**

a) is ignitable when in a mixture of 13 % or less by volume with air; or **Amdt 1**

b) has a flammable range with air of at least 12 % points regardless of the lower flammable limit **Amdt 1**

NOTE 1 Flammability should be determined by tests or by calculation, in accordance with methods adopted by ISO (see ISO 10156). **Amdt 1**

NOTE 2 Where there is insufficient data for the use of these methods, tests by a comparable method recognized by the approving authority of the country of origin may be used. **Amdt 1**

3.19 **Amdt 1**
gas cartridge
non-refillable container filled once only with gas or a mixture of gases for fuelling portable gas appliances which burn the gas or gases in use

3.20 **Amdt 1**
liquefied petroleum gas
LPG
commercial butane, commercial propane, or a mixture of light hydrocarbons (predominantly propane, propylene butane and butylene) that is gaseous under conditions of ambient temperature and pressure, and that is liquefied by an increase of pressure or a lowering of temperature

3.21 **Amdt 1**
low-pressure liquefiable gas
gas that, when packaged under pressure for transport, is partially liquid at temperatures above −50 °C and has a critical temperature above +65 °C

3.22 **Amdt 1**
maintenance
action that includes one or more of the following activities:

a) routine inspection of gas pressure receptacles;

b) testing and repair of pressure receptacles in accordance with SANS 1825;

c) changing of valves; or

d) restoring the external appearance of the pressure receptacle, including labelling and painting.

3.23 **Amdt 1**
maximum permissible operating pressure
highest pressure that may be developed during service

3.24 **Amdt 1**
non-refillable cylinder
cylinder that is designed to be filled only once after original manufacture

3.25 **Amdt 1**
normalize
heat treat
to heat a cylinder to a uniform temperature above the upper critical point of the steel to regenerate or homogenize the metallurgical structure of the steel to a sufficient degree to achieve the desired mechanical properties, and then to cool it in a controlled or still-air atmosphere

3.26 **Amdt 1**
pressure drum
welded transportable pressure receptacle with a water capacity greater than 150 L but not more than 1 000 L

EXAMPLE Cylindrical pressure receptacles that are equipped with rolling rings, spheres on skids, and dumpy tanks that incorporate forklift truck or crane facilities.

3.27 **Amdt 1**
pressure receptacle
collective term that includes cylinders, bundles, tubes and pressure drums for the storage and transportation of liquefied or compressed gases with a water capacity from 0,5 L to 3 000 L

NOTE 1 All types of pressure receptacle, excluding non-refillable cylinders, are refillable.

NOTE 2 The terms "transportable gas containers", "transportable pressure containers" and "containers" as used in SANS 347 and the relevant national legislation (see foreword), the relevant European Industrial Gases Association (EIGA) documents, and the various manufacturing standards listed in table 1 and annex A, are deemed to have the same meaning as a pressure receptacle as defined in this standard.

3.28 **Amdt 1**
pressure relief device
device that is fitted to the cylinder or cylinder valve and that is designed to relieve gas pressure in the event of abnormal conditions resulting in the development of excess pressure inside the cylinder

3.29 **Amdt 1**
professional diving
diving for remuneration as part of a diving operation, either commercial, military, or civil service, within the scope of the relevant national legislation (see foreword)

NOTE This does not include person or operations operating in the recreational industry.

3.30 **Amdt 1**
re-certification
certification of previously certified equipment where the required traceability (to the applicable statutory regulations and supporting documentation) is no longer available

3.31 **Amdt 1**
refrigerant
working fluid in a refrigeration cycle that absorbs heat from bodies at a low temperature and rejects heat to bodies at a higher temperature

3.32 **Amdt 1**
revalidation
periodic inspection and testing of transportable pressure receptacles in accordance with an approved standard

3.33 **Amdt 1**
special gas
gas or gas mixture that has specific properties and that is prepared for special applications

EXAMPLE Instrument calibration gas mixtures or technical diving mixtures.

3.34 **Amdt 1**
tare mass
empty mass of the cylinder including other fittings that are not removed during the filling operation, such as the valve, dip tube and any permanent or semi-permanently fixed valve protection device(s)

3.35 **Amdt 1**
temperature

3.35.1 **Amdt 1**
critical temperature
temperature above which the gas cannot exist in a liquid state

3.35.2 **Amdt 1**
reference temperature
maximum temperature that the gas in the gas pressure receptacle can be expected to reach under normal service conditions

3.36 **Amdt 1**
test pressure
pressure to which a pressure receptacle is subjected in accordance with its design standard

3.37 **Amdt 1**
tube
seamless transportable pressure receptacle with a water capacity greater than 150 L but not more than 3 000 L

3.38 **Amdt 1**
verification
act of reviewing, inspecting, testing, checking, auditing or otherwise determining and documenting whether items, processes, services or documents comply with specified requirements

3.39 **Amdt 1**
working pressure
settled pressure of a compressed gas at a uniform reference temperature of 20 °C in a full pressure receptacle

4 Design and manufacturing requirements

4.1 General

4.1.1 Pressure receptacles shall be designed and manufactured in accordance with the requirements of the relevant national legislation (see foreword), in conjunction with the appropriate design and manufacturing of the standards given in table 1 (see also annex A).

4.1.2 The preferred standards given in table 1 do not preclude the design, manufacture and use of pressure receptacles in accordance with

a) any of the current standards as given in annex A,

b) the special conditions specified in annex B, or

c) SANS 1825 subject to 4.8.3, and

d) the standards given in the relevant national legislation (see foreword), subject to 4.8.3.

NOTE It is recommended that bundles are designed, and prototype tested only in accordance with the associated clauses in ISO 10961.

4.2 Additional design requirements for pressure receptacles

4.2.1 The developed pressure of a gas at its reference temperature shall not exceed the test pressure of the pressure receptacle. The elevated minimum test pressures of low-pressure and high-pressure liquefiable gases given in tables 2 and 3 shall also apply as they take into account additional safety factors with regard to the properties of the contained gas.

NOTE Annex C contains information regarding the developed pressure for permanent gases.

4.2.2 The purchaser shall comply with the requirements given in 4.1 for both new and second-hand pressure receptacles.

Table 1 — Design and manufacturing standards for pressure receptacles

1	2
Type of pressure receptacle	**Standard**
Refillable welded stainless steel cylinders	ISO 18172-1 and ISO 18172-2
Refillable seamless steel gas cylinders of water capacity up to 150 L	SANS 9809-1, SANS 9809-2 and SANS 9809-3
Refillable seamless steel tubes of water capacity from 150 L to 3 000 L	SANS 11120
Dissolved acetylene cylinders of water capacity up to 150 L	ISO 3807
Gas cylinders – High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles	ISO 11439
Refillable welded steel pressure receptacles of water capacity up to 500 L	SANS 4706[a]
Seamless aluminium gas cylinders of water capacity up to and including 150 L	SANS 7866
Fully wrapped composite cylinders up to 450 L	EN 12245[b]
Hooped wrapped composite cylinders	ISO 11119-1
Fully wrapped fibre-reinforced composite gas cylinders with load-sharing metal liners	ISO 11119-2
Fully wrapped fibre-reinforced composite gas cylinders with non-load-sharing metal or non-metallic liners	ISO 11119-3
Gas cylinders – Refillable composite gas cylinders – Design, construction and testing – Part 4 Fully wrapped fibre reinforced wrapped composite Gas Cylinders up to 150 L with load sharing welded metallic liners	ISO 11119-4
Composite Reinforced Tubes of Water Capacity between 450 L and 3000 L Design, Construction & Performance	ISO 11515
Gas cylinders – Welded steel pressure drums up to 3000 litres capacity for the transport of gases – Design and construction – Part 1: Capacities up to 1000 litres	ISO 21172-1
Low pressure fire extinguishers with a gross mass that does not exceed 23 kg	SANS 1151, SANS 1739 and SANS 1910
Welded LPG fuel cylinders for motor vehicles up to 150 L	SANS 20067
Welded compressed natural gas (CNG) fuel cylinders for motor vehicles up to 150 L	SANS 20110
Welded aluminium-alloy gas cylinders up to 150 L	SANS 20703
Brazed steel cylinders for compressed gases up to 20 L	AS 2468[c, d]
Non-refillable metallic gas cylinders	DOT 39 and ISO 11118
Refillable seamless stainless steel gas cylinders	ISO 9809-4
Non refillable metallic gas cartridges for liquefied petroleum gases, total capacity between 50 ml and 1 000 ml	EN 417

[a] Welded steel cylinders manufactured for LPG shall use a test pressure of 3 000 kPa and a filling ratio of 0,425 for cylinder design.

[b] These containers shall have a lining as described in EN 12245 when manufactured for use in South Africa for LPG, butane and propane service. This requirement applies to all other composite cylinder standards.

[c] Cylinders made in accordance with AS 2468 shall be fitted with a pressure relief device.

[d] Notwithstanding the requirements of AS 2468, LPG cylinders may only be accepted in the normalized condition. AS 2468 refers only to compressed gases; LPG cylinders made in accordance with AS 2468 are acceptable. Specific gas types are listed in AS 2030.1, and in the definitions of that standard, LPG is referred to as a compressed gas.

Amdt 1

Table 2 — Low-pressure liquefiable gases[a]

1	2	3	4	5	6	7	8	9
Name of gas	**UN number**	**Chemical symbol**	**Dangerous properties[b]**	**Critical temperature** °C	**Minimum test pressure** kPa gauge	**Filling ratio[c]**	**Pressure relief device**	**Developed pressure at 65 °C** kPa gauge
Ammonia	1005	NH_3	C, T	132,4	2 900	0,54	Forbidden	2 848
Boron trichloride	1741	BCl_3	C, T	178,8	1 000	1,19	Forbidden	20 703
Bromochlorodifluoromethane (R 12 B1)	1974	$CBrClF_2$	A	153,7	1 000	1,61	[d]	693
1,2 – Butadiene	1010	$CH_2{:}C{:}CHCH_3$	F	176,1	1 000	0,59	[d]	–
1,3 – Butadiene	1010	$CH_2{:}CHCH{:}CH_2$	F	152,0	1 000	0,52	[d]	–
n-Butane	1011	C_4H_{10}	F	152,0	3 000	0,52	Mandatory	620
Carbonylsulfide	2204	COS	F	105,0	3 000	0,87	[d]	2 976
Chlorine	1017	Cl_2	C, T	144,0	2 200	1,25	[d and f]	1 886
Chlorine trifluoride	1749	ClF_3	C, T, O	153,7	3 000	1,40	[d]	614
Chlorodifluoromethane (R 22)	1018	$CHClF_2$	A	96,2	2 700	1,03	[d]	2 619
Chlorotrifluoroethane (R 133a)	1983	CH_2ClCF_3	A	150,0	1 000	1,18	[d]	570
Commercial butane	1011	C_4H_{10}	F	150,0	3 000	0,425	Mandatory	980
Commercial propane	1978	C_3H_8	F	95,0	3 000	0,425	Mandatory	2 655
Cyanogen chloride	1589	CCIN	C, T	215,0	2 000	1,03	Forbidden[e]	462
Cyclopropane	1027	C_3H_6	F	125,2	1 800	0,55	[d]	1 869
Dichlorofluoromethane (R 21)	1029	$CHCl_2F$	A	178,5	1 000	1,23	[d]	494
Dimethylamine	1032	$(CH_3)_2NH$	F	164,6	1 000	0,59	[d]	601
Dimethyl ether	1033	C_2H_6O	F	126,9	1 800	0,58	[d]	1 517

Table 2 *(continued)*

1	2	3	4	5	6	7	8	9
Gas name	**UN number**	**Chemical symbol**	**Dangerous properties**[b]	**Critical temperature** °C	**Minimum test pressure** kPa gauge	**Filling ratio**[c]	**Pressure relief device**	**Developed pressure at 65 °C** kPa gauge
Ethylamine	1036	C_2H_7N	F	183,4	1 000	0,61	Forbidden	20 703
Ethyl Formate	1190	$C_3H_6O_2$	F, T	235,0	20 700	0,167	Forbidden	140
Ethylene oxide	1040	C_2H_4O	F, T	195,8	1 500	0,78	Forbidden	483
Hydrogen cyanide	1051	HCN	F, T(A)	183,5	1 000	0,55	Forbidden[e]	275
Hydrogen sulfide	1053	H_2S	F, T	100,0	4 800	0,67	Forbidden	4 714
LPG	1075	–	F	95,0	3 000	0,425	Mandatory	2 655
Methylamine	1061	CH_3NH_2	F	156,9	1 300	0,58	Forbidden	1 081
Methyl bromide (R 40 B 1)	1062	CH_3Br	T	194,0	1 000	1,51	Forbidden	559
Methyl chloride (R 40)	1063	CH_3Cl	F	143,0	1 700	0,81	Forbidden	1 463
Nitrosyl chloride	1069	NOCl	C, T	167,5	1 300	1,10	Forbidden[e]	1 058
Octafluorocyclobutane (RC 318)	1976	C_4F_8	A	115,3	1 100	1,32	[d]	857
Propane	1978	C_3H_8	F	96,8	3 000	0,43	Mandatory	2 222
Propylene	1077	C_3H_6	F	92,4	2 700	0,43	[d]	2 676
Sulfur dioxide	1079	SO_2	C, T	157,5	1 200	1,23	Forbidden	1 172
1,1,1,2-Tetrafluoroethane (R 134a)	3159	CF_3CH_2F	A	101,1	–	1,05	[d]	–
Trimethylamine	1083	C_3H_9N	F	160,2	1 000	0,56	Forbidden[e]	559
Vinyl chloride (R 1140)	1086	C_2H_3Cl	F	156,5	1 200	0,81	Forbidden	1 039

[a] Gases that have a critical temperature below −10 °C.

[b] The properties are indicated as follows:
A = asphyxiant, C = corrosive, F = flammable, O = oxidizing, T = toxic, T(A) = classified as class A poison.

[c] For design purposes, LPG cylinders use the ratio 0,425.

[d] The fitting of a pressure relief device to a cylinder, cylinder valve and drum is subject to P200 of ADR.

[e] ADR states that it is forbidden to fit relief valves to cylinders or drums which contain a gas with a LC50 of 200 ppm or less.

[f] If relief devises are fitted to chlorine cylinders and drums they shall be fusible plug type with the yield temperature of 70°C to 74 °C.

Amdt 1

Table 3 — High-pressure liquefiable gases[a]

1	2	3	4	5	6	7	8	9
Name of gas	**UN number**	**Chemical symbol**	**Dangerous properties[b]**	**Critical temperature** °C	**Minimum test pressure** kPa	**Filling ratio**	**Pressure relief device**	**Developed pressure at 65 °C** kPa
Acetylene[c]	1001	C_2H_2	F	35,2	6 000	–	[d]	4 900
Carbon dioxide	1013	CO_2	A	30,1	25 000 19 000	0,76 0,68	Mandatory	24 000 18 800
Chlorotrifluoromethane (R 13)	1022	$CClF_3$	A	28,8	5 000 19 000 12 000 10 000	1,11 1,04 0,90 0,83	[d]	–
Diborane	1911	B_2H_6	T, F	16,0	25 000	0,07	Forbidden[e]	–
Ethane	1035	C_2H_6	F	32,3	30 000 12 000	0,40 0,30	[d]	–
Ethylene	1962	C_2H_4	F	9,2	30 000 22 500	0,38 0,34	[d]	19 600 14 400
Hydrogen chloride	1050	HCl	C, T	51,5	20 000 15 000	0,74 0,67	[d]	16 800 12 600
Nitrous oxide	1070	N_2O	O	36,4	25 000 19 000	0,75 0,68	Mandatory	22 600 17 000
Silane	2203	SiH_4	F	−3,5	25 000 22 500	0,36 0,32	Forbidden	–
Silicon tetrafluoride	1859	SiF_4	C, T	−14,2	30 000 20 000	1,10 0,74	Forbidden	–
Silicon hexafluoride	1080	SF_6	A	45,6	16 000 14 000 7 000	1,38 1,34 1,06	[d]	15 700 12 300

Amdt 1

Table 3 *(concluded)*

1	2	3	4	5	6	7	8	9
Name of gas	**UN number**	**Chemical symbol**	**Dangerous properties**[b]	**Critical temperature** °C	**Minimum test pressure** kPa	**Filling ratio**	**Pressure relief device**	**Developed pressure at 65 °C** kPa
Sulphuryl Fluoride	2191	SO_2F_2	T	33.3	5 000	1.10	Forbidden	4 550
Trifluoromethane (R 23)	1984	CHF_3	A	26,0	25 000 19 000	0,96 0,88	[d]	–
Xenon	2036	Xe	A	16,3	13 000	1,28	[d]	–

[a] Gases that have a critical temperature below −10 °C.

[b] The properties are indicated as follows:

A = asphyxiant, C = corrosive, F = flammable, O = oxidizing, T = toxic.

[c] Acetylene is not a liquefiable gas, but is a gas dissolved under pressure in acetone. Because the porous substance in acetylene cylinders prevents conventional internal inspections and because the cylinders are subjected to very severe handling in service, the developed pressure of the gas at reference temperature (4 900 kPa at 65 °C) is considered unacceptable for design purposes, and the minimum wall thickness shall be based on a hydrostatic test pressure, as given in the design standard.

[d] The fitting of a pressure relief device to a cylinder, cylinder valve and drum is subject to P200 of ADR.

[e] ADR states that it is forbidden to fit relief valves to cylinders or drums which contain a gas with a LC50 of 200 ppm or less.

Amdt 1

4.2.3 For low-pressure liquefiable gases, the maximum mass of contents per litre of water capacity shall equal 0,95 times the density of the liquid at 50 °C. In addition, the liquid portion of the gas shall not fill the pressure receptacle at any temperature up to 60 °C. The test pressure of the pressure receptacle shall be at least equal to the vapour pressure (absolute) of the liquid at 65 °C, minus 100 kPa. (See table 2.)

4.2.4 Notwithstanding the contents of 4.2.3, butane and propane pressure receptacles, including all LPG pressure receptacles, shall be rated for a test pressure of 3 000 kPa and shall be designed to a fill ratio of 0,425.

4.2.5 All LPG pressure drums (dumpy tanks) shall have a water capacity in excess of 150 L and shall be fitted with an approved pressure relief device.

Each LPG pressure drum (dumpy tank) shall have an automatic shut-off valve which shall operate at the maximum allowed liquid level applicable to the pressure drum (dumpy tank) being filled.

The above requirements in 4.2.5 are not applicable to refrigerant grades of LPG.

4.2.6 To ensure that pressure receptacles filled with low-pressure liquefiable gases, excluding LPG, are not overfilled due to filling system inaccuracies, the following additional parameters shall be taken into consideration when calculating the product capacity of the pressure receptacle (see annex D for a worked example):

a) The calculation shall be based on the minimum water capacity *WC*, in litres (L), of the selected pressure receptacle family, for example:

   The maximum theoretical filling weight (in kilograms (kg)) = minimum *WC* (L) × the fill ratio.

b) The actual maximum filling weight (in kilograms) shall be determined by subtracting from the maximum theoretical filling weight the sum of the following (see annex D for the formula to be used including a work example):

   1) the maximum tolerance in the stamped tare mass of the pressure receptacle;

   2) the maximum filling tolerance of the filling scale (½ display increment); and

   3) the filling process variation (determined from filling 20 pressure receptacles).

c) The weight variance shall be checked daily.

NOTE For LPG filling, see SANS 10087-3 and SANS 10087-7.

4.3 Heat treatment

4.3.1 The heat treatment applied to gas pressure receptacles during manufacture and maintenance shall be applied in accordance with the relevant design specification. All welded steel cylinders excluding welded steel non-refillable cylinders manufactured for liquefied gases, including LPG, shall be supplied to South Africa in a normalized condition between 900 °C and 930 °C. As a guide, the minimum temperature for normalizing welded steel cylinders manufactured from carbon steel that has an actual minimum carbon content of 0,1 % is 900 °C.

4.3.2 The manufacturer and the revalidator of the cylinder should ensure that the normalizing temperature takes into account the actual carbon content of the steel and the requirement to achieve at least the minimum mechanical properties (ultimate tensile strength, yield strength and percentage elongation) in accordance with the relevant design code.

4.3.3 The requirements in 4.3.1 and 4.3.2 regarding the normalizing of cylinders is not applicable to welded steel cylinders manufactured in accordance with health and safety standards which permit alternative design and construction methods using dual-phase steels that comply with EN 10338 (or similar).

4.3.4 The requirements in 4.3.1 and 4.3.2 regarding the normalizing of cylinders are not applicable to welded steel cylinders in chlorine gas services.

4.4 Powder coating

4.4.1 The powder coating of aluminium cylinders shall be in accordance with SANS 1274, SANS 10461 and ISO 18119. The process of powder coating can adversely affect the mechanical properties of an aluminium cylinder if not properly controlled due of the high temperature used in this process. **Amdt 1**

4.4.2 Gas cylinders manufactured in accordance with approved health and safety standards which permit alternative design and construction methods using dual-phase steel shall be powder coated. The maximum temperature for powder coating shall be in the range of 170 °C to 190 °C with a peak temperature not exceeding 200 °C.

4.4.3 The powder coating of seamless steel cylinders shall be in accordance with SANS 6406 and ISO 18119. **Amdt 1**

4.5 Class of pressure receptacle

Each metallic pressure receptacle shall have a class rating in accordance with that given in column 3 of table 4, appropriate to the type of gas given in column 2, subject to the provision that when the filling conditions are such that the developed pressure for the gas at reference temperature will exceed 7 000 kPa, only a class 1 pressure receptacle shall be used (see table 5 for reference temperatures and tables 2, 3, 6, 7 and 8 for developed pressures).

4.6 Special-purpose pressure receptacles

4.6.1 Pressure receptacles intended to be used as fuel tanks for motorized vehicles shall be specially manufactured for this purpose and shall comply with the requirements of SANS 20067 or SANS 20110 (or both).

4.6.2 Pressure receptacles that are intended for general duty shall not be used on motorized vehicles; however, LPG cylinders may be used on forklift trucks, provided that they are specifically adapted and marked as such in accordance with 8.6.3 and SANS 10087-6.

4.6.3 No person shall manufacture or import dissolved acetylene cylinders for distribution in South Africa unless such person can produce proof that such cylinders comply with the requirements of ISO 3807, or other approved standards (see annex A).

Table 4 — Class of pressure receptacles for specific gases

1	2	3
	Name of gas	**Minimum class of pressure receptacle**[a]
1	Acetylene	3
2	Air	1
3	Ammonia	2
4	Argon	1
5	Boron trichloride	2
6	Boron trifluoride	1
7	Bromochlorodifluoromethane (R 12 B1)	3
8	Bromotrifluoromethane (R 13 B1)	1
9	Butadiene	3
10	Butane, iso-	3
11	n-Butane	3
12	Carbon dioxide	1
13	Carbon monoxide	1
14	Chlorine	2
15	Chlorine trifluoride	2
16	Chlorotrifluoromethane (R 133a)	3
17	Coal gas	1
18	Cyanogen chloride	2
19	Cyclopropane	3
20	Dichlorodifluoromethane (R 12)	3
21	Dichloromonofluoromethane (R 21)	3
22	Dimethyl ether	3
23	Ethane	1
24	Ethylamine, mono-	3
25	Ethyl chloride	3
26	Ethylene	1
27	Ethylene oxide	3
28	Fluorine	1
29	Helium	1
30	Hydrogen	1
31	Hydrogen chloride	1
32	Hydrogen cyanide	1
33	Hydrogen fluoride	2
34	Hydrogen sulfide	1
35	LPG	3
36	Methane	1
37	Methylamine, di-	3
38	Methylamine, mono-	3
39	Methylamine, tri-	3
40	Methyl bromide	3
41	Methyl chloride	3
41	Monochlorodifluoromethane (R 22)	3
43	Neon	1
44	Nitrogen	1
45	Nitrogen dioxide	3

Table 4 *(concluded)*

1	2	3
	Name of gas	**Minimum class of pressure receptacle**[a]
46	Nitrous oxide	1
47	Octafluorocyclobutane (RC 318)	3
48	Oxygen	1
49	Phosgene	1
50	Propane	3
51	Propylene	3
52	Sulfur dioxide	2
53	Sulfur hexafluoride	3
54	Vinyl chloride	3

For the specific gases shown in column 2, the class of the pressure receptacle recommended shall be any number up to and including the corresponding number given in column 3, subject to the provision that when the filling conditions are such that the developed pressure for the gas at reference temperature exceeds 7 000 kPa, only a class 1 pressure receptacle shall be used.

[a] Class 1: seamless metallic pressure receptacles.

Class 2: metallic pressure receptacles of welded construction where all seams have been fully radiographed.

Class 3: metallic pressure receptacles of welded construction where the seams have been partially radiographed in accordance with an approved standard. Composite cylinder types 2, 3 and 4 can be used for containment of certain gases listed above, excluding acetylene. The liner material shall be selected based on the gas compatibility given in ISO 11114-1 and ISO 11114-2. See also table 1, annex A and annex B.

Table 5 — Reference temperatures

1	2	3	4
Water capacity of pressure receptacle	**Reference temperature for developed pressure, used when calculating the test pressure of a pressure receptacle** °C		
	Liquefiable gases		**Permanent gases**
L	**Low pressure**	**High pressure**	
0,5 up to but not including 150	65	65	65
150 up to and including 1 000	65	65	65
Greater than 1 000 up to and including 3 000	60	60	65
Non-refillable cylinders	In accordance with design standard	In accordance with design standard	In accordance with design standard

Table 6 — Properties and pressure groups of permanent gases[a]

1	2	3	4	5
Name of gas	**Chemical symbol**	**Dangerous properties**[b]	**Developed pressure group**[c]	**Critical temperature** °C
Air	–	–	2	−140,7
Argon	Ar	–	2	−122,0
Boron trifluoride	BF_3	T	[d]	−12,3
Carbon monoxide	CO	F and T(A)	2	−140,0
Coal gas	–	F and T	1	–
Fluorine	F_2	C and T	[e]	−129,0
Helium	He	–	3	−267,9
Hydrogen	H_2	F	3	−239,9
Methane	CH_4	F	1	−82,1
Neon	Ne	–	3	−228,7
Nitrogen	N_2	–	2	−147,0
Oxygen	O_2	–	2	−118,4

[a] Gases that have a critical temperature below −10 °C.

[b] The properties are indicated as follows:

C = corrosive
F = flammable
T = toxic
T(A) = classified as class A poison

[c] The relationship between charging pressures at 20 °C and developed pressures at 65 °C for the three groups of permanent gases, is given in tables 7 and 8.

[d] When boron trifluoride is filled into a pressure receptacle that is manufactured in accordance with this standard, the maximum charging pressure shall not exceed 60 % of the maximum working pressure of the pressure receptacle.

When boron trifluoride is filled into a pressure receptacle that is not manufactured in accordance with this standard and that is designed to be filled with permanent gases at a pressure of 13 900 kPa at 20 °C (13 650 kPa at 15 °C), the maximum charging pressure at 20 °C shall be 10 400 kPa.

[e] The mass of fluorine filled into any pressure receptacle shall not exceed 5,5 kg. The pressure at 20 °C shall not exceed 2 800 kPa, and the maximum working pressure of the pressure receptacle shall not exceed 18 600 kPa.

Table 7 — Permanent gases: charging pressures and corresponding developed pressures[a]

1	2	3	4
Charging pressure at 20 °C	**Developed pressure at 65 °C** kPa[b]		
kPa	**Group 1**	**Group 2**	**Group 3**
2 000	2 300	2 300	2 300
4 000	4 800	4 800	4 600
6 000	7 500	7 200	7 000
8 000	10 200	9 700	9 300
10 000	12 900	12 200	11 600
12 000	15 700	14 700	13 900
14 000	18 600	17 200	16 200
16 000	21 400	19 800	18 600
18 000	24 300	22 300	20 900
20 000	27 200	24 800	23 200
22 000	30 200	27 400	25 500
24 000	33 100	30 000	27 900
26 000	36 100	32 500	30 200
28 000	39 100	35 100	32 500
30 000	42 100	37 600	34 800
The developed pressure of permanent gases varies and has been grouped accordingly. Table 6 defines which group to use relative to the permanent gas.			
[a] See annex C for more information on developed pressure for permanent gases.			
[b] Values for charging pressures other than those given in column 1 may be obtained by linear interpolation.			

Table 8 — Permanent gases: developed pressures and corresponding charging pressures

1	2	3	4
Developed pressure at 65 °C	**Charging pressure at 20 °C** kPa[a]		
kPa	**Group 1**	**Group 2**	**Group 3**
2 000	1 800	1 700	1 700
4 000	3 400	3 400	3 400
6 000	4 900	5 000	5 200
8 000	6 400	6 600	6 900
10 000	7 900	8 200	8 600
12 000	9 300	9 800	10 300
14 000	10 800	11 400	12 100
16 000	12 200	13 000	13 800
18 000	13 600	14 600	15 500
20 000	15 000	16 200	17 200
22 000	16 400	17 800	19 000
24 000	17 800	19 300	20 700
26 000	19 100	20 900	22 400
28 000	20 500	22 500	24 100
30 000	21 900	24 000	25 800
32 000	23 200	25 600	27 600
34 000	24 600	27 200	29 300
36 000	25 900	28 700	31 000
38 000	27 300	30 300	32 700
40 000	28 600	31 800	34 500
42 000	29 900	33 400	36 200
The developed pressure of permanent gases varies and has been grouped accordingly. Table 6 defines which group to use relative to the permanent gas.			
[a] Values for charging pressures other than those given in columns 2, 3 and 4 may be obtained by linear interpolation.			

4.7 Change of pressure receptacle service

4.7.1 A pressure receptacle may, subject to the limitations given in 4.7.2, be transferred to a different service, provided that it is thoroughly cleaned and has been inspected and, when applicable, tested in accordance with clause 7, and provided that the relevant markings and colour coding have been changed in an acceptable manner in order to comply with the requirements of the new service and of clause 4.

When a pressure receptacle is transferred to a different service, the filler shall ensure that the developed pressure of the gas at reference temperature does not exceed the test pressure of the pressure receptacle and that the pressure receptacle is of a class suitable for the gas (see table 4, ISO 11621 and tables 2, 3, 4 and 5, and the ADR Packaging Instruction P200).

4.7.2 The transfer of a pressure receptacle to a different service shall comply, as a minimum, with ISO 11621. A pressure receptacle that has been used for the storage of any coal-produced gas (for example, methane or carbon monoxide) shall not be used for any other gas. Carbon monoxide cylinders shall not be converted to medical, breathing gasses, or food grade gas service (or all three). **Amdt 1**

4.7.3 A cylinder that is equipped with a foot ring shall not be used for underwater service.

4.8 Pressure receptacles general requirements

4.8.1 Only pressure receptacles that, in respect of basic design and manufacture, comply with the appropriate and relevant requirements of this standard, together with the standards approved by the relevant national department (see foreword) shall be allowed for general distribution and use in South Africa.

4.8.2 Used imported refillable pressure receptacles that do not comply with 4.8.1 may be distributed and used in South Africa provided that they are certified by an approved inspection authority, re-tested, declared safe for use and issued with a test certificate by an approved test station in accordance with an approved standard. (See 4.1, annex A, SANS 347 or SANS 1825, as relevant.)

NOTE For a list of approved inspection authorities, contact the relevant national department (see foreword).

4.8.3 New pressure receptacles shall not be manufactured in accordance with any local, regional or international standard after the indicated date of its withdrawal, taking into account the manufacturing end date stipulated in the type approval certificate issued to the pressure receptacle manufacture.

4.8.4 Evaluation of non-listed manufacturing standards shall be the responsibility of an evaluation committee (see 4.9).

4.8.5 Used pressure receptacles manufactured after the date of the manufacturing standard's withdrawal, shall not be imported for distribution and use in South Africa.

4.8.6 Gas companies, agents or distributors shall not supply customers with any out of test pressure receptacle or a composite pressure receptacle with an expired service life. (See 10.5.5).

4.8.7 LPG cylinders, LPG cylinder valves and individual relief valves fitted to LPG cylinders for general distribution and use in South Africa shall first be verified by the relevant national association (see foreword), an association approved by the relevant national department (see foreword), and issued with a verification certificate (permit).

4.9 Approval of non-listed standards

4.9.1 For the purpose of approval of non-listed design and manufacturing standards, the standards shall first be evaluated by an evaluation committee appointed by the approving authority.

4.9.2 The evaluation committee shall comprise members of the relevant Pressure Equipment Forum, which is chaired by the relevant national department (see foreword).

4.9.3 Approval of a new standard shall be obtained before the importation or manufacture of pressure receptacles compliant to the new standard being initiated.

4.10 Non-refillable receptacles

4.10.1 Non-refillable receptacles shall

a) be transported in an outer packaging, such as a box, a crate, a shrink-wrapped tray or a stretch wrapped tray,

b) not be permitted to be filled with flammable gas or flammable refrigerants in cylinders equal to or greater than 1,25 L water capacity,

c) not be used for toxic gases with an inhalation toxicity (LC_{50}) less than or equal to 200 mL/m^3,

d) not be repaired after being put into service,

e) not be refilled, and

f) not be modified for any alternative use.

4.10.2 Residual gas in non-refillable receptacles shall be recovered in a safe and environmentally responsible manner by suitably qualified persons before disposing of the non-refillable receptacles.

5 Valves

5.1 General

5.1.1 The design and construction of valves shall be such as to render the valves fit for purpose for the duty and service for which they are intended. All parts of valves that are in contact with the contents of the pressure receptacles shall be of material that will not react with the gas or the metal of the pressure receptacle (see ISO 11114-1 and ISO 11114-2).

5.1.2 All LPG cylinder valves shall comply with the requirements of SANS 199. LPG valves and LPG cylinders shall not be fitted with bleed valves.

5.1.3 LPG cylinder valves that do not incorporate a pressure relief device shall not be fitted to cylinders unless a separate pressure relief device is fitted directly to the cylinder. LPG cylinders equipped with only one threaded connection in one end of the pressure envelop, and fitted with a valve not containing a pressure relief device can still be filled, transported and used. When a valve in this design of LPG cylinder becomes defective it shall be replaced with a valve incorporating a pressure relief device.

5.1.4 With the exception of special gases, when the regulator is connected to the outlet of a refillable container, it shall be done so without the use of any outlet thread adapter that changes one thread size to another thread size, including left-to-right hand and right-to-left hand conversions.

5.2 Valve outlet connections

5.2.1 All new gas cylinder valve outlet connections for applications up to and including (25 000 kPa) (250 bar) shall comply with the requirements of table 9. See table 10 for valve outlet connections for refrigerants. Valve outlet connections for (30 000 kPa) (300 bar) cylinder applications shall comply with ISO 5145.

NOTE For more information on valves used on pressure receptacles, see annex E.

5.2.2 If pressure receptacles are required to be refilled they shall comply with the requirements of this standard. Imported pressure receptacles that contain special gases with a non-compliant valve outlet may be used but they shall not be refilled. Should these pressure receptacles remain in South Africa after first usage, the valve shall be changed to comply with the requirements of this standard.

5.2.3 Valve outlet connections for special gas mixtures are defined by the relevant gas company in accordance with the requirements of this standard.

5.3 LPG cylinder and valve inlet and outlet requirements excluding refrigerant grades

5.3.1 Outlet connections for butane, LPG and propane shall be as specified in SANS 199.

5.3.2 Valves with a G ⅜ RH outlet thread in accordance with SANS 1306-1 shall not be fitted to cylinders with a water capacity that exceeds 20 L.

5.3.3 Valves with a G ⅝ LH outlet in accordance with SANS 1306-1 shall not be fitted to cylinders with a water capacity less than 20 L.

5.3.4 Valves with a ¾ NGT inlet shall not be fitted to cylinders with a water capacity less than or equal to 20 L.

5.3.5 Valves with a ½ NGT inlet shall not be fitted to cylinders with a water capacity equal to or exceeding 20 L.

NOTE NGT is the American national gas taper thread.

5.3.6 Valves for composite cylinders shall comply with the requirements given in SANS 199.

Table 9 — Schedule of cylinder valve outlet connections for various gases

1	2	3	4	5	6	7	8
Gas		**UN No.**	**Chemical symbol**	**Class**[a]	**Subsidiary risk**[a]	**Outlet connection number or description**[b]	**Thread type**
1	Acetylene, dissolved	1001	C_2H_2	2.1	–	4	LH female
2	Air	1002	–	2.2	–	3	RH female
3	Ammonia cylinders	1005	NH_3	2.3	8	CGA 240[c] or CGA 660[c]	RH female/ RH male
4	Ammonia drums	1005	NH_3	2.3	8	1¾" ACME or CGA 660[c]	RH male (both)
5	Ammonia UHP	1005	NH_3	2.3	8	CGA 720[c]	RH male
6	Argon	1006	Ar	2.2	–	3	RH female
7	Butane	1011	C_4H_{10}	2.1	–	SANS 199[d]	–
8	Carbon dioxide	1013	CO_2	2.2	–	8	RH male
9	Carbon monoxide	1016	CO	2.3	2.1	4	LH female
10	Chlorine	1017	Cl	2.3	8	CGA 660[c]	RH male
11	Ethylene	1962	C_2H_4	2.1	–	4	LH female
12	Ethylene oxide cylinders	1040	C_2H_4O	2.3	2.1	15	LH male
13	Ethylene oxide (ETO) drums	1040	C_2H_4O	2.3	2.1	7	LH male
14	ETO/CO_2 mixture	1041	C_2H_4O/CO_2	2.1	–	2	LH female
15	Helium	1046	He	2.2	–	3	RH female
16	Hydrogen	1049	H_2	2.1	–	4	LH female
17	LPG	1075	C_4H_{10}/C_3H_8	2.1	–	SANS 199[d]	–
18	Medical gases	–	–	–	–	SANS 39[e]	–
19	Methane	1971	CH_4	2.1	–	4	LH female
20	Nitrogen	1066	N_2	2.2	–	G¾"[f] [f]	RH female
21	Nitrous oxide	1070	N_2O	2.2	5.1	13	RH male

Table 9 *(concluded)*

1	2	3	4	5	6	7	8
	Gas	**UN No.**	**Chemical symbol**	**Class**[a]	**Subsidiary risk**[a]	**Outlet connection number or description**[b]	**Thread type**
22	Oxygen	1072	O_2	2.2	5.1	3	RH female
23	Propane	1978	C_3H_8	2.1	–	SANS 199[d]	–
24	Sulfur dioxide	1079	SO_2	2.3	8	CGA 240[c]	RH female
25	Sulfur hexafluoride	1080	SF_6	2.2	–	6	RH male

ACME = American Chemical and Mechanical Engineering
BSP = British standard pipe
UHP = ultra-high purity

[a] The class and subsidiary risk shall be in accordance with SANS 10231.

[b] Unless otherwise specified, outlet connection numbers shall be in accordance with BS 341-3.

[c] CGA valve numbers for valve outlets shall be in accordance with CGA V-1.

[d] Outlets connections for butane, LPG and propane shall be as specified in SANS 199. See also 5.3.

[e] The use of pin index valves is mandatory for all sizes of medical gas pressure receptacles up to and including a water capacity of 10 L. Above this size, the connection is at the discretion of the supplier. Medical gas pressure receptacle valve outlets using the pin-index system of connections shall be as specified in SANS 39. The conversion of existing medical gas cylinders up to and including 10 L water capacity shall be completed by 1 January 2019.

[f] The outlet connection shall comprise a conical cone with profile and shape in accordance with BS 341-3 connection number 3.

Table 10 — Schedule of valve outlets for refrigerants class 2.1 and 2.2

1	2	3	2	3
Container size	**Outlet connections for class 2.1 (Flammable)**		**Outlet connection for class 2.2 (Non – Flammable)**	
	Gas	**Liquid**	**Gas**	**Liquid**
Refillable cylinders (up to and including 62 L water capacity)	½" ACME LH - CGA 166[a] W21.80 X 1/14 LH No. 1 DIN 477-1 G 5/8" LH Female No. 4 BS 341-3 1.030" – 14 NGO LH - CGA 670[a]	½" ACME LH - CGA 166[a] 3/8" SAE Flare CGA 182[a] W21.80 X 1/14 No. 1 DIN 477-1 1.030" – 14 NGO LH - CGA 670[a]	W21.80 X 1/14 No. 6 DIN 477-1 G 5/8" Female No. 3 BS 341-3 G 5/8" No. 6 BS 341-3	1/4" SAE Flare CGA 165[a] 3/8" SAE Flare CGA 182[a] W21.80 X 1/14 No. 6 DIN 477-1
0,5 t pressure drums	½" NPT[b] W21.80 X 1/14 No.1 DIN 477-1 G 5/8" LH Female No. 4 BS 341-3 1.030" – 14 NGO LH - CGA 670[a]	1" NPT[b] 3/8" SAE Flare CGA 182[a] W21.80 X 1/14 No. 1 DIN 477-1 1.030" – 14 NGO LH - CGA 670[a]	1.030-14NGO CGA 660[a]	
1,0 t pressure drums (up to 1 000 L water capacity)	½" NPT[b] W21.80 X 1/14 No. 1 DIN 477-1 G 5/8" LH Female No. 4 BS 341-3 1.030" – 14 NGO LH - CGA 670[a]	1" NPT[b] W21.80 X 1/14 No. 1 DIN 477-1 G 5/8" LH Female No. 4 BS 341-3 1.030" – 14 NGO LH - CGA 670[a]	G 5/8" female No. 3 BS 341-3 G 5/8" No. 6 BS 341-3	
High pressure refillable cylinders	G 5/8" LH Female No. 4 BS 341-3 1.030" – 14 NGO LH - CGA 670[a]		G 5/8" female No. 3 BS 341-3 G 5/8" No. 6 BS 341-3	

Table 10 *(concluded)*

1	2	3	2	3
Container size	**Outlet connections for class 2.1 (Flammable)**		**Outlet connection for class 2.2 (Non – Flammable)**	
	Gas	**Liquid**	**Gas**	**Liquid**
Refrigerant recovery cylinders and drums (up to and including 1 000 L water capacity)	G 5/8" LH Female No. 4 BS 341-3 ½" NPT[b]	3/8" SAE Flare CGA 182[a] 1" NPT[b]	1/4" SAE Flare CGA 165[a] ½" NPT[c] Ball valve ¾" NPT[c] Ball valve 1" NPT[c] Ball valve W21.80 X 1/14 No. 6 DIN 477-1 G 5/8" No. 6 BS 341-3 1.030-14NGO CGA 660[a]	
G 5/8" BSP thread form in accordance with SANS 1306-1. Ball valves and dry break couplings to be manufactured from materials compliant with the intended refrigerant service. See ISO 11114-1 and ISO 11114-2.				
NOTE 1 All outlets are RH male unless otherwise stated. NOTE 2 If required, more details regarding refrigerant outlets can be obtained from the relevant national association (see foreword).				
[a] CGA valve numbers for valve outlets shall be in accordance with CGA V-1. [b] Shall be used in conjunction with ball valve and dry break couplings only. [c] Ball valve shall have suitable pressure rating for intended refrigerant use and shall not protrude outside cylinder/ drum shroud.				

5.4 Valve stem and pressure receptacle neck thread connections

5.4.1 The valve stem is the section of the valve body that connects to the thread in the pressure receptacle body, and as such shall have matching threads for compatibility (see tables 11 and G.2).

5.4.2 BS 341-1 may be used to provide details relating to the cylinder valve stem threads and cylinder neck threads. **Amdt 1**

5.4.3 In the case of cylinders with a water capacity less than 10 L, the preferred valve thread connections are 17E or 18T. However, if agreed upon between the owner/purchaser and the manufacturer, 25E threads are acceptable. This does not apply to LPG cylinder valves that comply with SANS 199.

5.4.4 For the preferred connections on SCUBA and SCBA cylinders, see table G.2 and annex G.

5.5 Protection of valves

5.5.1 General

5.5.1.1 Unless as provided for in 5.5.2, valves on pressure receptacles shall be protected against mechanical damage.

5.5.1.2 On any cylinder the valve shall be protected by means of a detachable cap or a permanently attached shroud or guard in accordance with ISO 11117. This type of protection is not required if the valve is set into a recess in the pressure receptacle.

NOTE 1 A cap is attached to the cylinder by means of screw thread on the cylinder collar.

NOTE 2 A shroud is welded to the dome of the cylinder.

NOTE 3 A guard is attached to the cylinder collar by several means, for example a screw thread, cir clip or grub screw.

5.5.1.3 Such shroud, guard or cap shall not, in any way, be in contact with any part of the valve.

5.5.1.4 In the case of pressure receptacles that are used in the fixed fire protection industry, the valve shall be protected by a cap, where applicable, when transported or in storage. Pressure receptacles used in trolley units are exempt from using caps or guards. When pressure receptacles are removed from the trolley unit, the cap or guard shall be fitted. Pressure receptacles fitted with shrouds may be used in trolley units.

5.5.2 Exceptions

5.5.2.1 All fire extinguishers with a water capacity up to and including 15 L are exempt from the requirements in 5.5.1.2.

5.5.2.2 Notwithstanding the requirements of 5.5.1, pressure receptacles with a water capacity of 10 L and below do not require a cap, valve guard or shroud. This exception excludes flammable and toxic pressure receptacles, which shall comply with 5.5.1.2.

5.5.2.3 Medical gas cylinders, where the shroud or guard is an integral part of the cylinder or valve package, are excluded from the requirements of 5.5.1.2.

5.5.2.4 If it is not intended for the valve to be protected by a cap or other form of guarding, an impact test shall be carried out on the valve in accordance with ISO 10297.

5.6 Fitting of valves to pressure receptacles

Where the fitting requirements and torque values for valves have not been specified, valve torques shall comply with the requirements of ISO 13341.

NOTE For thread tape and lead cap material compatibility, see EIGA IGC Doc. 138/08.

5.7 Inspection and maintenance of valves

5.7.1 Valves shall be visually inspected and leak tested at the time of filling. (For LPG cylinder valves, see SANS 10087-7).

5.7.2 As a minimum, valves shall be inspected in accordance with ISO 22434 and shall be inspected at the same frequency as given in annex F for pressure receptacles.

5.7.3 LPG valves fitted with a relief valve shall be maintained at least every 10 years in accordance with the requirements of SANS 10297, or they shall be replaced. See also 6.1.

5.7.4 LPG cylinder valves shall only be maintained and reconditioned by organizations that demonstrate compliance with SANS 10297.

Table 11 — Neck threads for cylinders

1	2	3
No.	**Cylinder types**	**Threads**
1	Class 1 steel cylinders: a) for high pressure industrial service. Large diameter cylinders (for example, cylinder diameter 145 mm and larger) b) for high pressure industrial service. Small diameter cylinders (for example, cylinder diameter 140 mm and smaller)	25 E thread in accordance with ISO 11363-1 17 E thread in accordance with ISO 11363-1 **or** 18 T thread in accordance with BS 341-1 **or** 25 E thread in accordance with ISO 11363-1
2	Class 1 aluminium cylinders	Parallel thread in conjunction with an effective O-ring seal (for example, M 25 × 2 for large cylinders of 10 L water capacity and above, **or** M 18 × 1,5 for cylinders below 10 L water capacity) **or** threads as specified for class 1 steel cylinders
3	Classes 2 and 3 cylinders of water capacity not exceeding 15 L intended for low pressure liquefiable gas (excluding LPG)	25 E thread in accordance with ISO 11363-1 **or** 18 T thread in accordance with BS 341-1 **or** 17 E thread in accordance with ISO 11363-1 **or** ¾ –14" NGT **or** ½ –14" NGT
4	Classes 2 and 3 cylinders of water capacity exceeding 15 L intended for low pressure liquefiable gas (excluding LPG)	25 E thread in accordance with ISO 11363-1 **or** W31,3 × 1/14 DIN 477-1 **or** ¾ – 14" NGT
5	Classes 1 and 2 dissolved acetylene cylinders: a) smaller than 10 L b) 10 L and above	17 E thread in accordance with ISO 11363-1 **or** 18 T thread in accordance with BS 341-1 **or** 25 E thread in accordance with ISO 11363-1 **or** W28,8 in accordance with DIN 477-1 **or** 1,025" in accordance with BS 341-1 25 E thread in accordance with ISO 11363-1 **or** W28,8 in accordance with DIN 477-1 **or** 1,025" in accordance with BS 341-1
6	LPG cylinders	Threads in accordance with SANS 199 (see also 5.3)
7	Fire suppressant cylinder necks (cylinders used in fixed installations only) Cylinders with internal and external threads and other with only an external thread: a) Internal thread b) External thread	Based on internationally accepted practice in accordance with the Underwriters Laboratory (UL) in the USA G 1 in accordance with SANS 1306-1 G 1 ½ B in accordance with SANS 1306-1 and M 55 × 2 – 8 g in accordance with SANS 1700-2-5, SANS 1700-2-6 and SANS 1700-2-7

Amdt 1

Table 11 *(concluded)*

1	2	3
No.	**Cylinder types**	**Threads**
8	Cylinders with internal and external threads and other with only an external thread:	
	a) Internal thread	1" NGT
	b) External thread	W80 × 1/11
	a) Internal thread	None
	b) External thread	2½"-12UN-2A
NOTE: NGT = National gas taper NPS = National pipe standard UNF = Unified national fine UN = Unified.		

5.8 Valve lubricants

No valve lubricant other than that specified by the original valve manufacturer, or an approved alternative compatible with the valve material and gas service, for the specified gas used shall be applied to threads or spindles.

6 Pressure relief devices

6.1 General

6.1.1 The purpose of pressure relief devices is to relieve pressure in a pressure receptacle when the pressure receptacle is exposed to adverse conditions. The device shall be of robust construction and shall be capable of an accurate setting. All parts of the device shall be of material(s) that will not react with the contents or the metal of the pressure receptacle on which it is mounted. Pressure relief devices shall not be used for toxic and poisonous gases. For these exclusions, see tables 2 and 3 of ADR Packaging Instruction P200. (See also BS 341-4 for guidance regarding the design and application of pressure relief devices.)

6.1.2 Pressure receptacles that incorporate a pressure relief valve or bursting disc shall have these safety components replaced within 10 y of the date of original manufacture and every 10 y thereafter (see tables 2 and 3 and ADR Packaging Instruction P200 for gases that require pressure relief devices). **Amdt 1**

6.2 Type of pressure relief device

6.2.1 General

More than one type of pressure relief device may be used and more than one device of the same type may, when so required, be used on one pressure receptacle.

6.2.2 Spring-loaded pressure relief devices

6.2.2.1 A spring-loaded pressure relief device shall be set (when installed on a pressure receptacle) to commence relieving between 75 % and 100 % of the minimum test pressure of the pressure receptacle and be adequately sized to accommodate the required discharge capacity.

6.2.2.2 The performance requirements of spring-loaded safety valves on LPG cylinders, whether fitted directly into the cylinder or incorporated in the cylinder valve, shall be in accordance with SANS 199.

6.2.3 Frangible discs

6.2.3.1 Primary frangible discs

Primary frangible discs shall be designed to rupture at the reference temperature in respect to the maximum permissible operating pressure of the pressure receptacle (see table 5).

6.2.3.2 Secondary frangible discs

Secondary frangible discs shall rupture at a nominal pressure that is 10 % above the start-to-discharge pressure of the pressure relief device.

6.2.4 Fusible plugs acetylene cylinders

A fusible plug shall contain a fusible alloy that has a yield temperature of not lower than 96 °C and not higher than 110 °C. At ambient temperature (20 °C), the fusible plug shall withstand a pressure equal to the applicable hydrostatic test pressure.

6.3 Location of pressure relief devices

6.3.1 With the exception of CO_2 fire suppression systems where a pressure relief device is fitted to a cylinder that contains a liquefied gas, a pressure relief device shall be so positioned that when the cylinder is in the upright position, gas or vapour will be vented in preference to liquid.

6.3.2 For cylinders manufactured in accordance with health and safety standards listed in ADR section 6.2, pressure relief devices shall be incorporated into cylinders in accordance with ADR Packaging Instruction P200. (See also tables 2 and 3).

6.3.3 A pressure relief device on a transportable pressure receptacle shall be protected against mechanical damage either by the way in which it is set into the transportable pressure receptacle, or by being protected with an acceptable housing.

NOTE For more information on the use of pressure relief valves, see EIGA IGC Doc. 91/10.

7 Revalidation of pressure receptacles

7.1 General

Only an approved test station shall carry out periodic inspection and testing (revalidation) of pressure receptacles. Such inspection and testing shall be in accordance with SANS 1825.

7.2 Frequency of inspection and testing

The frequency of inspection and hydrostatic testing shall be in accordance with annex F and table G.3. **Amdt 1**

7.3 Methods of test

7.3.1 All methods of pressure testing or ultrasonic examination in accordance with the periodic inspection and testing standards listed in SANS 1825 shall be acceptable.

7.3.2 Alternative forms of testing will require prior approval from the approving authority.

7.4 Test stations

7.4.1 Approval

All test stations shall be approved by an approving authority.

7.4.2 Accreditation

Before approval is given, the test station shall be accredited by the relevant national body (see foreword) in accordance with this standard, SANS 17020 and SANS 1825).

7.5 Safety precaution

Cylinders that are overdue for inspection and testing shall not be refilled, however, the gas content can be used unless where applicable the expiry date of the gas has lapsed (see 10.5.5). **Amdt 1**

7.6 Scrapping or rejection criteria for pressure receptacles **Amdt 1**

7.6.1 The decision to reject a cylinder may be taken at any stage during the inspection and testing procedure. If it is impossible to recover a rejected cylinder, the test station shall, after the owner has been notified, make the cylinder unserviceable for holding gas under pressure so that it is impossible for any part of the cylinder, especially the shoulder, to be re-issued into service. In case of any disagreement, the test station shall ensure that the owner of the cylinder is made aware of and understands the possible future ramifications. **Amdt 1**

7.6.2 For cylinders owned by external parties to the gas test station, where the owner refuses to have the cylinders rendered unserviceable, or where there is an ongoing process in place for clarification of manufacturing standards, the gas test station shall document and record it accordingly after informing the client and prior to returning the cylinders back to the owner. In such a case, the cylinders shall be returned with documentation stating the reason for rejection and without the valve fitted, thereby making the cylinders unable to hold pressure. **Amdt 1**

7.6.3 Rejection and disposal criteria for pressure receptacles and methods for rendering pressure receptacles unserviceable shall be in accordance with SANS 1825. **Amdt 1**

7.6.4 Should the owner scrap or reject his own pressure receptacles, the rejection criteria shall be as provided in SANS 1825, and an approved test station shall dispose of the pressure receptacle in the appropriate manner. **Amdt 1**

7.7 Repair of pressure receptacles

7.7.1 All repairs that require the application of heat to the body of the pressure receptacle or any component part of the body shall be carried out under the direction and supervision of an approved inspection authority. The pressure receptacle shall be hydrostatically tested and verified by an approved test station before being placed back into service (see also 8.1 and 8.3).

7.7.2 Where the cylinder was supplied in a normalized condition (see 4.3), the cylinder shall, after any hot work has been carried out on the cylinder body or dished ends, including the replacement of the valve boss, valve guard or foot ring, be re-normalized to the original normalizing requirement for a new cylinder in accordance with 4.3.

7.7.3 Cylinders manufactured from dual-phase steel are not repairable by the application of heat to the pressure envelop. The manufacturers of dual-phase steel cylinders do not recommend any form of repair to the pressure envelop.

7.7.4 In the case of the replacement of valve guards and foot rings only, where it can be demonstrated that the local heat input into the pressure envelope of the cylinder from the welding process does not exceed 600 °C, there is no requirement to normalize the cylinder. Examples would include tack welding a valve guard to a cylinder thread boss and welding a replacement foot ring to an old existing foot ring or part thereof.

7.7.5 Composite cylinders shall be repaired in accordance with the requirements of the revalidation standard SANS 11623.

7.7.6 Under no circumstances shall seamless pressure receptacles of any size be repaired.

8 Marking, labelling, colour coding and certificates

8.1 Permanent marking

8.1.1 Each pressure receptacle shall be legibly and durably marked (hard-stamped, embossed or embedded in the resin of composite pressure receptacles) with the information required by the applicable design standard or ISO 13769.

8.1.2 Pressure receptacles for compressed gases are not required to be marked with the tare mass in accordance with the requirements of ISO 13769. When cylinders without tare mass are changed from a permanent gas service to a liquefiable gas service, the tare mass shall be stamped onto the shoulder of the pressure receptacle, provided the pressure receptacle complies with the design requirements for that particular gas, which shall be verified by a competent person. The tare mass shall be given in kilograms (kg).

8.1.3 Liquefiable pressure receptacle stampings shall comply with the requirements given in ISO 13769. The letter "N" shall be stamped on welded liquefied gas pressure receptacles (for example, LPG) to indicate that the pressure receptacle has been normalized, when appropriate.

8.1.4 For gases other than LPG, the unit of pressure "bar" may be used as an alternative to "Pa" (Pascal) on any pressure receptacle or associated valve that is governed by an approved standard where such is allowed.

8.1.5 No permanent marking shall be removed from any pressure receptacle. Where change of ownership takes place, the previous owner’s marks may be cancelled by over-stamping using the letter "X".

8.1.6 The manufacturer’s serial number shall never be removed from any pressure receptacle.

8.1.7 In the case of re-rating of cylinders in respect of test pressure, the re-rated design of the cylinder shall be approved by an approved inspection authority and the inspection and test shall be validated by an approved test station.

8.2 Identification of permanent marking

The manufacturer shall, on the certificate of manufacture or on the certificate of re-certification, list all the permanent marking on the pressure receptacle.

8.3 Permanent marking following revalidation

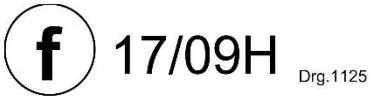
8.3.1 Taking in to account the requirements in 8.3.5 and 8.3.6, the following additional permanent markings shall be hard-stamped on the shoulder of the pressure receptacle after revalidation in the following order together:

a) the identification mark of the approved test station;

b) the year and month (for example, 15/04 (yy/mm)) and the suffix "H" if a hydrostatic test has been done; and

c) when relevant, the new tare mass, shall be hard stamped in a location close to the original marking

NOTE Example of Markings



8.3.2 A metallic tag indicating the tare mass of the pressure receptacle may be used as an alternative to hard-stamping the tare mass on the cylinder. The tare mass tag shall be located under the valve stem in such a manner that it cannot be easily removed.

8.3.3 On satisfactory completion of the periodic inspection and hydrostatic pressure test of a composite cylinder, it is necessary to mark or affix a label in an area close to the original date of manufacture containing the information in clause 8.3.1. Paper, plastic or metal foil are appropriate materials for the labels and these shall be securely affixed to the composite cylinder, using a clear epoxy resin, the label being coated on both sides. A rubber stamp containing the information in clause 8.3.1 using an indelible ink, which is then over coated with a clear epoxy resin, can also be used.

8.3.4 In addition to the requirements of 8.3.1, after internal inspection of acetylene cylinders, the year and month in which the inspection was carried out, followed by an "I" (for example, 11/04 I (yy/mm)), shall be hard-stamped on the pressure receptacle, or on a metal test ring retained between the valve inlet stem and cylinder shoulder.

8.3.5 Hard-stamping when revalidating welded pressure receptacles shall only be done on the foot ring, shroud or doubling plate specifically attached for the purpose of cylinder identification of a revalidated welded pressure receptacle. Hard-stamping on the shell of a welded steel cylinder is prohibited.

8.3.6 Hard-stamping when revalidating seamless cylinders shall only be done on the shoulder.

8.4 Maintenance of permanent marking

Permanent markings on a pressure receptacle shall be maintained in an acceptable manner and the pressure receptacle shall not be filled if the markings are illegible. Cylinders protected by an outer sleeve (for example, plastic coating) may be filled if fitted with a test date ring and if the cylinder is within the test date period.

8.5 Colour coding

8.5.1 Colour identification of pressure receptacles

8.5.1.1 The colours in table 12 are the allocated colours for the gases indicated in column 2. When the service of a pressure receptacle is changed, the old paint shall be removed entirely before the new identification colour is applied.

8.5.1.2 Where colours are allocated to fire extinguishers, they shall comply with the requirements of SANS 1910 and SANS 1567.

8.5.1.3 Where cylinders indicate the nature of their contents by means of additional colour bands. The width of the second band, where applicable, shall be at least one-quarter of the diameter of the cylinder and be adjacent to the shoulder of the cylinder.

8.5.1.4 If the gas is toxic and non-flammable, the cylinder shall have a golden yellow (1071-Y20R) shoulder band (see table 12).

8.5.1.5 If the gas is non-toxic and flammable, the cylinder shall have a signal red (1580-Y90R) shoulder band. LPG pressure receptacles are excluded from these requirements.

8.5.1.6 If the gas is toxic and flammable, the cylinder shall have a golden yellow (1071-Y20R) shoulder band, as well as a signal red (1580-Y20R) shoulder band. The red band shall be next to the neck and the yellow band shall be between the red band and the junction of the shoulder and body of the cylinder.

8.5.1.7 Imported cylinders that are not for trade use can remain in the "as supplied" colour; however, such cylinders shall be appropriately labelled in accordance with 8.6. Should these cylinders remain in South Africa after first usage, the colour shall be changed to comply with this standard.

Table 12 — Colour marking of gas cylinders

1	2	3	4	5
No.	**Name of gas**	**Chemical symbol**	**Colour of cylinder body**[a]	**Colour(s) of shoulder**[b]
1	Acetylene	C_2H_2	Maroon 8010-R10B	–
2	Air	–	French grey 4010-G50Y	–
3	Air, synthetic[c]	–	Protea 1020-Y80R	–
4	Ammonia	NH_3	Aluminium	Signal red 1580-Y90R and Golden yellow 1070-Y20R
5	Argon	Ar	Peacock blue 5040-B20G	–
6	Carbon dioxide	CO_2	Light Brunswick green 5540-G30Y	–
7	Carbon monoxide	CO	Signal red 1580-Y90R	Signal red 1580-Y90R and Golden yellow 1070-Y20R
8	Chlorine	Cl_2	yellow 1070-Y20R	–
9	Chlorine (cylinder with dip pipe)	Cl_2	yellow 1070-Y20R	Black S 9000-N
10	Compressed natural gas	NCG[d]	White S0603-R80B	Signal red 1580-Y90R
11	Ethylene	C_2H_4	Dark violet 5040-R50B	Signal red 1580-Y90R
12	Ethylene oxide	C_2H_4O	Dark violet 5040-R50B	Signal red 1580-Y90R and Golden yellow 1070-Y20R
13	Helium	He	Middle brown 7020-Y40R	–
14	Hydrogen	H_2	Signal red 1580-Y90R	–
15	Methane	CH_4	Signal red 1580-Y90R	Black (band) S 9000-N
16	Neon	Ne	Middle brown 7020-Y40R	Black S 9000-N
17	Nitrogen	N_2	French grey 4010-G50Y	Black S 9000-N
18	Oxygen	O_2	Black S 9000-N	–
19	Special gas	–	Protea 1020-Y80R	–

NOTE The finish of the above paint colours is semi-gloss (sheen).

[a] The colours specified are in accordance with the Scandinavian Colour Institute AB, Stockholm, Sweden (NCS). See SANS 1091 for information on the National Colour System (NCS) system and colours. More information about the NCS-system and colours is available on www.ncscolour.com.

[b] Where a second colour band is stated, the second band should be adjacent to the shoulder colour.

[c] Synthetic air is made up of pure oxygen and pure nitrogen; the oxygen content is a volume fraction of 21 %. Synthetic air cylinders not intended for breathable use shall be stencilled or have labels affixed to them stating "**NOT FOR BREATHING**". This requirement is over and above the normal shoulder label stating the type of gas in the cylinder. Industrial synthetic air cylinders shall be labelled accordingly.

[d] CNG includes Biogas.

8.5.2 LPG cylinders

Unique colours that are used to identify LPG cylinders shall be registered with the relevant national association (see foreword). There shall be no confusion with colours allocated for other gases or applications in order to avoid any colour duplication with table 12, including shades of the listed colours. **Amdt 1**

8.5.3 Pressure receptacles for gases for which specific colour markings have not been allocated

8.5.3.1 Unique identification colours for branded pressure receptacles for compressed and liquefiable gases (excluding LPG pressure receptacles) shall be approved and registered by the relevant national association (see foreword) to avoid any colour duplication with table 12.

8.5.3.2 Pressure receptacles for special gases or pressure receptacles for which specific colour markings have not been allocated shall be coloured Protea (1020-Y80R), or as otherwise approved.

8.5.3.3 The width of each shoulder band shall be at least one-quarter of the diameter of the pressure receptacle body

8.5.4 Cylinders for medical gases

Cylinders for medical gases shall be colour-marked in accordance with SANS 10006.

8.5.5 Refrigerant cylinders

8.5.5.1 The valve guard/shrouds for pressure receptacles for refrigerant gases shall be coloured in accordance with AHRI Guideline N and table 13. If corporate branding by means of the colour of the body of the pressure receptacle is required, it shall be approved and registered with the relevant national association (see foreword) to avoid any colour duplication with tables 12 and 13.

8.5.5.2 In the absence of a recognised colour shown in table 13, the "R" designation of the gas shall be stencilled onto the cylinder body circumference and shall be clearly visible when the cylinder is in the upright position. In addition a sticker or tag may be attached to the cylinder identifying the contents.

Table 13 — Refillable refrigerant cylinder colour chart

1	2	3	4
Gas reference	**Colour of cylinder Guard/shroud**	**Guard/shroud Colour**	Shoulder band[b]
R 22	S0540-G	Light green	–
R 123	S1510-R90B	Light blue green	–
R 124	S3555-B80G	Deep green	–
R 125	S3030-Y	Medium brown	–
R 134a	S0530-B	Light blue	–
R 152a	S1580-Y90R	Red	–
R 290	S1580-Y90R	Red	–
R 404A	S0580-Y60R	Orange	–
R 407A	S3020-G40Y	Light green grey	–
R 407c	S3050-Y50R	Medium brown	–
R 408A	S2060-R40B	Medium purple	–
R 409A	S3020-Y20R	Medium brown tan	–
R 410A	S1040-R20B	Rose	–
R 427A	S1565-G	Brilliant green	–
R 507	S2050-B70G	Blue green	–
R 600A	S1580-Y90R	Red	–
R 1234yf[a]	S0603–R80B	White	Red
R 1234ze	S0603–R80B	White	Green
R 1233zd	S0603–R80B	White	Black

NOTE The colour references are based on the National Colour System (NCS) and have been agreed to by the relevant national association (see foreword). Colours for refrigerant gases. Colours that are not listed above can be found in AHRI Guideline N.

[a] R1234yf is a flammable gas.

[b] The 50 mm wide colour band shall be located immediately below the cylinder top shoulder as follows:
1 Red NCS 1580-Y90R;
2 Black NCS S 9000-N; and
3 Green NCS 5540-G30Y.

8.5.6 Pressure receptacles fitted with internal tubes for liquid withdrawal

8.5.6.1 A pressure receptacle fitted with a conventional-type vapour withdrawal valve that is connected to an internal eductor tube or dip tube for liquid withdrawal shall be clearly marked by means of two diametrically opposed vertical yellow (in the case of chlorine cylinders, black) stripes of width 50 mm, to indicate the presence of the eductor or dip tube.

8.5.6.2 In the case of a pressure receptacle fitted with a dual-purpose valve that has both vapour and liquid outlets, the liquid withdrawal outlet shall be clearly identified and the liquid and vapour outlets shall be non-interchangeable. In this case there is no requirement to mark the associated pressure receptacles with vertical yellow stripes.

8.5.6.3 The above does not apply to refrigerant cylinders. Refrigerant recovery cylinders shall be painted with a yellow shroud.

8.5.6.4 Fire extinguishers and fire suppression systems are exempt from the requirement to fit vertical yellow stripes to the respective gas cylinders.

8.6 Labelling

8.6.1 Precautionary labels — General

The labelling of cylinders (excluding LPG cylinders) shall comply with ISO 7225. Alternative methods can be used, but shall incorporate the objectives of ISO 7225.

8.6.2 Dangerous-commodity labels

8.6.2.1 If a pressure receptacle has been filled with a dangerous commodity as defined in SANS 10228, and is to be conveyed by any type of transport on a public road, it shall be labelled in accordance with SANS 10229-1, except that, when the pressure receptacle is readily visible, the pressure receptacle need not bear the "compressed gas" label.

8.6.2.2 If a pressure receptacle is concealed in an outer box or some other type of container, the outer container shall bear the "compressed gas" label and the label applicable to the commodity in the pressure receptacle. The pressure receptacle labelling shall comply with the requirements of SANS 10234 and SANS 10263-0.

8.6.3 Labelling on LPG pressure receptacles

8.6.3.1 LPG cylinders of water capacity not exceeding 20 L shall bear, in the form of a pictogram (see figure H.1) on a label (of minimum size 100 mm × 40 mm), a warning that the cylinder shall not be placed on hot plates or stoves, be exposed to excessive heat, and shall always be used in an upright position.

8.6.3.2 All cylinders shall indicate the direction of use and the position for transportation in accordance with annex H. (See also figure H.2).

8.6.3.3 Limitations on quantities of LPG cylinders for use in buildings shall be as specified in SANS 10087-1. The allowable quantities shall be included on the cylinder label, as appropriate.

8.6.3.4 Cylinders fitted with dual outlet valves (liquid/gas) shall be marked **"NOT FOR DOMESTIC USE"**.

8.6.3.5 LPG cylinders used on forklift trucks shall be labelled to identify them for this use and to indicate the direction of installation. Operating instructions shall be attached. The label shall indicate that the cylinder is for forklift trucks only and is to be used in liquid service.

8.6.4 Other labelling

In addition to the marking required in 8.1, 8.3 and, when relevant, 8.4, each filled pressure receptacle shall be labelled in accordance with the relevant national legislation (see foreword) and SANS 289. Pressure receptacles shall not be labelled or branded with marketing or promotion material.

8.7 Certificates

8.7.1 General

Manufacturers and or the local importer or distributor (as defined in the relevant national legislation (see foreword)) shall keep and make available on request manufacturing and inspection certificates for all pressure receptacles that are sold. Batch certificates are acceptable.

8.7.2 Revalidation inspection and test certificates

8.7.2.1 Revalidation inspection and test certificates shall comply with the requirements given in SANS 1825.

8.7.2.2 Cylinders in service shall be inspected and tested in accordance with table F.1.

8.8 Consumer protection

When labelling pressure receptacles consideration shall be given to the provision of end user instructions in accordance with the relevant national legislation (see foreword).

9 Filling of pressure receptacles

9.1 General

9.1.1 Pre-filling inspection

Before filling, an inspection shall be performed as specified in 9.1.4. Should the cylinder fail, the owner shall ensure that the disposal of the cylinder is carried out in accordance with SANS 1825, or that the cylinder is sent to an approved test station for further examination or disposal. The rejection criteria shall be in accordance with SANS 1825.

9.1.2 Permission to fill pressure receptacles

Permission to fill pressure receptacles shall be obtained from the owner of the pressure receptacle, in writing, except where the pressure receptacle is privately owned by the end user. This requirement is for safety reasons. The containment history of the pressure receptacle is an essential requirement for safe filling.

9.1.3 Persons competent to fill pressure receptacles

No person shall fill a pressure receptacle with gas unless such person is competent to fill pressure receptacles with the gases being handled, and is conversant with the relevant requirements of this standard.

9.1.4 Inspection before, during and after filling

9.1.4.1 The pre-fill inspection of the pressure receptacle by the filler shall be in accordance with the criteria given in tables 14, 15, 16, 17 and 18. See SANS 10087-7 for LPG cylinders.

9.1.4.2 Before filling any pressure receptacle, the filler shall ensure that

a) the requirements of 9.1.2 have been fulfilled.

b) the pressure receptacle is clean and free from obvious contaminants.

c) the pressure receptacle complies with the requirements of an approved standard and has the appropriate pressure rating.

d) the pressure receptacle is not due for periodic inspection or testing and in the case of a composite pressure receptacle, it does not have an expired service life.

e) the pressure receptacle, valve and pressure relief devices, if any, are in good serviceable condition.

f) the correct cylinder colour for the intended gas service has been applied before filling, or, for jacketed composite cylinders, the entire outer jacket is the correct colour for the intended gas service.

g) for composite cylinders, where applicable, the markings on embedded labels are undamaged and comply with the requirements of the respective pressure receptacle design code.

h) during filling, leak detection is carried out with an acceptable leak detection fluid at regular intervals. Typical checks shall comprise checking of the valve outlet, gland nut and valve stem to the cylinder neck thread joint.

i) after filling, the pressure receptacle is visually inspected for leaks. If a leak is found and it cannot be stopped, the pressure receptacle shall be emptied and shall not be refilled until the cause of the leak has been rectified.

j) after filling, the statutory labels are in place and all information on the labels is clearly visible.

k) if at any stage a non-compliance is observed, the filler shall stop any further work, quarantine the cylinder and report the non-compliance to a competent person.

Table 14 — Pre-fill inspection/rejection criteria for seamless cylinders

1	2
Condition	**Rejection criteria**
Arc or torch burns	Localized heat-affected zone plus addition of weld metal or removal of metal by grinding, filing, etc.
Bulges	Visible swelling
Chain pitting, line or channel (or both) corrosion	When any one condition affects 50 % or more of the diameter of the cylinder
Cracks	Split in material
Crevice corrosion	When this occurs close to an opening in a welded steel cylinder. **or** If the depth is greater than 20 % of the original wall thickness in welded and seamless cylinders.
Cuts or gouges	When metal has been removed and the depth of the cut or gouge is greater than 10 % of the cylinder wall thickness.
Dents	The dent is greater than 3 % of the cylinder diameter. **or** The diameter of the dent is greater than 15 times the depth of the dent.
Depressed bung	When the profile of a welded cylinder has changed from the original shape.
Fire damage	When there is excessive general or local heating, for example a) burning and charred paint, b) burning of metal, c) distortion of cylinder, d) melting of valve parts, and e) melting of any plastic parts, such as test ring, guard or cap.
General corrosion	If the original surface of the metal cannot be seen.
Isolated pits	Pits up to 5 mm in diameter.
Plug or neck inserts	Additional inserts to base or wall, which are not part of the original design, for example pipes, nuts and bolts.
Stamping	Any stamped markings on the parallel part of the cylinder wall. Any alterations, illegible, incorrect or inadequate markings.
Suspicious marks	Marks introduced other than by the manufacturer or an approved test station.
Vertical instability	Any stacking of cylinders which creates an unstable condition such that cylinders might fall.

Table 15 — Pre-fill inspection/rejection criteria for all welded steel cylinders other than welded LPG cylinders

1	2
Condition	**Rejection criteria**
Arc or torch burns	Localized heat-affected zone plus addition of weld metal or removal of metal by grinding, filing, for example.
Bulges	Visible swelling
Chain pitting, line or channel (or both) corrosion	When any one condition affects 50 % or more of the diameter of the cylinder.
Cracks	Split in material
Crevice corrosion	When this occurs close to an opening in a welded steel cylinder **or** If the depth is greater than 20 % of the original wall thickness in welded and seamless cylinders.
Cuts or gouges	When metal has been removed and the depth of the cut or gouge is greater than 10 % of the cylinder wall thickness.
Dents	When the depth of the dent exceeds 25 % of its width at any point.
Depressed bung	When the profile of the cylinder has changed from the original shape.
Fire damage	When there is excessive general or local heating, for example, a) burning and charred paint, b) burning of metal, c) distortion of cylinder, d) melting of valve parts, and e) melting of any plastic parts, such as test ring, guard or cap.
General corrosion	If the original surface of the metal cannot be seen.
Isolated pits	When there is more than one pit per 500 mm^2 of the surface area.
Plug or neck inserts	Additional inserts to base or wall, which are not part of the original design, for example pipes, nuts and bolts.
Stamping	Any stamped markings on the parallel part of the cylinder wall. Any alterations, illegible, incorrect or inadequate markings.
Suspicious marks	Marks introduced other than by the manufacturer or an approved test station.
Vertical instability	Any stacking of cylinders which creates an unstable condition such that cylinders might fall.
NOTE For welded LPG cylinders, refer to the relevant section in SANS 10087-7.	

Amdt 1

Table 16 — Pre-fill inspection/rejection criteria for jacketed composite cylinders

1	2
Step	**Action**
1	Check that the jacket is not contaminated with a) oil or grease, b) dirt, and c) foreign material such as concrete or bitumen.
2	If there is any indication of contamination, check the base for trapped material. Trapped dirt will make the tare weight (empty assembled weight) inaccurate.
3	Check that the jacket is intact, complete and securely assembled.
4	Check that the jacket is not distorted as indicated by significant gaps in the assembly joints.
5	Check the jacket for any significant punctures, cuts, gouges or heavy scratches. Light scratches or areas of abrasion are acceptable.
6	Check for signs of fire damage. This includes: a) blisters, charred, deformed, discoloured or melted parts; b) arc or torch burns; and c) burn or soot marks on the jacket, label or fittings.
7	Examples of composite cylinder jacket reject criteria are given in table 17.

Table 17 — Prefill inspection / rejection criteria — Examples of composite cylinder jacket damages

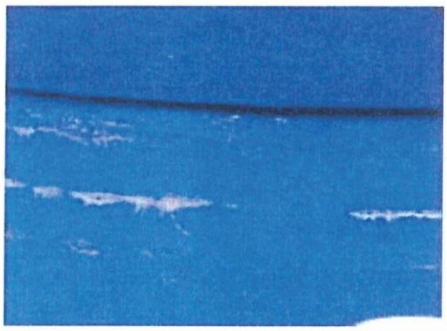
1	2	3
Type of damage	**Fail criteria**	**Graphics**
Scratches, scrapes and burns	Unacceptable scratches, scrapes and burns are deep enough to create a rough surface with plastic burrs, which are sharp to the touch. Unacceptable burns will cause a distortion in the surface and a thinning of the plastic. Unacceptable damage may require the plastic part to be scrapped and replaced before the cylinder can be returned to service.	 Drg.335i Scratch/scrape  Drg.335ia Sharp burr on handle  Drg.335ib Burn/fire damage

Table 17 *(continued)*

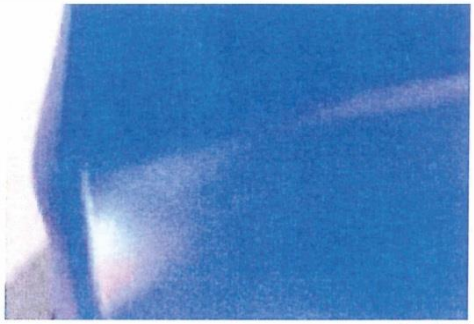
1	2	3
Type of damage	**Fail criteria**	**Graphics**
Holes, cuts, bends and breaks	Holes, cuts, bends or breaks in a cylinder are unacceptable. If the plastic is overstressed the plastic will start to change in colour to a milky white. Parts that contain holes, cuts, bends or breaks shall be replaced.	 Drg.335j Overstressed  Drg.335ja Impact damage
	Should the defect penetrate through the plastic part the inner pressure vessel shall be examined for damage.	 Drg.335jb Puncture damage

Table 17 *(continued)*

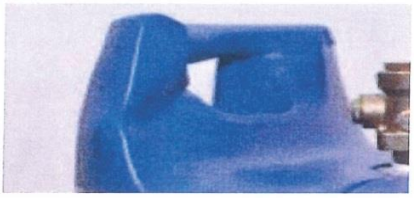
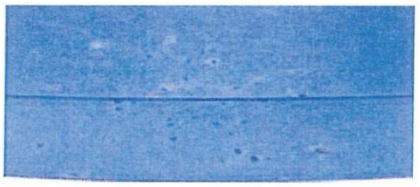
1	2	3
Type of damage	**Fail criteria**	**Graphics**
Paint and marking		 Drg.335k Deformed handle
	Paint and other permanent marking materials are very difficult to remove from a cylinder because of the surface roughness of the plastic shell. Ideally no paint or marker should find its way onto the cylinder but small thin amounts can be deemed acceptable.	 Drg.335ka Paint/marker
	Grinding splatter can embed itself into the jacket and is unacceptable.	 Drg.335kb Grinding splatter

Table 18 — Pre-fill inspection/rejection criteria for composite cylinders

1	2		
Type of damage	**Level of damage**		
	Level 1 **Acceptable damage**	**Level 2** **Rejectable damage (requiring additional inspections or repairs)**	**Level 3** **Condemned damage (not repairable)**
Abrasion damage or damage from cuts	Damage to the following depth is acceptable: Less than 0,25 mm[a]	Damage greater than Level 1 but less than Level 3 shall be referred to the manufacturer for repair procedures.[b] Otherwise, the damage shall be considered Level 3. If the manufacturer does not provide repair instructions, the damage shall be considered Level 3.	Damage greater than: –15 % of composite overwrap thickness for fully-wrapped cylinders; –30 % of composite overwrap thickness for hoop-wrapped cylinders.
Impact damage	Damage from impact, which causes a frosted appearance or hairline cracking in the impact area that is less than 25 mm in diameter without permanent deformation, is acceptable.[b]	Damage greater than Level 1 shall be referred to the manufacturer for evaluation.[b] Otherwise, the damage shall be considered Level 3.	Damage from impact that causes permanent deformation (for example, dent).
Delamination	No visible delamination	Loose fibre ends from the termination of the wrapping process shall be repaired.	Delaminating fibres not included in Level 2.
Heat or fire damage	When the composite overwrap is only soiled from smoke or other debris and is found to be suitable for further service.[b] Additional attention shall be given to cylinders with an aluminium-alloy liner/boss or a non-load sharing liner.	Damage greater than Level 1 no repair allowed – consider as Level 3.	Cylinders with evidence of heat or fire damage greater than Level 1 shall be rendered unserviceable.
Structural damage	When the cylinder is found to be suitable for further service [b]	No repair allowed	All cylinders
Chemical attack	When the cylinder is found to be suitable for further service [b]	If the chemical nature is known, the cylinder manufacturer shall provide documentation confirming Level 1 or 2. If Level 2, the manufacturer shall suggest a suitable repair procedure. [b]	All cylinders if chemical unknown. Any attack of the fibre.
Missing/illegible identification label or markings	Not applicable	In the event that manufacturer can unmistakably identify the cylinder, by at least the serial number, a new label shall be supplied by the manufacturer and affixed or the marks applied either by the inspection body or the manufacturer (see ISO 13769).	All cylinders that cannot be identified and relabelled/remarked.

Table 18 (*concluded*)

1	2		
Type of damage	**Level of damage**		
	Level 1	**Level 2**	**Level 3**
	Acceptable damage	**Rejectable damage (requiring additional inspections or repairs)**	**Condemned damage (not repairable)**
Loose permanent attachments	Not applicable	Repair possible provided manufacturer gives written consent.	All cylinders other than those in Level 2.
Improper repair	Not applicable	Following a repair (see 7.4), all defects can be repaired a second and final time; the cylinder shall be retested.	All cylinders with defects after the second repair.
Other damage (of a cosmetic nature)	Minor damage that would be considered normal. Such damage should have no adverse effects on the safety of the cylinder and its continued use. Damage with no appreciable depth	Not applicable Small groups of abraded fibres	Not applicable
Damaged permanent attachment	No damage or minor damage such as nicks, scratches consistent with normal wear	When dented, cracked, broken, showing other signs of damage (e.g. discolouration from impact) or as advised by the manufacturer. Permanent attachment to be removed and composite cylinder to be assessed for damage. New attachment may be fitted provided cylinder suitable for further service.	If Level 2 damage exists and replacement of the damaged is not possible Or If the composite cylinder shows damage adjacent to a damaged area on the attachment
[a] The depth measurement starts at the surface of the cylinder, including coating if present, but excluding protective sleeves that are not part of the cylinder design.			
[b] This needs to be established by further investigation.			

9.1.5 Legal metrology compliance

9.1.5.1 When filling a pressure receptacle for sale, the requirements of the relevant national legislation (see foreword) shall be fulfilled.

9.1.5.2 Imported new and second-hand cylinders may have a stamped charging pressure and product content related to a lower reference temperature, as used in their country of origin. In such cases, the 20 °C reference temperature in South Africa will correlate to a lower product mass for the same stamped settled charging pressure. The filler shall ensure that cylinders filled in South Africa are filled to a product mass calculated using the reference temperature of 20 ºC. See also annex C.

9.2 Filling of pressure receptacles with liquefiable gases (excluding LPG)

9.2.1 All pressure receptacles that are filled with a liquefiable gas shall be filled using a mass measuring system that complies with the relevant national legislation (see foreword). If the liquefiable gas is not given in tables 2 and 3, the requirements in table 2 of ADR Packaging Instruction P200 shall apply.

9.2.2 A pressure receptacle being filled with a liquefiable gas shall not be filled to its full water capacity. An ullage space shall be left to allow the gas to expand due to ambient temperature fluctuations up to the reference temperature. Pressure receptacles shall be filled in accordance with the allowable filling ratio this will avoid the pressure receptacle from being overfilled. See tables 2 and 3 and table 2 of ADR Packaging Instruction P200.

9.2.3 In addition to carrying out the inspections required in 9.1.4, the filler shall ascertain the test pressure, the tare mass and the water capacity of the pressure receptacle and, by reference to tables 2 and 3 and ADR Packaging Instruction P200, shall calculate the maximum permissible mass of gas that can be filled into the pressure receptacle. The requirements of 4.2.6 shall also apply.

9.3 Filling of LPG pressure receptacles

The filling of LPG pressure receptacles shall be carried out in accordance with SANS 10087-3, SANS 10087-7 and SANS 10087-8 and the relevant national legislation (see foreword).

9.4 Filling of pressure receptacles with permanent and dissolved gases

NOTE See annex C and tables 7 and 8 for the developed pressure for permanent gases.

9.4.1 Permanent gases

In addition to the inspections of the pressure receptacle as required in 9.1.4 pressure receptacles for permanent gases shall be filled in compliance the corporate quality system of the filler

9.4.2 Corrosive gases

In addition to the inspections of the pressure receptacle as required in 9.1.4, the valve functionality shall be checked and, if necessary, the valve shall be reconditioned or replaced.

9.4.3 Acetylene

Inspection and filling of acetylene cylinders shall be carried out in accordance with ISO 11372 and ISO 13088. Inspections should form part of the corporate quality system of the company concerned.

9.4.4 Filling composite cylinders

Cylinders of composite construction (all types) shall not be filled at a rate exceeding 3000 kPa per minute.

10 Handling, storage, transport and use

10.1 Handling

Pressure receptacles shall be handled in accordance with SANS 10263-2. Pressure receptacles shall not be subjected to any undue shock. They shall be handled safely and carefully, while sliding, rolling and skidding shall be avoided.

10.2 Stacking

10.2.1 General

The maximum height of any stack shall be such as to ensure that the cylinders can be handled safely. Only pressure receptacles that are specifically designed for stacking shall be stacked.

10.2.2 Rules for the stacking of liquefied gas pressure receptacles

10.2.2.1 All cylinders that contain liquefied gas shall be stored in a vertical position, and they shall rest on their foot rings or specially formed bases.

10.2.2.2 Pressure drums designed for horizontal use can be stored in a horizontal position.

10.2.2.3 Only new or refurbished welded liquefied gas pressure receptacles that contain no liquefied gas may be transported and stacked horizontally.

10.2.2.4 Cylinders that are stored vertically may be arranged in groups, each group containing up to four rows of cylinders, with gangways between the groups.

10.2.2.5 New empty cylinders may be stored horizontally. They shall be in single rows or in groups that comprise two rows with the valves adjacent to the gangways. The ends of each horizontal row shall be securely wedged.

10.2.2.6 Gangways shall be maintained between stacks, walls and fences.

10.2.2.7 When pallets or baskets are used, these shall be placed in single rows with gangways between the rows.

10.2.2.8 LPG cylinders shall be stacked in accordance with SANS 10087-4 and SANS 10087-7.

10.3 Storage

The warehousing of dangerous goods shall be done in accordance with the requirements of SANS 10228, SANS 10229-1 and SANS 10263-2.

10.4 Transport

10.4.1 General

10.4.1.1 Transport of pressure receptacles shall be carried out in accordance with the relevant national legislation (see foreword), and the requirements of SANS 10228.

10.4.1.2 When gas pressure receptacles are packed, the package shall comply with the relevant transport requirements of the relevant national legislation (see foreword).

10.4.1.3 Pressure receptacles that are transported in a vehicle shall be so blocked or braced (or both) as to prevent movement, and shall not project beyond the sides or ends of the vehicle.

10.4.1.4 Cylinders that are transported in ISO containers for shipping shall comply with local or international requirements given in the International Maritime Dangerous Goods (IMDG) Code, the International Air Transport Association (IATA) Dangerous Goods Regulations manual, and the requirements in chapter 3.2.1 and table A of ADR. **Amdt 1**

10.4.2 Mixed transport

When pressure receptacles that contain various types of gas are to be transported together, this shall be done in accordance with SANS 10231.

10.5 Use of pressure receptacles

10.5.1 When a pressure receptacle is supplied to a user, the applicable safety requirements shall be made available in accordance with the relevant national legislation (see foreword).

10.5.2 Owing to the possibility of leakage as a result of minor defects, pressure receptacles shall be stored in vented areas. In the case of gases that are heavier than air, care shall be taken to ensure that drains or trenches do not create pockets in which such gases might collect (see SANS 10087-1 and SANS 10087-3).

10.5.3 If a leaking pressure receptacle is found and the leak cannot be stopped easily and quickly, the pressure receptacle shall be moved immediately to that part of an open space where it is least dangerous to life and property, and advice shall be obtained from the owner/filler before any action is taken.

10.5.4 Cylinders shall be disposed of in accordance with SANS 1825.

10.5.5 The following shall apply to pressure receptacles which have passed and are within their periodic inspection and test date when in use or reserved at a customer site (see 7.5): **Amdt 1**

a) It may continue to be used as long as the pressure receptacle has not been subjected to abusive or abnormal service conditions.

b) Pressure receptacles may continue in use beyond the stated test interval for periodic inspection or beyond the stated service life for composites and should be returned for the periodic inspection and test or removal from service when no longer required for use. Pressure receptacles shall not be refilled or topped-up beyond the stated test interval period or beyond the stated service life for composites. **Amdt 1**

c) Pressure receptacles, particularly those containing corrosive gases, should be retested within a period not exceeding twice the retest time interval.

d) For breathing gasses used in the SCUBA and SCBA environment, these should be inspected at intervals in accordance with table G.3 as far as reasonably practical, based on a risk assessment, and should not exceed the hydrostatic inspection interval in accordance with table G.3, or the inspection intervals forming part of the SCBA unit as per OEM instructions. **Amdt 1**

e) Portable and system gas cylinders where the gas content is only used in response to an emergency incident are excluded from this clause (see 10.5.5). **Amdt 1**

11 General safety precautions

11.1 Pressure receptacles exposed to fires

Where it is evident from the condition of the paint that a pressure receptacle has been exposed to fire, it shall be immediately removed from service or its place of storage, and be presented for inspection and evaluation to an approved test station, which will follow the requirements of SANS 1825.

11.2 Position and support of pressure receptacles in use

11.2.1 Pressure receptacles that contain liquefiable gases and pressure receptacles that contain dissolved acetylene shall always be used in the normal upright position for gas or liquid withdrawal and, when relevant, shall be so supported that they cannot be knocked over.

11.2.2 Pressure receptacles that may be used in a horizontal position shall be so secured that they cannot roll.

11.2.3 When pressure receptacles are on their transport cradles, they shall be secured so that they cannot move.

11.3 Reporting of incidents

Incidents, as defined in the relevant national legislation (see foreword), shall be reported in accordance with the requirements contained in the relevant national legislation (see foreword).

11.4 Handling of pressure receptacle emergencies

For guidance on dealing with emergencies related to pressure receptacles, see EIGA IGC Doc. 80/08.

Annex A
(normative)

List of acceptable manufacturing standards for gas pressure receptacles

The following norms and standards given in tables A.1 to A.11 (inclusive) provide a list of acceptable manufacturing standards for gas pressure receptacles from various countries.

NOTE 1 While the information contained in annex A was correct at the time of publication of this SANS standard, it remains the duty of the purchaser/importer to ensure validity of the listed standards. **Amdt 1**

NOTE 2 Table A.4 and table A.7 in annex A, and table 1 in respect to EN and DOT pressure receptacles are not definitive. All EN and DOT standards pertaining to refillable and non-refillable pressure receptacles of water capacity 0,5 L to 3 000 L and cartridges of water capacity greater than 0,5 L are deemed acceptable for design, manufacture, use, and maintenance. **Amdt 1**

NOTE 3 Manufacturers who wish to import gas pressure receptacles into South Africa should note that there could be further regulatory requirements (see also annex B). **Amdt 1**

Table A.1 — Australia

Standard	Description
AS 1777	Aluminium cylinders for compressed gases – Seamless – 0,1 kg to 130 kg
AS 2468	Steel cylinders for compressed gases – Brazed – 0,1 kg to 11 kg Note See also the caution in B.2 of this standard.
AS 2470	Steel cylinders for compressed gases – Welded three-piece construction with longitudinal joint – 11 kg to 150 kg
AS 2527	Cylinders for dissolved acetylene
AS 3577	Steel cylinders for compressed gases – Welded – 150 kg to 500 kg

Table A.2 — Canada (Canadian Transport Commission Regulations)

Standard	Description
TC 4BA	Welded or brazed steel cylinders
TC 4BW	Welded steel cylinders made of definitely prescribed steels with electric-arc welded longitudinal seam

Table A.3 — France

Standard	Description
CODAP 2020	CODAP 2020 Division 1 and 2. Code for construction of unfired pressure vessels

Amdt 1

Table A.4 — International Standards Organizations, European Norms, standard specifications and EEC directives

Standard	Description
EN 417	Non-refillable metallic gas cartridges for liquefied petroleum gas, with or without a valve, for use with portable appliances – Construction, inspection, testing and marking
EN 1442	LPG equipment and accessories – Transportable refillable welded steel cylinders for LPG – Design and construction NOTE See also the caution in B.2 of this standard.
EN 12094-4	Fixed firefighting systems – Components for gas extinguishing systems – Part 4: Requirements and test methods for container valve assemblies and their actuators
EN 12245	Transportable gas cylinders – Fully wrapped composite cylinders
EN 12257	Transportable gas cylinders – Seamless hoop-wrapped composite cylinders
EN 12862	Transportable gas cylinders – Specification for the design and construction of refillable transportable welded aluminium alloy gas cylinders
EN 13110	LPG equipment and accessories – Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG) – Design and construction
EN 13293	Transportable gas cylinders – Specification for the design and construction of refillable transportable seamless normalized carbon manganese steel gas cylinders of water capacity up to 0,5 litre for compressed, liquefied and dissolved gases and up to 1 litre for carbon dioxide
EN 13322-1	Transportable gas cylinders – Refillable welded steel gas cylinders – Design and construction – Part 1: Carbon steel
EN 14140	LPG equipment and accessories – Transportable refillable welded steel cylinders for LPG – Alternative design and construction NOTE See also the caution in B.2 of this standard.
EN 14208	Transportable gas cylinders – Specification for welded pressure drums up to 1 000 litre capacity for the transport of gases – Design and construction
EN 14427	LPG equipment and accessories – Transportable refillable fully wrapped composite cylinders for LPG – Design and construction
EN 14638-3	Transportable gas cylinders – Refillable welded receptacles of a capacity not exceeding 150 litres – Part 3: Welded carbon steel cylinders made to a design justified by experimental methods NOTE See also the caution in B.2 of this standard
EU/35/2010	Directive 2010/35/EU of the European Parliament and of the Council of 16 June 2010 on transportable pressure equipment and repealing Council Directives 76/767/EEC, 84/525/EEC, 84/526/EEC, 84/527/EEC and 1999/36/EC
ISO 3807	Gas cylinders – Acetylene cylinders – Basic requirements and type testing
ISO 4706	Gas cylinders – Refillable welded steel cylinders – Test pressure 60 bar and below
ISO 7866	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing

Table A.4 *(concluded)*

ISO 9809-1	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa
ISO 9809-2	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa
ISO 9809-3	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders
ISO 9809-4	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa
ISO 11118	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods
ISO 11119-1	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 L
ISO 11119-2	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with load-sharing metal liners
ISO 11119-3	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with non-load-sharing metallic or non-metallic liners with or without liners
ISO 11119-4	Gas cylinders – Refillable composite gas cylinders – Design, construction and testing – Part 4: Fully wrapped fibre reinforced composite gas cylinders up to 150 L with load sharing welded metallic liners
ISO 11439	Gas cylinders – High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles
ISO 11515	Gas cylinders – Refillable composite reinforced tubes of water capacity between 450 L and 3000 l – Design, construction and testing
ISO 16148	Gas cylinders – refillable seamless gas cylinders and tubes – Acoustic emission examination (AT) and follow-up ultrasonic examination (UT) for periodic inspection and testing
ISO 18172-1	Gas cylinders – Refillable welded stainless steel cylinders – Part 1: Test pressure 6 MPa and below
ISO 18172-2	Gas cylinders – Refillable welded stainless steel cylinders – Part 2: Test pressure greater than 6 MPa
ISO 21172-1	Gas cylinders – Welded steel pressure drums up to 3000 litres capacity for the transport of gases – Design and construction – Part 1: Capacities up to 1000 litres
ISO 22991	Gas cylinders – Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) – Design and construction NOTE See also the caution in B.2 of this standard.

Amdt 1

Table A.5 — Japan

Standard	Description
JIS B 8240	Construction of pressure vessels for refrigeration
JIS B 8241	Seamless steel gas cylinders

Table A.6 — United Kingdom

Standard	Description
BS 5045-6	Transportable gas containers. Specification for seamless containers of less than 0,5 litre water capacity
BS 5045-7	Transportable gas containers. Specification for seamless steel gas containers of water capacity 0,5 L up to 15 L for special portable applications
BS 5045-8	Transportable gas containers. Specification for seamless aluminium alloy gas containers of water capacity 0,5 L up to 15 L and up to 300 bar charged pressure at 15°C for special portable application

Table A.7 — United States of America (Department of Transportation Regulations (Code of Federal Regulations Title 49))

Standard	Description
DOT 3A	Seamless steel cylinders up to 1 000 lbs water volume. Service pressure 150 psi minimum
DOT 3AA	Seamless steel cylinders made of definitely prescribed steels up to 1 000 lbs water volume. Service pressure 150 psi minimum
DOT 3AL	Seamless aluminium cylinders up to 1 000 lbs water volume and minimum service pressure 150 psi
DOT 3AX	Seamless stainless steel cylinders of capacity over 1 000 lbs water volume. Service pressure at least 500 psi
DOT 3AAX	Seamless steel cylinders made of definitely prescribed steel of capacity over 1 000 lbs water volume. Service pressure 500 psi minimum
DOT 3E	Seamless steel cylinders with a maximum outside diameter 2 inches. Service pressure 1 800 psi maximum
DOT 3T	Seamless steel cylinder with minimum water capacity 1 000 pounds and minimum service pressure 1 800 psi
DOT 4A	Forge welded steel cylinders
DOT 4B	Welded steel cylinders made from low carbon steel up to 1 000 lbs water volume. Service pressure between 150 and 500 psi
DOT 4DS	Welded stainless steel cylinders for aircraft use up to 1 000 lbs water volume. Service pressure between 500 and 900 psi
DOT 4E	Welded aluminium cylinders made of definitely prescribed aluminium up to 1 000 lbs water volume. Service pressure between 225 and 500 psi
DOT 4BA	Welded steel cylinders made of definitely prescribed steels up to 1 000 lbs water volume. Service pressure between 225 and 500 psi
DOT 4BW	Welded steel cylinders made of definitely prescribed steels with electric-arc welded longitudinal seam. Service pressure between 225 and 500 psi
DOT 4L	Welded insulated cylinders with a water capacity not over 1 000 pounds and a service pressure of at least 40 but not greater than 500 psi

Table A.7 *(concluded)*

Standard	Description
DOT E7638	Steel cylinders with approved porous filling for acetylene. Service pressure 250 psi. Incorporates CGA C-12
DOT 8	Welded steel cylinders made of definitely prescribed steel for the transportation of acetylene. Service pressure 250 psi. Incorporates CGA C-12
DOT 8AL	Steel cylinders with approved porous filling for acetylene. Service pressure 250 psi. Incorporates CGA C-12
DOT 39	Non-reusable (non-refillable) cylinders. Service pressure not to exceed 80 % of the test pressure
DOT E-1032	Welded steel cylinders made of definitely prescribed steels with electric-arc welded longitudinal seam. Service pressure between 225 and 500 psi for the transportation of acetylene
DOT Special Permits	All pressure receptacles designed and manufactured to DOT Special Permits are approved

Table A.8 — South Africa

Standard	Description
SANS 220	Dissolved acetylene cylinders
SANS 399	Transportable refillable welded stainless steel cylinders for low pressure gases – Alternative design and construction
SANS 1151	Portable rechargeable fire extinguishers – Halogenated hydrocarbon type extinguishers
SANS 1475-1	The production of reconditioned fire-fighting equipment – Part 1: Portable and wheeled (mobile) rechargeable fire extinguishers
SANS 1475-2	The production of reconditioned fire-fighting equipment – Part 2: Fire hose reels and above-ground hydrants
SANS 1567	Portable rechargeable fire extinguishers – CO_2 type extinguishers
SANS 1739	Low pressure welded steel cylinders for fire extinguishers
SANS 1910	Portable refillable fire extinguishers
SANS 4706	Gas cylinders – Refillable welded steel cylinders – Test pressure 60 bar and below
SANS 7866	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing
SANS 20703	Gas cylinders – Refillable welded aluminium-alloy cylinders – Design, construction and testing

Table A.8 (*concluded)*

Standard	Description
SANS 9809-1	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa
SANS 9809-2	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa
SANS 9809-3	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders
SANS 10019	Transportable pressure receptacles for compressed, dissolved and liquefied gases – Basic design, manufacture, use and maintenance
SANS 11120	Gas cylinders – Refillable seamless steel tubes of water capacity between 150 L and 3 000 L – Design, construction and testing
SANS 20067	Uniform provisions concerning: I. Approval of specific equipment of motor vehicles using liquefied petroleum gases in their propulsion system; II. Approval of a vehicle fitted with specific equipment for the use of liquefied petroleum gases in its propulsion system with regard to the installation of such equipment
SANS 20110	Uniform provisions concerning the approval of: I. Specific components of motor vehicles using compressed natural gas (CNG) in their propulsion system; II. Vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) in their propulsion system
SANS 52094-4	Fixed firefighting systems – Components for gas extinguishing systems – Part 4: Requirements and test methods for container valve assemblies and their actuators

Annex B
(normative)

Special conditions applicable to the acceptability of standards given in annex A

B.1 The safety requirements that apply to cylinders manufactured in accordance with the acceptable standards for use in South Africa are stipulated in table B.1. These requirements are required to ensure that cylinders comply with this standard.

B.2 When using the approved standards in annexes A and B that permit the construction of cylinders from aluminium, care shall be taken to avoid using aluminium alloy cylinders for the conveyance of propane, butane and mixtures of these gases (LPG). Consultation with the relevant national body (see foreword) is advised. This cautionary note is with respect to the sulfur and caustic content in the propane and butane of LPG available in South Africa.

Table B.1 — Safety requirements for cylinders in South Africa

1	2	3
Standard	**Description**	**Conditions**
AS 2468	Steel cylinders for compressed gases – Brazed – 0,1 kg to 11 kg	Cylinders shall be fitted with a pressure relief device.
EN 12257	Transportable gas cylinders – Seamless hoop-wrapped composite cylinders with a water capacity up to and including 450 L for compressed, liquefied and dissolved gases	Transportable gas cylinders manufactured to this standard shall have a limited life only.
EN 1442	LPG equipment and accessories – Transportable refillable welded steel cylinders for LPG – Design and construction	Welded steel cylinders manufactured for all liquefied gases, including LPG, shall be normalized and the cylinder shall be stamped with the letter "N".
ISO 22991	Gas cylinders – Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) – Design and construction	Non-heat-treated cylinders shall not be imported or used in South Africa.
EN 12245	Fully wrapped composite cylinders up to 450 L WC	These containers, when used in LPG, butane or propane service, shall be manufactured including a liner.
EN 14140	LPG equipment and accessories – Transportable refillable welded steel cylinders for LPG – Alternative design and construction	LPG cylinders manufactured to this standard using dual-phase steel are limited to a maximum of 23 L water capacity (9 kg). LPG cylinders manufactured using dual-phase steels shall be fitted with plastic handles and incorporate a pressure relief device. See also the requirements in this standard for heat treatment, powder coating and repair.
EN 14638-3	Transportable gas cylinders – Refillable welded receptacles of a capacity not exceeding 150 L – Part 3: Welded carbon steel cylinders made to a design justified by experimental methods	LPG cylinders shall not be manufactured to this standard. Cylinders manufactured to this standard using dual-phase steel are limited to a maximum of 23 L water capacity. Cylinders manufactured using dual-phase steels shall be fitted with plastic handles and incorporate a pressure relief device. See also the requirements in this standard for heat treatment, powder coating and repair.

Annex C
(informative)

Developed pressure for permanent gases

Figure C.1 shows the effect of the change of reference temperature from 15 °C to 20 °C on the developed pressure of permanent gases, except for methane, for cylinders filled to industry standard pressures. The lower developed pressure at 20 °C will correspond to a reduced product mass capacity compared to the same cylinder having a settled pressure at 15 °C.

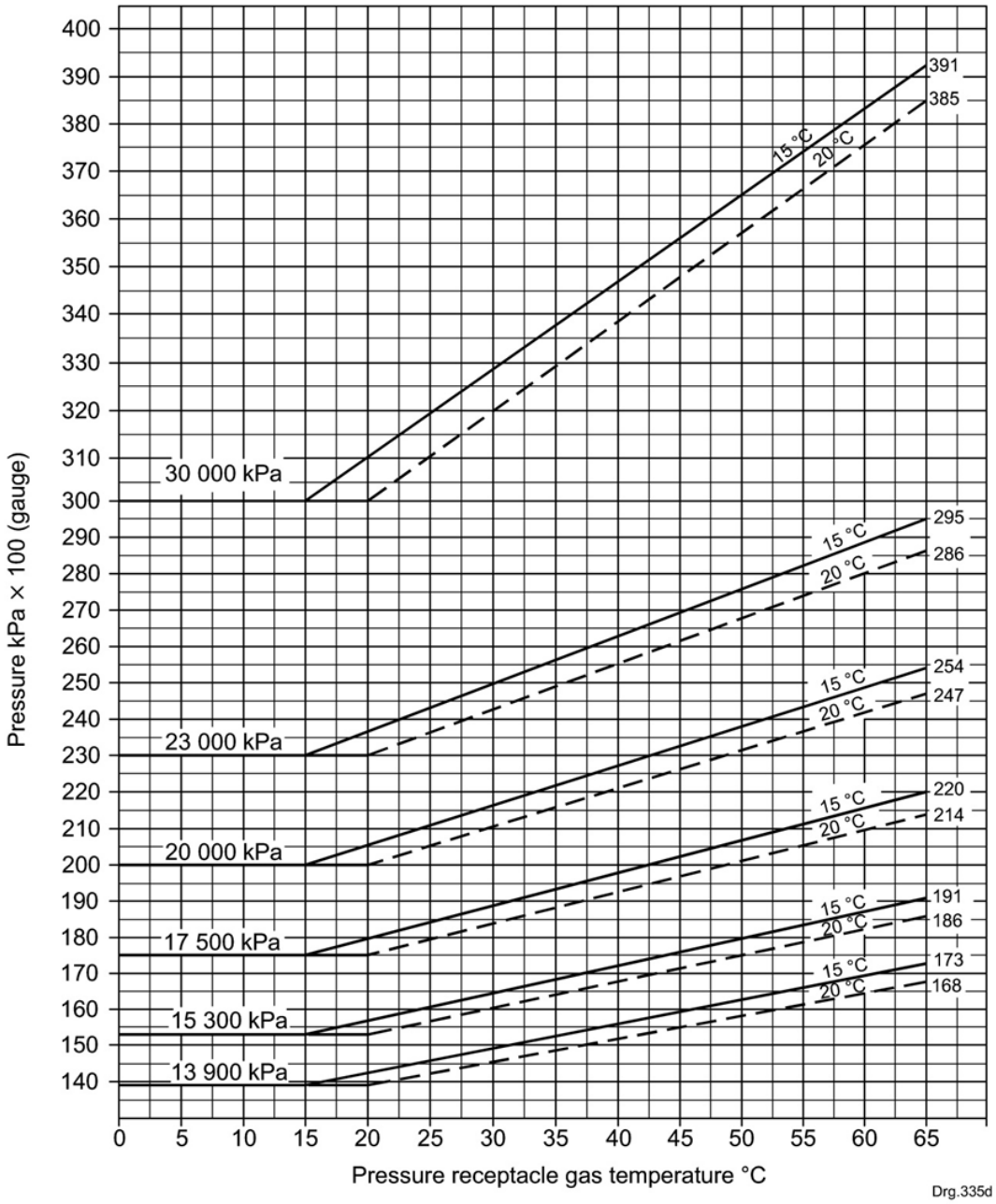


Figure C.1 — Developed pressures

Annex D
(informative)

Example of calculation to determine the product capacity of a 10 L water capacity carbon dioxide gas cylinder

Water capacity: 10 L. Always use the minimum water capacity of the cylinder taking manufacturing tolerances into account and the cylinder test pressure.

Fill ratio: 0,68 (as per table 3)

Nominal product weight (kg) = Maximum theoretical fill weight – filling uncertainties

Maximum theoretical fill weight (kg) = Cylinder minimum water capacity × fill ratio

Filling uncertainties = $E1$, $E2$, $E3$

$$NPW = (WC \times FR) - 2\sqrt{(E1^2 + E2^2 + E3^2)}$$

NPW = 6,8 kg – 0,3 kg;

NPW = 6,5 kg.

where

NPW is the nominal product weight, in kilograms (kg);

WC is the water capacity, in litres (L);

FR is the fill ratio (Refer to tables 2 and 3. For liquefiable gases not listed see the tables in ADR P200);

$E1$ is the cylinder tare mass variance, in kilograms (kg) (Maximum tolerance in the stamped tare mass of the cylinder) Example 0,1 kg;

$E2$ is the filling scale uncertainty, in kilograms (kg) (1/2 a scale display increment) Example 0,05 kg;

$E3$ is the filling process variation, in kilograms (kg) (Determined from filling 20 cylinders) Example 0,1 kg

Annex E
(informative)

Pressure receptacle valve standards

Reference can be made to the following CGA or ISO standards with regard to valve design, manufacture and tests:

a) CGA V1, connection No. CGA 600 *Valve outlet connections 1,000 – 20 UNEF-RH.EXT*.

b) ISO 5145, *Cylinder valve outlets for gases and gas mixtures – Selection and dimensioning*.

c) ISO 10297; *Gas cylinders – Cylinder valves – Specification and type testing.*

d) ISO 11118; *Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods*.

e) ISO 15996, *Gas cylinders – Residual pressure valves – General requirements and type testing.*

f) ISO 22435, and, *Gas cylinders – Cylinder valves with integrated pressure regulators – Specification and type testing*.

g) SANS 39/ISO 407, *Small medical gas cylinders – Pin-index yoke-type valve connections.*

Annex F
(normative)

Frequency of inspections and tests for pressure receptacles

F.1 The test periods given in table F.1 shall be used, provided that the dryness of the product (and that of the filled cylinder) is such that there is no free water. This condition shall be proved and documented within the filler's quality management system. If these conditions cannot be fulfilled, more frequent testing may be required.

F.2 Certain requirements may necessitate a shorter time interval, for example, the dew point of the gas, polymerization reactions, decomposition reactions, cylinder design specifications and change of gas service.

F.3 The re-test periods given in table F.1 shall also apply to pressure receptacles used in fixed fire installations. Such cylinders shall be removed from service at the end of the given re-test period and shall be depressurized and made safe before they are inspected and tested by an approved test station.

F.4 Pressure receptacles used in back-up or buffer service in systems or process systems shall be re-tested in accordance with the frequencies given in table F.1.

Table F.1 — Intervals for periodic inspection and testing of pressure receptacles
(For receptacles used for breathing gases in the SCUBA and SCBA Industry, see table G.3)
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1	2	3
Description of gas type	**Example of pressure receptacles by gas type**	**Frequency of pressure receptacle inspection and testing**[a] years
Receptacles for gases other than breathing gases used in the SCUBA and SCBA Industry		
Compressed gases	Ar, N_2, He	10
	H_2 [b] CNG, Methane	10
	Air, O_2	10
	Medical gases and breathing air	10
	CO[c]	5
Acetylene Monolithic mass Non-monolithic mass	Acetylene	First internal inspection 3 y after the initial massing of a cylinder shell[d] Thereafter every 10 y[d] --- First internal inspection 2 years after the initial massing of a cylinder shell[d] Thereafter every 2 y[d]
Liquefied gases	Refrigerants, CO_2, NH_3, LPG[e], LNG, He, Commercial Propane[e]	10
Corrosive gases[f]		5
Toxic gases that are non-corrosive	SO_2F_2	5
Very Toxic gases that are non-corrosive	AsH_3, PH_3	5
Gas mixtures	All mixtures	Every 5 y and 10 y according to dangerous properties. Generally, mixtures that are toxic or corrosive have a 5 y interval, and other mixtures have a 10 y interval.
Composite cylinders	All gases	See SANS 11623

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Table F.1 *(concluded)*

[a] Local regulations shall specify the interval of periodic inspections and tests.

[b] Particular attention shall be paid to the tensile strength and surface conditions of cylinders. Cylinders that do not comply with the special hydrogen requirements shall be withdrawn from hydrogen service. (See EIGA IGC Doc. 79/13/E section 7 recommendation no. 5 for possible additional testing.)

[c] This product shall require special consideration regarding moisture content when filled in steel cylinders. (See ISO 11114-1.)

[d] Acetylene cylinder shells shall be hydrostatically tested every time the porous substance is removed.

[e] Welded steel cylinders for LPG and commercial Propane are exempt from the requirements but shall be internally inspected whenever they are hydrostatically tested. This exemption does not apply to LPG and commercial Propane cylinders manufactured from other types of materials, for example, welded aluminium alloy, welded stainless steel, all types of composite cylinders.

[f] Corrosiveness with reference to human tissue shall be determined in accordance with ISO 13338 and NOT cylinder material.

NOTE 1 These test periods should be used provided the dryness of the product and the filled cylinder is such that there is no free water. This condition should be proven and documented within the quality system of the filler. If these conditions cannot be fulfilled, alternative or more frequent testing may be appropriate.

NOTE 2 Certain requirements may necessitate a shorter time interval, for example the dew point of the gas, polymerization reactions and decomposition reactions, cylinder design specifications or a change of gas service or toxic gases that are non-corrosive.

NOTE 3 The re-test periods are also applicable to medical gas cylinders, and to pressure receptacles used in fixed fire installations.

NOTE 4 The frequencies given in this table apply to pressure receptacles used in back-up or buffer service in process systems.

NOTE 5 The frequencies given in this table indicates the maximum time interval between inspection, and supersedes any more lenient intervals in referenced standards

NOTE 6 The "Example of pressure receptacles by gas type" is for the final use Pressure receptacle.

NOTE 7 Maritime use cylinders should be inspected and filled in terms of the requirements of IMO, by an approved relevant national authority (see foreword) facility approved for the specific services – Proof of final owner/vessel to be retained by the facility.

NOTE 8 Where "Internal Inspection" is referenced in this table, it has the meaning of internal and external inspection with reference to the rejection limits as specified by the relevant inspections standards as referenced in SANS 1825.

NOTE 9 Where "Test" is referenced in this table it has the meaning of a hydrostatic pressure test (or approved alternative method) with reference to the relevant standards as referenced in SANS 1825.

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Annex G
(normative)

SCUBA and SCBA cylinder requirements

G.1 Powder coating

Powder coating of SCUBA and SCBA cylinders shall comply with the requirements of 4.4 of this standard, where applicable.

G.2 Change of pressure receptacle service

Where the service of a cylinder to be used for SCUBA or SCBA purposes, or removed from SCUBA/SCBA use, a cylinder that is equipped with a foot ring shall comply with the requirements of 4.7 of this standard and shall not be used for SCUBA service, as per 4.7.3.

G.3 Pressure receptacles general requirements

SCUBA and SCBA cylinders shall comply with the requirements of 4.8.1 to 4.8.4 (inclusive).

G.4 Approval of non-listed standards

SCUBA and SCBA cylinders shall comply with the requirements of 4.9.

G.5 Valves

G.5.1 General

SCUBA and SCBA cylinders shall comply with the requirements of 5.1.1.

G.5.2 Valve outlet connections

For outlet connections on SCUBA and SCBA cylinders for working pressures up to and including 30 MPA, see table G.1.

Table G.1 — Valve outlet connections for SCUBA and SCBA cylinders

1	2	3
Gas	**Outlet connection**	**Thread type**
Breathing air	K-valve with A-clamp (yoke connection) in accordance with CGA 850, limited to 23,2 MPa	N/A
	No. 13 in accordance with DIN 477-1 for up to 20 MPa applications	G5/8 five threads
	No. 3 in accordance with BS 341-1 for 25 MPa applications	G5/8 five threads
	No. 56 in accordance with DIN 477-5 for 30 MPa applications	G5/8 seven threads
Oxygen-enriched air (Nitrox) & Mixtures where Helium is used (Trimix, HELIOX)	In accordance with EN 144-3 for 23,2 MPa and 30 MPa applications	M26 × 2
	K-valve with A-clamp (yoke connection) in accordance with CGA 850, limited to 23,2 MPa	N/A
	No. 13 in accordance with DIN 477-1 for up to 20 MPa applications	G5/8 five threads
	No. 3 in accordance with BS 341-1 for 25 MPa applications	G5/8 five threads
	No. 56 in accordance with DIN 477-5 for 30 MPa applications	G5/8 seven threads
NOTE CGA valve numbers are in accordance with CGA V-1.		

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G.5.3 Valve stem and pressure receptacle neck thread connections

G.5.3.1 SCUBA and SCBA cylinders shall comply with the requirements of 5.4.1.

G.5.3.2 For the preferred connections on SCUBA and SCBA cylinders, see table G.2.

Table G.2 — Neck threads for cylinders

1	2	3
No.	**Cylinder types**	**Threads**
7	SCUBA and SCBA cylinders	M 25 × 2 parallel thread in conjunction with an effective O-ring seal
		M 18 × 1.5 parallel thread in conjunction with an effective O-ring seal
		¾" National pipe standard (NPS) parallel thread in conjunction with an effective O-ring seal
		7/8" unified national fine (UNF) parallel thread in conjunction with an effective O-ring seal
		17 E in accordance with ISO 11363-1
NOTE: NGT = National gas taper NPS = National pipe standard UNF = Unified national fine UN = Unified.		

G.5.4 Protection of valves

Caps and shrouds are not required on cylinders for SCUBA and SCBA with a water capacity up to and including 20 l.

G.5.5 Fitting of valves to pressure receptacles

SCUBA and SCBA cylinders shall comply with the requirements of 5.6. In the absence of manufacturer torque specifications, the following requirements of ISO 13341 should be followed:

Valving torques for seamless steel cylinders and composite cylinders with steel boss

Taper threads according to ISO 11363-1

1	2	3
	Torque Nm	
Taper valve stem size	**Minimum**[a]	**Maximum**[a]
17E	120	150
NOTE Users should be aware that use of high torque levels gives the possibility of valve stem thread deformation		
[a] All values shall be reduced to 2/3 of the values in this table for stainless steel valves.		

Parallel threads according to ISO 15245-1

1	2	3
	Torque Nm	
Parallel valve stem size	**Minimum**	**Maximum**
M18	100	130
M25	100	130

Valving torques for aluminium alloy cylinders and composite cylinders with aluminium alloy boss

Taper threads according to ISO 11363-1

1	2	3
	Torque Nm	
Taper valve stem size	**Minimum**	**Maximum** **Without cylinder neck reinforcement**
17E	75	95
25E	95	110

Parallel threads according to ISO 15245-1

1	2	2
	Torque Nm	
Parallel valve stem size	**Minimum**	**Maximum**
M18	85	100
M25	95	130

G.5.6 Inspection and maintenance of valves

G.5.6.1 SCUBA and SCBA cylinders shall comply with the requirements of 5.7.1 and 5.7.2

G.5.6.2 Valves used in SCUBA and SCBA, should be externally inspected for defects, including the following requirements of ISO 22434 at the time of filling if the valve remains in the cylinder:

a) the spindle does not move smoothly or is difficult to turn;

b) bent, deformed, corroded, badly marked and scored bodies or those with cracks;

c) bent or damaged spindles;

d) cross-threaded, damaged, worn, corroded or stripped valve outlet and filling connections;

e) damaged, corroded or worn outlet sealing surfaces or any non-metallic sealing element (or both);

f) any indication of having been subjected to excessive heat or having been in a fire;

g) foreign matter obstructing or blocking ports;

h) distorted wrenching flats on key operated valves;

i) evidence of abuse or tampering;

j) evidence of damaged gauges;

k) damage to handwheels;

l) missing or damaged residual pressure valve unit;

m) incorrect rating of pressure relief device;

n) inappropriate valve for the gas service;

o) contamination or suspected improper lubrication or sealant at the valve to cylinder interface; and

p) loose gland nuts.

G.5.7 Valve lubricants

SCUBA and SCBA cylinders shall comply with the requirements of 5.8.

G.6 Pressure relief devices

SCUBA and SCBA cylinders shall comply with the requirements of 6.1.2, 6.2.3.1, and 6.3.3.

G.7 Revalidation of pressure receptacles

G.7.1 SCUBA and SCBA cylinders shall comply with the requirements from 7.1 to 7.6 (inclusive).

G.7.2 The frequency of inspection and hydrostatic testing shall be in accordance with table G.3.

G.7.3 Test stations shall ensure that cylinders are of the correct colour for the final intended use, as indicated by the owner, in accordance with table G.3.

G.7.4 For cylinders used in the maritime industry, the vessel/agent shall provide the vessel name and the flag state requirements relating to the intervals for periodic inspection as stipulated and the specific colour coding requirements, if different to the requirements as stipulated in tables G.3 and G.4 respectively.

Table G.3 — Intervals for periodic inspection and testing of pressure receptacles used for breathing gasses in the SCUBA and SCBA industry

1	2	3
Description of gas type	**Example of pressure receptacles by gas type**	**Frequency of pressure receptacle inspection and testing**[a] years
Compressed gases	Self-Contained Breathing Apparatus air	2 year internal, 4 year hydrostatic test
	Gases for Self-Contained Underwater Breathing Apparatus	2 year internal, 4 year hydrostatic test
	Oxygen and breathing air This includes cylinders used in conjunction with a breathing air compressor and Gas system	10
Composite cylinders	All gases	See SANS 11623 – Where Inspection Intervals are greater than above listed, Frequency in table G.3, shall take precedence.

[a] Local regulations shall specify the interval of periodic inspections and tests.

NOTE 1 These test periods should be used provided the dryness of the product and the filled cylinder is such that there is no free water. This condition should be proven and documented within the quality system of the filler. If these conditions cannot be fulfilled, alternative or more frequent testing may be appropriate.

NOTE 2 At all times, certain requirements may necessitate a shorter time interval, for example the dew point of the gas, polymerization reactions and decomposition reactions, cylinder design specifications or a change of gas service or toxic gases that are non-corrosive.

NOTE 3 The re-test periods are also applicable to medical gas cylinders, and to pressure receptacles used in fixed fire installations.

NOTE 4 The frequencies given in this table apply to pressure receptacles used in back-up or buffer service in process systems.

NOTE 5 The frequencies given in this table indicates the maximum time interval between inspections, and supersedes any more lenient intervals in referenced standards.

NOTE 6 The "example of pressure receptacles by gas type" is for the final use pressure receptacle.

NOTE 7 Maritime use cylinders should be inspected and filled in terms of the requirements of IMO, by an approved relevant national authority (see foreword) facility approved for the specific services – Proof of final owner/vessel to be retained by the facility.

NOTE 8 Where "Internal Inspection" is referenced in this table it has the meaning of internal and external inspection with reference to the rejection limits as specified by the relevant inspections standards as referenced in SANS 1825.

NOTE 9 Where "Hydrostatic Test" is referenced in this table it has the meaning of a pressure test (or approved alternative method) incorporating an internal and external inspection with reference to the rejection limits as specified by the relevant inspections standards as referenced in SANS 1825.

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G.8 Repair of pressure receptacles

SCUBA and SCBA cylinders shall comply with the requirements of 7.7.5 and 7.7.6.

G.9 Marking, labelling, colour coding and certificates

G.9.1 Permanent marking

SCUBA and SCBA cylinders shall comply with the requirements of 8.1.1, 8.1.2, 8.1.4, 8.1.5, and 8.1.6.

G.9.2 Identification of permanent marking

SCUBA and SCBA cylinders shall comply with the requirements of 8.2.

G.9.3 Permanent marking following revalidation

G.9.3.1 SCUBA and SCBA cylinders shall preferably be marked by means of hard stamping and in the case of composite construction cylinders, be permanently marked by means other than hard stamping.

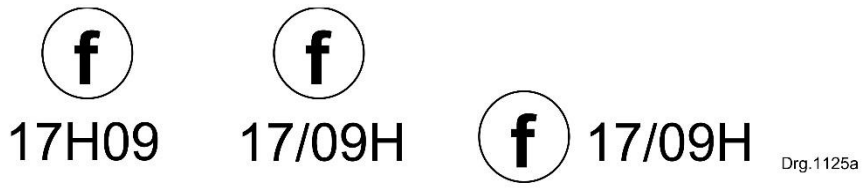
G.9.3.2 Where this marking can cause damage to a protective coating that is integral to the protection of the cylinder, or for operational concerns, the hydrostatic test information may be indicated on a ring placed between the valve and the cylinder which will permanently incorporate the cylinder's serial number, inspection information as given in 8.3.1, and the approved test station's information, permanently indicated on the ring.

G.9.3.3 SCUBA and SCBA cylinders shall comply with the requirements of 8.3.1(a) and 8.3.1(b).

G.9.3.4 For SCUBA and SCBA cylinders, the stamp marking layout can be altered to suite the size of the cylinder. The given order shall be maintained, however the requirement to align the markings in a straight line is relaxed.

G.9.3.5 The stamp markings for SCUBA/SCBA cylinders shall be in the format of year first then the month, but the two can be separated by the letter "H", denoting a Hydrostatic Test was performed.

NOTE Examples of Markings:



G.9.3.6 There is no specific requirement to have the visual inspection test date hard stamped, on any SCUBA/SCBA cylinder. The test station however shall ensure that other than a certificate issued, there is a clear indication affixed to the cylinder, indicating the test facility's date of the last inspection.

G.9.3.7 Where the inspection ring is missing or the last inspection date on the cylinder is not legible, it shall be deemed not to be within the statutory inspection intervals and be required to be submitted for hydrostatic testing at an approved cylinder testing station.

G.9.4 Maintenance of permanent marking

SCUBA and SCBA cylinders shall comply with the requirements of 8.4.

G.9.5 Colour coding

G.9.5.1 Colour identification of pressure receptacles

SCUBA and SCBA cylinders shall comply with the requirements of 8.5.1.7.

G.9.5.2 Cylinders for medical gases

SCUBA and SCBA cylinders shall comply with the requirements of 8.5.4.

G.9.5.3 Cylinders for SCUBA and SCBA use

G.9.5.3.1 Cylinders for SCUBA and SCBA use shall be colour-marked with the appropriate colour given in table G.4. **Amdt 1**

Table G.4 — Schedule of SCUBA and SCBA cylinder colour coding and labels

1	2	3	4	5	6
Description	**Gas type**				
	Air	Pure oxygen	Nitrox (breathing gas with potentially Oxygen concentrations other than normal air)	Trimix (breathing gas with potentially Oxygen and Helium concentrations other than normal air)	Breathing gas Part of compressed gas system (storage bank)
Body colour	Canary yellow 0570-Y	Black S 9000-N	Canary yellow 0570-Y	Canary yellow 0570-Y	Navy Light Grey 3005-B20G
Shoulder colour	Navy Light Grey 3005-B20G	White S 0500-N	Navy Light Grey 3005-B20G	Navy Light Grey 3005-B20G	Black and White Quadrants
Adhesive band colour	N/A	N/A	Clear[a]	Clear[a]	Clear[a]
Adhesive band size[b]	N/A	N/A	80 mm	80 mm	80 mm
Lettering	N/A	N/A	NITROX 40 mm	TRIMIX 40 mm	Relevant to content if Oxygen or Helium Mixtures
Lettering colour	N/A	N/A	Deep green S3555-B80G	Golden Brown 4550-Y30R	Relevant to content if Oxygen or Helium Mixtures
Shoulder colour - Alternative	Black and White Quadrants		Black and White Quadrants	Black and White Quadrants	
Contents label (as specified)	N/A	N/A	Mandatory	Mandatory	

[a] The adhesive band is normally clear and the colour of the cylinder body should show through with the words of the type of gas in the correct letter colouring.

[b] See figures G.1 and G.2 for examples.

NOTE Due to exposure to elements these colours do not need to be exact. It should be clear and distinguishable as a minimum

Amdt 1

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Figure G.1 — Content label for Nitrox

Figure G.2 — Content label for Trimix

NOTE Background colour reference should be clear.

G.9.5.3.2 For the purposes of nitrox and trimix a 80 mm wide self-adhesive band should be applied to the cylinder just below the shoulder, indicating the specific breathing gas mixture. For Enriched oxygen mixtures the NITROX Lettering shall be in green, and for any mixtures containing Helium the wording TRIMIX shall be in brown. In both instances the backing shall be clear, to allow the condition of the cylinder to be inspected at a time of filling.

G.9.5.3.3 When filling cylinders with the markings of NITROX or TRIMIX, the filling station shall ensure that the cylinders are marked in a visible manner, with the following information:

a) For NITROX – oxygen content in % VOL; and

b) For TRIMIX (gas mixes containing helium) – helium and oxygen content in % VOL.

NOTE It is the responsibility of the end user prior to using a cylinder that has a label indicating NITROX or TRIMIX, to analyse the supplied mixture and determine suitability for a diving profile.

G.9.6 Labelling

G.9.6.1 Precautionary labels

G.9.6.1.1 General

SCUBA and SCBA cylinders shall comply with the requirements of 8.6.1.

G.9.6.1.2 Breathing gas

G.9.6.1.2.1 Components of breathing gas mixtures other than air, shall be listed on a 80 mm wide self-adhesive band fixed adjacent to the shoulder (see table G.4).

G.9.6.1.2.2 These adhesive bands shall be for the gas predominantly used in the cylinder, and indicate that there could be traces of Helium, or by the fillers labelling, that oxygen enriched gas is still present in the cylinder.

G.9.6.1.2.3 The end user shall ensure that the cylinder is sufficiently analysed prior to use and that the decision shall remain with the user to determine suitability for the use/profile.

G.9.6.2 Other labelling

SCUBA and SCBA cylinders shall comply with the requirements of 8.6.4.

G.9.7 Certificates

SCUBA and SCBA cylinders shall comply with the requirements of 8.7.1 and 8.7.2.1.

G.10 Filling of pressure receptacles

G.10.1 General

SCUBA and SCBA cylinders shall comply with the requirements of 9.1.1, 9.1.2, 9.1.4, and 9.1.5, and the requirements of tables 14 and 18. **Amdt 1**

G.10.2 Persons competent to fill pressure receptacles

G.10.2.1 No person shall fill a pressure receptacle with breathing gas for use in the SCUBA and SCBA industry unless such person is deemed competent to fill pressure receptacles with the gases being handled and is conversant with the relevant requirements of this standard.

G.10.2.2 The filling station shall determine and document the necessary criteria for performing the task under its control, and on a regular pre-determined basis and method, evaluate the effectiveness of these criteria and the individuals performing the filling, through monitoring, mentoring, observations, continuation training, or feedback from clients.

G.10.2.3 Part of the competence criteria should include independently verified or developed training which shall include as a minimum the following topics:

a) knowledge of applicable sections of this standard;

b) duties and responsibilities of the person filling receptacles in relation to the relevant national legislation (see foreword);

c) inspection of cylinder, valve and associated equipment, including acceptance and rejection criteria for filling;

d) safe use of filling equipment, e.g. high-pressure compressor, booster pump, connection devices, hoses, panels;

e) setting up of filling equipment (location, environment, ventilation, environmental contaminants);

f) air quality and filtering systems;

g) gases and their special precautions;

h) working knowledge of flow, volume, pressure, and working with pressurised equipment;

i) basic maintenance of filling equipment;

j) record keeping;

k) work place hazard identification;

l) written exam; and

m) practical evaluation.

G.10.2.4 This verified or developed training should be performed by a SCUBA or SCBA industry recognised organisation, which shall have a documented curriculum covering the above topics for the specific type of filling being performed.

NOTE Competence is based on each facility's written criteria for the position, which should be based on each facility's unique criteria evaluation and should include industry best practices, specific circumstances at the facility, gases, and equipment handled at the facility. Competence is specific to the filling installation where assessment took place, although certain skills are transferable, and the shortfalls should be addressed through activities such as, but not limited to, mentoring by a competent person, assessment, in-house training, etc.

G.11 Filling of SCUBA and SCBA cylinders

G.11.1 General

Amdt 1

G.11.1.1 The requirements in 9.1 shall apply to the filling of SCUBA and SCBA pressure receptacles. **Amdt 1**

NOTE SCUBA cylinders for professional and civil service use is covered in the relevant national legislation (see foreword).

G.11.1.2 In addition to the requirements on the filling of pressure receptacles in 9.1 to 9.1.5.2 (inclusive) and in tables 14 and 18, the following records shall be kept by the filling station, as a minimum for SCUBA and SCBA cylinders: **Amdt 1**

a) the date of filling;

b) the contact details of the owner;

c) the serial number of the cylinder;

d) the service type of the cylinder;

e) the type of gas filled into the cylinder;

f) the charging pressure;

g) the indication that pre-filling external inspection was performed in accordance to relevant standards, including that the cylinder is in date for specific service; and

h) the name and signature of the person filling the cylinder.

G.11.2 Additional checks before filling

G.11.2.1 In addition to carrying out inspections in accordance with 9.1.4, the filling station operator shall ensure that no cylinder equipped with a foot ring is used for underwater service, and that the cylinder is not due for a periodic inspection or testing (or both). Where the cylinder has a detachable boot, the filler shall remove the boot and inspect the bottom of the cylinder for signs of external corrosion.

G.11.2.2 Where the cylinder is part of a manifolded configuration and there is indication or concern of hidden or obscured corrosion or damage, the filling station operator shall document and remove all banding and fittings for thorough inspection. If the external condition indicates signs of corrosion or damage in line with the pre-fill rejection criteria indicated in table 15, during the pre-fill inspection, the filling station operator shall reject the cylinder for filling until the owner has submitted the cylinder to an approved test station for inspection.

G.11.3 Cleaning of Nitrox and Trimix cylinders for exposure to oxygen concentrations greater than 25 %/Vol

G.11.3.1 Before its first fill with nitrox and trimix gases, where the oxygen concentration during any part of the filling process is greater than 25 %, the cylinder shall be oxygen cleaned in accordance with EIGA IGC Doc. 33/06.

G.11.3.2 The cleaning of the cylinder and valve (if as a unit) should be performed as part of each hydrostatic pressure test. This should also be performed when any other medium was introduced, for the purposes of cleaning, testing, where contamination is suspected, or when a cylinder cleaned for oxygen compatibility was filled with non-oxygen compatible air.

G.11.4 Air quality

G.11.4.1 Breathing gas filling stations/facilities for SCUBA and SCBA cylinders shall ensure that these cylinders are filled with compressed air or breathing gas mixtures that comply with the acceptable limits.

G.11.4.2 The requirements of SANS 277 as indicated in table G.5 below for specific breathing gas fillings, shall be met.

G.11.4.3 Breathing gases used in the SCUBA and SCBA industry, other than air or oxygen compatible air, shall take in to consideration the applicable breathing gas quality requirements in SANS 277.

G.11.4.4 Breathing gas testing should be performed at intervals taking into consideration the filtration system capacity and the Original Equipment Manufacturer (OEM) recommended change out, the type of system, operating temperatures, operating environment, and the replacement filtration parts (OEM vs generic vs user refurbished).

Table G.5 — Air quality requirements included on SANS 277

1	2
Contamination	**Accepted limits**
H_2O	≤ 50 mg m^{-3} for cylinders with a charging pressure up to 20 MPa
	≤ 35 mg m^{-3} for cylinders with a charging pressure greater than 20 MPa
	The water content of the air supplied by the compressor for filling 20 MPa or 30 MPa cylinders should not exceed 25 mg/m^{-3}.
Oil	< 0,5 mg m^{-3} (non-enriched, breathing air)
	< 0,1 mg m^{-3} [a] (oxygen-enriched breathing gas)
Particles[b]	< 0,5 mg m^{-3} Particles ≤ 5 microns
CO_2	A volume fraction of < 500 µg/g [≤ 500 ml m^{-3} (ppm)]
CO	A volume fraction of ≤ 5 µg/g [≤ 5 ml m^{-3} (ppm)]
Odour	The gas shall be free from unsatisfactory odour or taste
Notes:	Any appropriate analytical method should be employed as far as reasonably practicable for determining compliance with the limits For measuring and assessing results the accuracy of the method shall be taken into consideration. The following examples, but not limited to list below, of methods for assessing are: a) Hydrometer b) Dew-Point Meter c) Detector Tubes d) Gravimetric Analysis e) Microscopy f) Infrared Analyser g) Electrochemical Analyser h) Any advanced analytical instrument incorporating, for example PID (photoionization detector), MS-M-FID (mass spectrometry methaniser flame ionization detector), GC-MS (gas chromatography mass spectroscopy), paramagnetic sensor. i) Human Smell Sense j) Olfactometer The detection limit of the method employed shall be below the required limit value

[a] When a requirement for oxygen compatible air with a potential exposure to oxygen content >25 %/vol exists, or the filling of cylinders that is labelled for NITROX, TRIMIX, or OXYGEN CLEANED, the oil limit shall be < 0,1 mg/m³.

[b] Particles should be removed through inline mechanical filtration capable of achieving required results.

NOTE Where breathing gas is provided on a commercial basis evidence should be available where the tests on the system was performed at least twice in a 12 month period.

G.12 Handling, storage, transport and use

G.12.1 Handling

SCUBA and SCBA cylinders shall comply with the requirements of 10.1.

G.12.2 Stacking

SCUBA and SCBA cylinders shall comply with the requirements of 10.2.1.

G.12.3 Storage

SCUBA and SCBA cylinders shall comply with the requirements of 10.3.

G.12.4 Transport

SCUBA and SCBA cylinders shall comply with the requirements of 10.4.

G.12.5 Use of pressure receptacles

SCUBA and SCBA cylinders shall comply with the requirements of 10.5.

G.13 General safety precautions

G.13.1 Pressure receptacles exposed to fires

SCUBA and SCBA cylinders shall comply with the requirements of 11.1.

G.13.2 Position and support of pressure receptacles in use

SCUBA and SCBA cylinders shall comply with the requirements of 11.2.

G.13.3 Reporting of incidents

SCUBA and SCBA cylinders shall comply with the requirements of 11.3.

G.13.4 Handling of pressure receptacle emergencies

SCUBA and SCBA cylinders shall comply with the requirements of 11.4.

Annex H
(normative)

Placement of cylinders

Pictograms for the placement of LPG cylinders not exceeding 20 L water capacity are given in figures H.1 and H.2 (see 8.6.3).

Figure H.1 — Correct and incorrect placement of cylinders

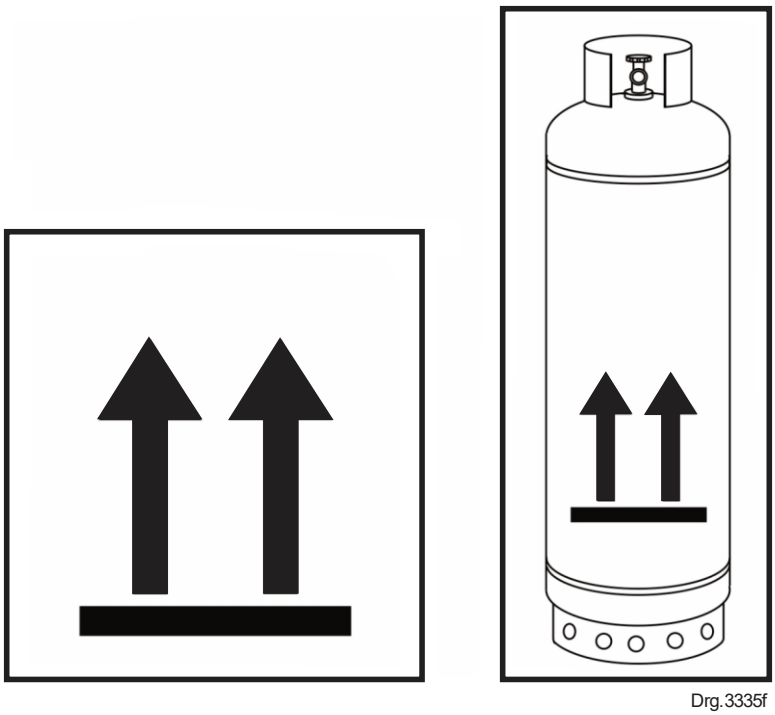

Figure H.2 — Directional arrows on cylinders

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DOT 3AL, *Seamless aluminium cylinders up to 1 000 lbs water volume and minimum service pressure 150 psi*.

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DOT 3AAX, *Seamless steel cylinders made of definitely prescribed steel of capacity over 1 000 lbs water volume. Service pressure 500 psi minimum*.

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DOT 3T, *Seamless steel cylinder with minimum water capacity 1 000 pounds and minimum service pressure 1 800 psi*.

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DOT 4B, *Welded steel cylinders made from low carbon steel up to 1 000 lbs water volume. Service pressure between 150 and 500 psi*.

DOT 4DS, *Welded stainless steel cylinders for aircraft use up to 1 000 lbs water volume. Service pressure between 500 and 900 psi*.

DOT 4E, *Welded aluminium cylinders made of definitely prescribed aluminium up to 1 000 lbs water volume. Service pressure between 225 and 500 psi*.

DOT 4BA, *Welded steel cylinders made of definitely prescribed steels up to 1 000 lbs water volume. Service pressure between 225 and 500 psi*.

DOT 4BW, *Welded steel cylinders made of definitely prescribed steels with electric-arc welded longitudinal seam. Service pressure between 225 and 500 psi.*

DOT 4L, *Welded insulated cylinders with a water capacity not over 1 000 pounds and a service pressure of at least 40 but not greater than 500 psi*.

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