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Gas cylinders — Conditions for filling gas cylinders

Bouteilles à gaz — Conditions de remplissage des bouteilles à gaz



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11622 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

Gas cylinders — Conditions for filling gas cylinders

1 Scope

This International Standard specifies the general requirements (charging pressure, filling ratio, etc.) for filling single gas cylinders and manifolded gas cylinders (bundles) with single component gases.

This International Standard excludes the specific requirements for filling cryogenic gas and liquefied petroleum gas (LPG) commercial-grade cylinders.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6406, *Gas cylinders — Seamless steel gas cylinders — Periodic inspection and testing*

ISO 10460, *Gas cylinders — Welded carbon-steel gas cylinders — Periodic inspection and testing*

ISO 10461, *Gas cylinders — Seamless aluminium-alloy gas cylinders — Periodic inspection and testing*

ISO 10462, *Gas cylinders — Transportable cylinders for dissolved acetylene — Periodic inspection and maintenance*

ISO 10691, *Gas cylinders — Refillable welded steel cylinders for liquefied petroleum gas (LPG) — Procedures for checking before, during and after filling*

ISO 11755, *Gas cylinders — Cylinder bundles for compressed and liquefied gases (excluding acetylene) — Inspection at time of filling*

ISO 24431, *Gas cylinders — Cylinders for compressed and liquefied gases (excluding acetylene) — Inspection at time of filling*¹⁾

1) To be published.

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1

gas

any substance that is completely gaseous at 1,013 bar ²⁾ and 20 °C or has a vapour pressure exceeding 3 bar at 50 °C

NOTE 1 Hydrogen fluoride and hydrogen cyanide are handled as low-pressure liquefied gases in this International Standard and listed in Table 5 together with other liquids that may be used to fill gas cylinders.

NOTE 2 All pressures are given in bar gauge unless otherwise stated (1 bar = 10⁵ N/m² = 100 kPa).

3.2

single component gas

gas (3.1) that is technically pure in the gas cylinder

NOTE A single component gas dissolved under pressure falls within this category.

3.3

gas cylinder

transportable pressure receptacle of a water capacity not exceeding 150 l

3.4

bundle

assembly of cylinders that are fastened together and are interconnected by a manifold and transported as a unit with a total water capacity not exceeding 3 000 l, except for bundles intended for the transport of Division 2.3 (as defined in the *United Nations Recommendations on the Transport of Dangerous Goods — Model Regulations*), which are limited to 1 000 l water capacity

3.5

compressed gas

gas which when packaged 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.

3.6

high-pressure liquefied gas

gas which when packaged under pressure for transport is partially liquid at temperatures above –50 °C and has a critical temperature between –50 °C and +65 °C

3.7

low-pressure liquefied gas

gas which when packaged under pressure for transport is partially liquid at temperatures above –50 °C and has a critical temperature above +65 °C

3.8

dissolved gas

gas which when packaged under pressure for transport is dissolved in a liquid-phase solvent

3.9

critical temperature

temperature above which a substance cannot exist in the liquid state

2) 1 bar = 10⁵ Pa = 100 kPa = 0,1 MPa = 10⁵ N/m².

3.10**filling ratio**

ratio of the mass of gas to the mass of water at 15 °C that would fill completely a pressure receptacle fitted ready for use

NOTE Related terms are filling factor and filling degree, often expressed in kg/l or similar.

3.11**filling-ratio reference temperature**

temperature at which the liquid density is to be evaluated for calculating the filling ratio

NOTE See 4.3 and 4.4.

3.12**developed pressure**

pressure achieved by the contents of a gas cylinder filled according to this International Standard when raised to a specified reference temperature

3.13**developed pressure at $T_{\max}$**

pressure developed by the gas contents in a cylinder at a uniform temperature of $T_{\max}$

NOTE $T_{\max}$ is the expected maximum uniform temperature in normal service as specified in international or national cylinder filling regulations.

3.14**settled pressure**

pressure of the contents of the cylinder at 15 °C (p_{15})

3.15**test pressure**

required pressure applied during a pressure test

3.16**pressure relief device**

device that is fitted to the cylinder or cylinder valve and designed to relieve gas pressure in the event of abnormal conditions resulting in the development of excessive pressure inside the cylinder or when the cylinder is subjected to high temperatures

3.17**compatibility**

interaction of gas and cylinder/cylinder equipment that comes in contact with gas under the conditions of use, implying a satisfactory gas/cylinder/cylinder equipment combination

3.18**tare weight**

mass of the cylinder and other fittings not removed during the cylinder filling operation, such as valve, dip tube and any permanently or semi permanently fixed valve protection device

4 Principles and requirements for filling gas cylinders**4.1 General requirements (all gases and gas cylinders)**

4.1.1 The gas to be used for filling shall be compatible with the cylinder, the cylinder valve and any other fittings that may be in contact with the gas (see ISO 11114-1 and ISO 11114-2).

4.1.2 When presented for filling, the cylinder shall be within the specified period for periodic inspection and test in accordance with ISO 6406, ISO 10460, ISO 10461 and ISO 10462.

4.1.3 The cylinder and cylinder valve shall be in serviceable condition in accordance with ISO 10691, ISO 11755 and ISO 24431.

4.1.4 The cylinder shall be equipped with a suitable valve with the appropriate valve outlet.

4.1.5 The cylinder shall be correctly identified for the intended gas.

4.1.6 Filling ratios specified in this International Standard are maximum values. Hence, the filling mass charged into the cylinder shall take account of the accuracy of the filling procedure and weighing equipment.

4.1.7 The pressure relief device shall be suitably designed to a setting relative to the cylinder's test pressure. It shall operate between -10 % and +0 % of the cylinder test pressure.

4.1.8 If required before filling, the identity of the cylinder's owner shall be established, and his authorization shall be obtained to fill the cylinder.

4.2 Compressed gases

The maximum settled pressure shall be the lower of the following values:

- a) two-thirds of the test pressure;
- b) a pressure that does not exceed the cylinder test pressure when the cylinder content is raised to the reference temperature of 65 °C;
- c) the pressure given in Table 1.

4.3 Low-pressure liquefied gases

The developed pressure at 65 °C shall not exceed the cylinder test pressure.

At a filling ratio reference temperature of 50 °C, there shall be a vapour space of at least 5 % of the total cylinder water capacity, and the cylinder shall not be hydraulically full at any temperature up to 60 °C.

Data for low-pressure liquefied gases are given in Table 2. The tare weight of the cylinder shall be identified in accordance with ISO 13769. For pure gases where the filling data are not provided in Table 2, the following determination is required:

$$k_f = (0,0032 \times T_b - 0,24) \times \rho_l$$

where

k_f is the maximum filling ratio

T_b is the boiling point (in Kelvin)

ρ_l is the density of liquid at boiling point (in kg/l)

4.4 High-pressure liquefied gases

4.4.1 The chosen filling ratio shall be such that the developed pressure at a reference temperature of 65 °C does not exceed the corresponding cylinder test pressure.