
Gas cylinders — Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) — Design, construction, testing, use and periodic inspection

Bouteilles à gaz — Bouteilles en acier soudées rechargeables contenant des matériaux pour le stockage des gaz à une pression sub-atmosphérique (à l'exclusion de l'acétylène) — Conception, fabrication, essais, utilisation et contrôle périodique

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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 11513 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 3, *Cylinder design*.

Introduction

This International Standard provides a specification for the design, manufacture, use and periodic inspection and testing of a welded steel cylinder necessary to facilitate sub-atmospheric pressure gas packaging technology on a worldwide basis. The specifications given are based on knowledge of, and experience with, materials, design requirements, manufacturing processes and control at manufacture of cylinders in common use in the countries of the ISO member bodies. With respect to those aspects concerning construction materials, approval of design rules and inspection during manufacture which are subject to national or international regulations, it is necessary for interested parties to ensure that, in the practical application of this International Standard, the requirements of the relevant authority are also satisfied.

The pressure shell of the cylinder is fabricated by manufacturing a cylindrical shape with a base and welding a machined plug (boss) or semi-ellipsoidal or torispherical shape onto the open end of the shell to form the cylinder. This method of fabrication allows for insertion of material prior to sealing the cylinder.

A further objective of this International Standard is to balance design and economic efficiency against international acceptance and universal utility. It aims to eliminate the concerns about climate, duplicate inspections and restrictions currently existing because of lack of definitive International Standards. It should not be construed as reflecting on the suitability of the practices of any nation or region.

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WARNING — This International Standard requires the use of substances and procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage. It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

1 Scope

This International Standard specifies minimum requirements for the material, design, construction, workmanship, examination and testing at manufacture of refillable welded steel cylinders for the sub-atmospheric pressure storage of liquefied and compressed gases. It only applies to the cylinders themselves, irrespective of the materials contained therein (e.g. adsorbents, media, materials and/or gases) and other related applications. The cylinders have a test pressure not greater than 42 bar and a water capacity from 0,5 l up to and including 12 l exposed to ambient temperatures for the purpose of facilitating the sub-atmospheric pressure storage of liquefied and compressed gases. Inspection at the time of fill is specified in Annex A and periodic inspection and testing is specified in Annex B.

High-pressure and low-pressure liquefied gases as specified in Annex C can be suitably filled into these cylinders. The filling pressure will be less than one bar gauge at 21 °C.

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 2504:1973, *Radiography of welds and viewing conditions for films — Utilization of the recommended patterns of image quality indications (I.Q.I.)*

ISO 4978, *Flat rolled steel products for welded gas cylinders*

ISO 6892-1:2009, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7438, *Metallic materials — Bend test*

ISO 9809-3:2010, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 3: Normalised steel cylinders*

ISO 11117, *Gas cylinders — Valve protection caps and valve guards — Design, construction and tests*

ISO 13769, *Gas cylinders — Stamp marking*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints*

ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

UN Recommendations on the Transport of Dangerous Goods — Model Regulations, sixteenth edition, Packaging Note P200

3 Terms, definitions and symbols

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

3.1 Terms and definitions

3.1.1

yield strength

value corresponding to the lower yield strength, R_{eL} , or $0,92 \times$ the upper yield strength, R_{eH} , or for steels that do not exhibit a defined yield, the 0,2 % proof strength, $R_{p0,2}$

3.1.2

stress relieving

heat treatment given to the drawn pressure shell by heating to a uniform temperature below the lower critical point, AC_1 , of the steel and cooling in a still atmosphere

NOTE The object is to reduce the residual stresses without altering the metallurgical structure of the steel.

3.1.3

batch

quantity of finished cylinders made consecutively during the same or consecutive days to the same design, size and material specifications and cast for each pressure-containing part on the same equipment and subjected to the same heat-treatment conditions

NOTE Different suppliers can be used for the different pressure-containing parts within a batch, e.g. one supplier for shells, another for plugs.

3.1.4

design stress factor

F
ratio of equivalent wall stress at test pressure, p_h , to guaranteed minimum yield strength, R_{eg}

3.1.5

sub-atmospheric gas packaging

gas source package that stores and delivers gas at sub-atmospheric pressure, which includes a container (e.g. gas cylinder and outlet valve) that stores and delivers gas at a pressure of less than 1 bar at normal conditions of temperature and pressure

NOTE The container can incorporate a medium in order to reduce the pressure of the gas to sub-atmospheric levels.

3.2 Symbols

- a Calculated minimum thickness, in millimetres, of the cylindrical shell
- a' Guaranteed minimum thickness, in millimetres, of the cylindrical shell (including any corrosion allowance, see 8.1)
- a_1 Guaranteed minimum thickness, in millimeters, of a concave base at the knuckle. See Figure 1 a).
- a_2 Guaranteed minimum thickness, in millimetres, at the centre of a concave base. See Figure 1 a).
- b Calculated minimum thickness, in millimetres, of the cylinder end
- A Percentage elongation after fracture
- D Outside diameter of the cylinder, in millimetres