SLOVENSKI STANDARD
SIST EN ISO 9809-2:2019

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SIST EN ISO 9809-2:2010

Plinske jeklenke - Konstruiranje, izdelava in preskušanje ponovno polnljivih plinskih jeklenk in velikih jeklenk iz celega iz jekla - 2. del: Jeklenke in velike jeklenke iz jekel za poboljšanje z natezno trdnostjo, enako ali večjo od 1100 MPa (ISO 9809-2:2019)

Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa (ISO 9809-2:2019)

Gasflaschen - Gestaltung, Konstruktion und Prüfung von wiederbefüllbaren nahtlosen Gasflaschen aus Stahl - Teil 2: Flaschen aus vergütetem Stahl mit einer Zugfestigkeit größer als oder gleich 1 100 MPa (ISO 9809-2:2019)

Bouteilles à gaz - Conception, construction et essais des bouteilles à gaz et des tubes rechargeables en acier sans soudure - Partie 2: Bouteilles et tubes en acier trempé et revenu ayant une résistance à la traction supérieure ou égale à 1 100 MPa (ISO 9809-2:2019)

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Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa (ISO 9809-2:2019)

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Gasflaschen - Auslegung, Herstellung und Prüfung von wiederbefüllbaren nahtlosen Gasflaschen aus Stahl - Teil 2: Flaschen aus vergütetem Stahl mit einer Zugfestigkeit größer als oder gleich 1 100 MPa (ISO 9809-2:2019)

This European Standard was approved by CEN on 25 July 2019.

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European foreword

This document (EN ISO 9809-2:2019) has been prepared by Technical Committee ISO/TC 58 "Gas cylinders" in collaboration with Technical Committee CEN/TC 23 “Transportable gas cylinders” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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

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The text of ISO 9809-2:2019 has been approved by CEN as EN ISO 9809-2:2019 without any modification.

INTERNATIONAL STANDARD

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Gas cylinders — Design, construction and testing of refillable seamless steel gas cylinders and tubes —

Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa

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Partie 2: Bouteilles et tubes en acier trempé et revenu ayant une résistance à la traction supérieure ou égale à 1 100 MPa

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 9809-2:2010), which has been technically revised. The changes compared to the previous edition are as follows:

— water capacity extended from below 0,5 l and up to and including 450 l;

— batch size for tubes now introduced;

— bend test retained only for prototype tests;

— test requirements for check analysis (tolerances modified);

— new test requirements for threads introduced including an informative Annex F;

— original European Annexes now incorporated into the body of this document;

— Annex A "Manufacturing imperfections" now aligned with ISO/TR 16115.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document provides a specification for the design, manufacture, inspection and testing of a seamless steel cylinder and tube. The objective is to balance design and economic efficiency against international acceptance and universal utility.

ISO 9809 (all parts) aims to eliminate existing concern; about climate, duplicate inspections and restrictions because of a lack of definitive International Standards.

This document is intended to be used under a variety of regulatory regimes, and has been written so that it is suitable to be referenced in the UN Model Regulations[11].

Gas cylinders — Design, construction and testing of refillable seamless steel gas cylinders and tubes —

Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa

1 Scope

This document specifies minimum requirements for the material, design, construction and workmanship, manufacturing processes, examination and testing at time of manufacture for refillable seamless steel gas cylinders and tubes with water capacities up to and including 450 l.

it is applicable to cylinders and tubes for compressed, liquefied and dissolved gases and for quenched and tempered steel cylinders and tubes with an actual tensile strength $R_{ma} \geq 1\,100$ MPa.

It is not applicable to cylinders and tubes with $R_{ma,\,max} > 1\,300$ MPa for diameters >140 mm and guaranteed wall thicknesses $a' \geq 12$ mm and for cylinders and tubes with $_{Rma,\,max} > 1\,400$ MPa for diameters ≤140 mm and guaranteed wall thicknesses $a' \geq 6$ mm because, beyond these limits, additional requirements can apply.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

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

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 10286, *Gas cylinders — Terminology*

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

ISO 11114-4, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 4: Test methods for selecting steels resistant to hydrogen embrittlement*

ISO 13341, *Gas cylinders — Fitting of valves to gas cylinders*

ISO 13769, *Gas cylinders — Stamp marking*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10286 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
batch
quantity of up to 200 for cylinders and up to 50 for tubes, plus cylinders/tubes for destructive testing of the same nominal diameter, thickness, length and design made successively on the same equipment, from the same cast of steel and subjected to the same heat treatment for the same duration of time

Note 1 to entry: In this document where not specifically mentioned for "cylinder/tube" only the term "cylinder" will be used.

3.2
burst pressure
p_b
highest pressure reached in a cylinder during a burst test

3.3
design stress factor
F
ratio of equivalent wall stress at test pressure, p_h, to guaranteed minimum yield strength, R_{eg}

3.4
quenching
hardening heat treatment in which a cylinder, which has been heated to a uniform temperature above the upper critical point, Ac_3, of the steel, is cooled rapidly in a suitable medium

3.5
reject
cylinder that has been set aside (Level 2 or Level 3) and not allowed to enter into service

3.6
rendered unserviceable
cylinder that has been treated in such a way as to render it impossible for it to enter into service

Note 1 to entry: Examples for acceptable methods to render cylinders unserviceable can be found in ISO 18119. Any actions on cylinders rendered unserviceable are outside the scope of this document.

3.7
repair
action to return a rejected cylinder to a Level 1 condition

3.8
tempering
toughening heat treatment which follows quenching, in which the cylinder is heated to a uniform temperature below the lower critical point, Ac_1, of the steel

3.9
test pressure
p_h
required pressure applied during a pressure test

Note 1 to entry: Test pressure is used for cylinder wall thickness calculation.

3.10
working pressure
settled pressure of a compressed gas at a uniform reference temperature of 15 °C in a full gas cylinder

3.11
yield strength
stress value corresponding to the upper yield strength, R_{eH}, or for steels which do not exhibit a defined yield, the 0,2 % proof strength (non-proportional extension), $R_{p0,2}$

Note 1 to entry: See ISO 6892-1.

4 Symbols

A	percentage elongation after fracture
a	calculated minimum thickness, in millimetres, of the cylindrical shell
a'	guaranteed minimum thickness, in millimetres, of the cylindrical shell
a_1	guaranteed minimum thickness, in millimetres, of a concave base at the knuckle (see Figure 2)
a_2	guaranteed minimum thickness, in millimetres, at the centre of a concave base (see Figure 2)
b	guaranteed minimum thickness, in millimetres, at the centre of a convex base (see Figure 1)
c	maximum permissible deviation of burst profile, in millimetres (see Figure 13)
d	depth of artificial flaw, in millimetres, in flawed cylinder burst test and flawed cylinder cycle test (see Figure 5)
D	nominal outside diameter of the cylinder, in millimetres (see Figure 1 and Figure 2)
D_c	external diameter, in millimetres, of cutter milling tool for flawed cylinder burst test and flawed cylinder cycle test (see Figure 5)
D_f	diameter, in millimetres, of former (see Figure 6)
F	design stress factor (variable) (see 3.3)
H	outside height, in millimetres, of domed part (convex head or base end) (see Figure 1)
h	outside depth (concave base end), in millimetres (see Figure 2)
l_o	length of artificial flaw, in millimetres, in flawed cylinder burst test and flawed cylinder cycle test (see Figure 5)
L_1	length of cylindrical part of the cylinder, in millimetres (see Figure 3)
L_o	original gauge length, in millimetres, as defined in ISO 6892-1 (see Figure 8)
p_b	measured burst pressure, in bars, above atmospheric pressure
	NOTE 1 bar = 10^5 Pa = 0,1 MPa.
p_f	measured failure pressure, in bars, above atmospheric pressure
p_h	hydraulic test pressure, in bars, above atmospheric pressure
p_y	observed pressure when cylinder starts yielding during hydraulic bursting test, in bars, above atmospheric pressure
r	inside knuckle radius, in millimetres (see Figure 1 and Figure 2)