INTERNATIONAL STANDARD

ISO 9809-3

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Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing —

Part 3: Normalized steel cylinders

Bouteilles à gaz — Bouteilles à gaz rechargeables en acier sans soudure — Conception, construction et essais —

Partie 3: Bouteilles en acier normalisé

Reference number
ISO 9809-3:2000(E)

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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 3.

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 part of ISO 9809 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9809-3 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 3, *Cylinder design*.

This first edition of ISO 9809-3, together with ISO 9809-1 and ISO 9809-2, cancels and replaces ISO 4705:1983.

ISO 9809 consists of the following parts, under the general title *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*

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

— *Part 3: Normalized steel cylinders*

Annex B forms a normative part of this part of ISO 9809. Annexes A, C and D are for information only.

Introduction

The purpose of this part of ISO 9809 is to provide a specification for the design, manufacture, inspection and testing of a seamless steel cylinder for worldwide usage. The objective is to balance design and economic efficiency against international acceptance and universal utility.

This part of ISO 9809 aims to eliminate the concern about climate, duplicate inspections and restrictions currently existing because of lack of definitive International Standards and should not be construed as reflecting on the suitability of the practice of any nation or region.

Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing —

Part 3: Normalized steel cylinders

1 Scope

This part of ISO 9809 specifies minimum requirements for the material, design, construction and workmanship, manufacturing processes and tests at manufacture of refillable normalized, or normalized and tempered seamless steel gas cylinders with water capacities from 0,5 l up to and including 150 l for compressed, liquefied and dissolved gases.

NOTE 1 If so desired, cylinders of water capacity less than 0,5 l may be manufactured and certified to this part of ISO 9809.

NOTE 2 For quenched and tempered cylinders with maximum tensile strength less than 1 100 MPa, refer to ISO 9809-1. For quenched and tempered cylinders with maximum tensile strength ⩾ 1 100 MPa, refer to ISO 9809-2.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9809. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9809 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 148:1983, *Steel — Charpy impact test (V-notch).*

ISO 2604-2:1975, *Steel products for pressure purposes — Quality requirements — Part 2: Wrought seamless tubes.*

ISO 6506-1:1999, *Metallic materials — Brinell hardness test — Part 1: Test method.*

ISO 6508-1:1999, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T).*

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature.*

ISO 7438:1985, *Metallic materials — Bend test.*

ISO 9712:1999, *Non-destructive testing — Qualification and certification of personnel.*

ISO 9809-1:1999, *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 9809-2:2000, *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 11114-1:1997, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials.*

ISO 13769:—[1], *Gas cylinders — Stamp marking.*

3 Terms and definitions

For the purposes of this part of ISO 9809, the following terms and definitions apply.

3.1
yield stress
value corresponding to the lower yield stress R_{eL} or, for steels that do not exhibit a defined yield, the 0,2 % proof stress (non-proportional elongation) $R_{p0,2}$

cf. ISO 6892.

3.2
normalizing
heat treatment in which a cylinder is heated to a uniform temperature above the upper critical point (Ac_3) of the steel and then cooled in still air

3.3
tempering
softening heat treatment which follows normalizing, in which the cylinder is heated to a uniform temperature below the lower critical point (Ac_1) of the steel

3.4
batch
quantity of up to 200 cylinders plus cylinders for destructive testing of the same nominal diameter, thickness and design made successively from the same steel and subjected to the same heat treatment for the same duration of time

NOTE The lengths of the cylinders in a heat-treatment batch may vary by ± 12 %.

3.5
test pressure
p_h
required pressure applied during a pressure test

NOTE It is used for cylinder wall thickness calculations.

3.6
burst pressure
p_b
highest pressure reached in a cylinder during a burst test

3.7
design stress factor (variable)
F
ratio of equivalent wall stress at test pressure (p_h) to guaranteed minimum yield stress (R_e)

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1) To be published.

4 Symbols

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)
A	Percentage elongation
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 5b), c) and d)]
D	Nominal design outside diameter of the cylinder, in millimetres (see Figure 1)
D_f	Diameter, in millimetres, of former (see Figure 8)
F	Design stress factor (variable), see 7.2.
h	Outside depth (concave base end), in millimetres (see Figure 2)
H	Outside height, in millimetres, of domed part (convex head or base end) (see Figure 1)
L_o	Original gauge length, in millimetres, as defined in ISO 6892 (see Figure 7)
n	Ratio of diameter of bend test former to actual thickness of test piece (t)
p_b	Measured burst pressure, in bar[2], above atmospheric pressure
p_h	Hydraulic test pressure, in bar, above atmospheric pressure
p_w	Working pressure, in bar, above atmospheric pressure
p_y	Observed pressure when cylinder starts yielding during hydraulic bursting test, in bar, above atmospheric pressure
r	Inside knuckle radius, in millimetres (see Figures 1 and 2)
R_e	Minimum guaranteed value of yield stress, in megapascals (see 3.1)
R_{ea}	Actual value of the yield stress, in megapascals, as determined by the tensile test (see 10.2)
R_g	Minimum guaranteed value of tensile strength, in megapascals
R_m	Actual value of tensile strength, in megapascals, as determined by the tensile test (see 10.2)
S_o	Original cross-sectional area of tensile test piece, in square millimetres, in accordance with ISO 6892
t	Actual thickness of the test specimen, in millimetres
u	Ratio of distance between knife edges or platens in the flattening test to average cylinder wall thickness at the position of test

2) 1 bar = 10^5 Pa = 10^5 N/m^2.

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