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Gas cylinders — Ball valves — Specification and testing

Bouteilles à gaz — Robinets à boisseau sphérique — Spécifications et essais

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Contents

Page

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 2, *Cylinder fittings,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 23, *Transportable gas cylinders*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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 covers the function of a ball valve as a closure (defined by the UN Model Regulations[29]). It is possible that additional features of ball valves (e.g. pressure regulators, residual pressure devices, non-return devices, pressure relief devices) are covered by other standards or regulations.

Ball valves conforming to this document can be expected to perform satisfactorily under normal service conditions.

This document pays particular attention to:

a) safety (mechanical strength, impact strength, endurance, leak tightness, resistance to acetylene decomposition);

b) suitability of materials;

c) testing;

d) marking.

This document has been written so that it is suitable to be referenced in the UN Model Regulations[29].

In this document the unit bar is used, due to its universal use in the field of technical gases. It should, however, be noted that bar is not an SI unit, and that the corresponding SI unit for pressure is Pa (1 bar = 10^5 Pa = 10^5 N/m^2).

Pressure values given in this document are given as gauge pressure (pressure exceeding atmospheric pressure) unless noted otherwise.

Tests and examinations performed to demonstrate conformity to this document shall be conducted using instruments calibrated before being put into service and thereafter according to an established programme.

Any tolerances given in this document include measurement uncertainties.

Gas cylinders — Ball valves — Specification and testing

1 Scope

This document specifies design, type testing, marking, manufacturing tests and examinations requirements for ball valves used as:

a) closures of refillable transportable gas cylinders, pressure drums and tubes;

b) main valves for cylinder bundles;

c) valves for cargo transport units [e.g. trailers, battery vehicles, multi-element gas containers (MEGCs)];

which convey compressed gases, liquefied gases and dissolved gases.

NOTE 1 In this document, the term "valve" is used with the meaning of "ball valve".

This document does not apply to ball valves for:

— oxidizing gases as defined in ISO 10156;

— toxic gases (i.e. gases listed in ISO 10298 having an LC_{50} value ≤ 5 000 ppm[1]);

— acetylene for single gas cylinders, pressure drums and tubes.

NOTE 2 The reason for the exclusion of oxidizing gases is that the use of ball valves as closures of high-pressure cylinders for oxidizing gases is known to lead to specific ignition hazards that cannot reasonably be mitigated through the ball valve design or type testing. Safety hazards concern both the ball valve itself and any downstream equipment.

NOTE 3 The reason for the exclusion of acetylene for single gas cylinders, pressure drums and tubes is that the risk of an acetylene decomposition cannot reasonably be mitigated through the ball valve design or type testing.

This document does not apply to ball valves for liquefied petroleum gas (LPG), cryogenic equipment, portable fire extinguishers and cylinders for breathing apparatus.

NOTE 4 Requirements for valves for cryogenic vessels are specified in ISO 21011.

NOTE 5 Certain specific requirements for quick-release valves for fixed fire-fighting systems in addition to those that are given in this document are specified in ISO 16003.

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 10286, *Gas cylinders — Vocabulary*

ISO 10524-3, *Pressure regulators for use with medical gases — Part 3: Pressure regulators integrated with cylinder valves (VIPRs)*

1) ppm = parts per million.

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 14246, *Gas cylinders — Cylinder valves — Manufacturing tests and examinations*

ISO 15615:2013, *Gas welding equipment — Acetylene manifold systems for welding, cutting and allied processes — Safety requirements in high-pressure devices*

ISO 22435, *Gas cylinders — Cylinder valves with integrated pressure regulators — Specification and type testing*

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
ball valve
valve which uses the rotation of a ball with a through-passage to allow or shut-off flow through it

Note 1 to entry: Ball valves can have multiple ports.

3.2
main valve
valve which is fitted to the manifold of a bundle, battery vehicle, battery wagon or MEGC isolating it from the main connection(s)

[SOURCE: ISO 10286:—[2)], 3.1.5.4]

3.3
valve operating mechanism
<ball valves> mechanism which rotates the ball and which includes the external sealing systems and can include the internal sealing systems

3.4
valve operating device
component which actuates the *valve operating mechanism* (3.3)

EXAMPLE Handle/lever, handwheel/knob, key or actuator.

[SOURCE: ISO 10297:2014, 3.3, modified — The example has been changed.]

3.5
stop mechanism
system which limits the position of the *valve operating mechanism* (3.3)

EXAMPLE Stop pin and stop plate, mechanical stop in valve body and counterpart in handle/lever.

2) Under preparation. Stage at the time of publication: ISO/FDIS 10286:2021.

3.6
external leak tightness
leak tightness to atmosphere (leakage in and/or leakage out) when the valve is open

[SOURCE: ISO 10297:2014, 3.4, modified — Note 1 to entry has been deleted.]

3.7
internal leak tightness
leak tightness across the seat (leakage in and/or leakage out) when the valve is closed

[SOURCE: ISO 10297:2014, 3.5, modified — Note 1 to entry has been deleted.]

3.8
valve working pressure
p_w
settled pressure of a compressed gas at a uniform reference temperature of 15 °C in a full pressure receptacle for which the valve is intended

Note 1 to entry: This definition does not apply to liquefied gases (e.g. carbon dioxide), or dissolved gases (e.g. acetylene).

[SOURCE: ISO 10297:2014, 3.6, modified — "pressure receptacle" has replaced "gas cylinder or cylinder bundle" and Note 2 to entry has been deleted.]

3.9
valve burst test pressure
p_{vbt}
minimum pressure applied to a valve during hydraulic burst pressure test

[SOURCE: ISO 10297:2014, 3.7, modified — Note 1 to entry has been deleted.]

3.10
valve test pressure
p_{vt}
minimum pressure applied to a valve during testing

[SOURCE: ISO 10297:2014, 3.8, modified — Note 1 to entry has been deleted.]

3.11
lowest operating pressure
<ball valve> lowest settled pressure of the gas(es) for which the *ball valve* (3.1) is designed

3.12
endurance torque
T_e
torque used during the endurance test

Note 1 to entry: The endurance torque is expressed in Nm.

[SOURCE: ISO 10297:2014, 3.11, modified — "torque used" has replaced "closing torque applied".]

3.13
over torque
T_o
torque applied to the *valve operating device* (3.4) in opening and closing direction which the *valve operating mechanism* (3.3) and/or *stop mechanism* (3.5) can tolerate and remain operable

Note 1 to entry: The over torque is expressed in Nm.

[SOURCE: ISO 10297:2014, 3.12, modified — "torque" has replaced "opening or closing torque (whichever is the lower value)", "in opening and closing direction" has replaced "to determine the level of torque" and "and/or stop mechanism" has been added.]

3.14
failure torque
T_f
opening or closing torque (whichever is the lower value) applied to the *valve operating device* (3.4) at which mechanical failure occurs

Note 1 to entry: The failure torque is expressed in Nm.

[SOURCE: ISO 10297:2014, 3.13, modified — "at which mechanical failure occurs" has replaced "to obtain mechanical failure of the valve operating mechanism and/or valve operating device".]

3.15
valve inlet connection
connection on the valve which connects the valve to the pressure receptacle

[SOURCE: ISO 10297:2014, 3.16, modified — "pressure receptacle" has replaced "cylinder(s)".]

3.16
valve outlet connection
connection on the valve used to discharge the pressure receptacle

Note 1 to entry: For most valves, this connection is also used for filling.

[SOURCE: ISO 10297:2014, 3.17, modified — "pressure receptacle" has replaced "cylinder(s)".]

3.17
valve filling connection
connection on the valve used to fill the pressure receptacle

Note 1 to entry: The valve filling connection can be different from the *valve outlet connection* (3.16).

[SOURCE: ISO 10297:2014, 3.18, modified — "pressure receptacle" has replaced "cylinder(s)".]

4 Valve description

4.1 A ball valve (see Figure 1) typically comprises:

a) valve body;

b) valve operating mechanism;

c) valve operating device;

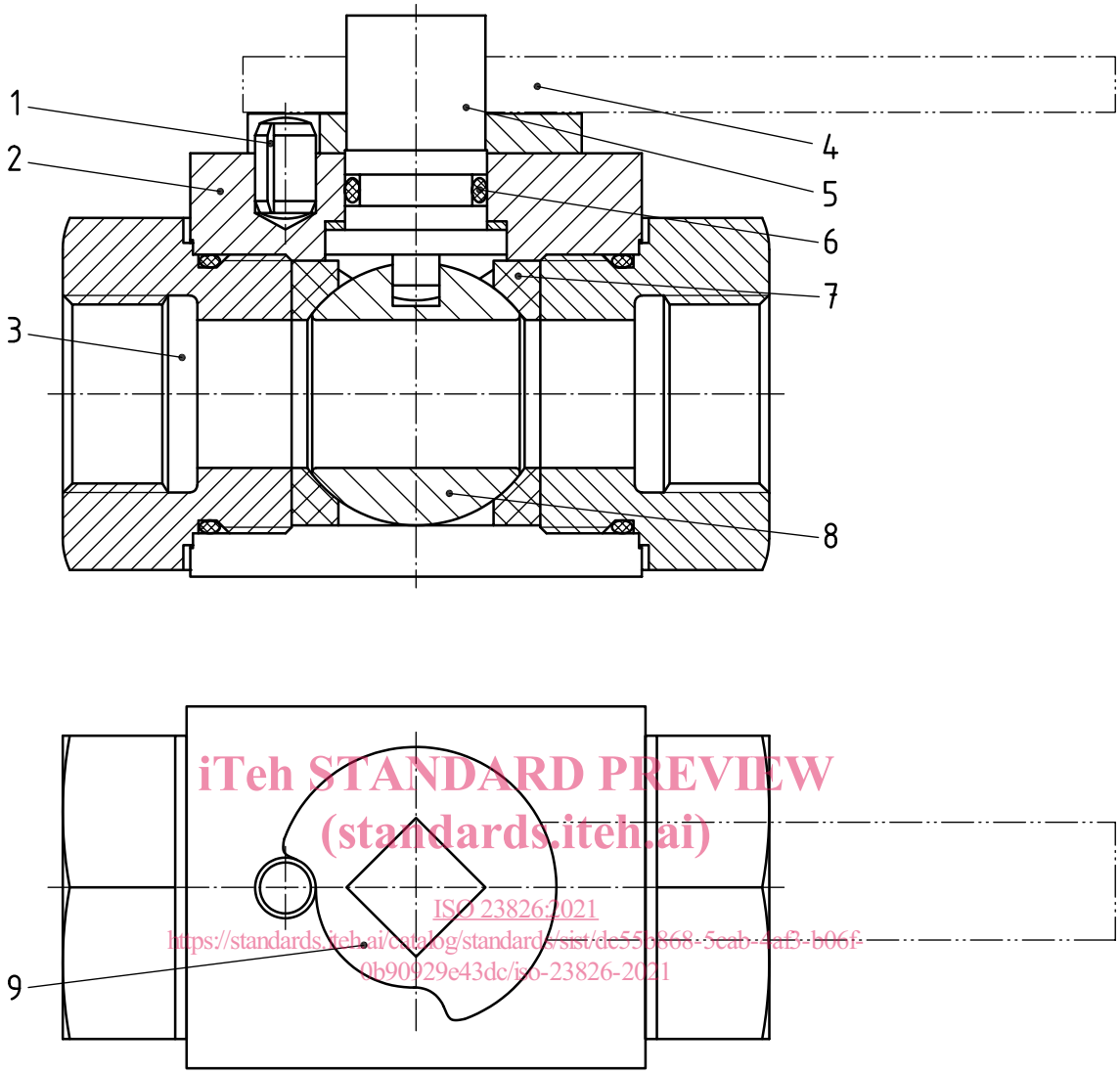
d) stop mechanism;

e) means to ensure internal leak tightness;

f) means to ensure external leak tightness;

g) valve outlet connection(s);

h) valve inlet connection.



Key

1	stop pin	6	stem sealing
2	valve body	7	seat
3	valve connection (inlet/outlet)	8	ball
4	handle/lever	9	stop plate
5	stem		

NOTE Stop plate and handle/lever can be combined in one component.

Figure 1 — Example of a ball valve design

4.2 Ball valves can also include:

a) pressure-relief device;

NOTE 1 The relevant transport regulation can require or forbid pressure relief devices for some gases, gas mixtures or gas groups. Additional requirements for pressure-relief devices can exist in international/regional regulations/standards.

b) dip tube;

c) connection plug/cap;

d) excess flow device;

e) non-return valve on the valve filling connection;

f) residual pressure device with or without non-return function;

NOTE 2 Requirements for residual pressure devices are given in ISO 15996.

g) pressure regulating device;

NOTE 3 Requirements for pressure regulating devices are given in ISO 22435 for industrial applications and in ISO 10524-3 for medical applications.

h) separate valve filling connection;

i) flow restricting orifice;

j) filter(s).

Not all of these components have test requirements detailed in this document.

4.3 There are typically two ball valve types:

a) floating ball type (see Figure 2);

b) trunnion type (see Figure 3).

The valve designs shown in Figures 2 and 3 are given as typical examples only.

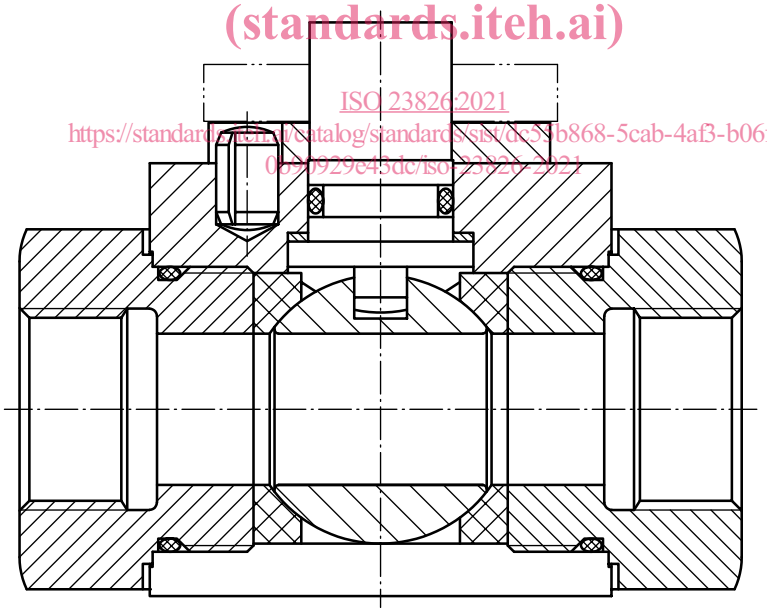


Figure 2 — Floating ball type design