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ISO 10297

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Transportable gas cylinders — Cylinder valves — Specification and type testing

Bouteilles à gaz transportables — Robinets de bouteilles — Spécifications et essais de type

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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 10297 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 2, *Cylinder fittings*.

This second edition cancels and replaces the first edition (ISO 10297:1999), which has been technically revised.

Introduction

Cylinder valves are fitted on gas cylinders used in, for example, industrial, medical and breathing applications. Such valves have to perform safely and reliably for at least the cylinder test period, often in hazardous situations.

Valves complying with this International Standard can be expected to perform satisfactorily under normal services conditions.

This International Standard pays particular attention to:

— suitability of materials;

— dimensions of inlet connections;

— dimensions of outlet connections;

— safety (mechanical strength, endurance, resistance to ignition);

— leakage;

— cleanliness;

— testing;

— identification.

NOTE For satisfactory service, valves are manufactured and batch tested to ISO 14246.

Transportable gas cylinders — Cylinder valves — Specification and type testing

1 Scope

This International Standard specifies valve design, production and marking requirements, and type test methods for valves intended to be fitted to gas cylinders which convey compressed, liquefied or dissolved gases.

This International Standard does not apply to valves for cryogenic equipment, for fire extinguishers or for liquefied petroleum gas (LPG).

Additional specific requirements for valves fitted with pressure-reducing devices (see ISO 22435 and EN 738-3), residual pressure-retaining devices and non-return devices (see ISO 15996), and bursting discs and pressure-relief devices (see ISO 4126 and prEN 14513) are not covered by this International Standard.

NOTE Requirements for valves for liquefied petroleum gas (LPG) are specified in ISO 14245 and EN 13152, and in ISO 15995 and EN 13153. Requirements for valves for cryogenic vessels are specified in ISO 21011. Further specific requirements for valves for breathing apparatus are specified in EN 144-1, EN 144-2 and EN 144-3.

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 407, *Small medical gas cylinders — Pin-index yoke-type valve connections*

ISO 5145, *Cylinder valve outlets for gases and gas mixtures — Selection and dimensioning*

ISO 8573-1, *Compressed air — Part 1: Contaminants and purity classes*

ISO 10156, *Gases and gas mixtures — Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets*

ISO 10286, *Gas cylinders — Terminology*

ISO 10692-1, *Gas cylinders — Gas cylinder valve connections for use in the microelectronics industry — Part 1: Outlet connections*

ISO 15001, *Anaesthetic and respiratory equipment — Compatibility with oxygen*

3 Terms, definitions and symbols

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

3.1
working pressure
p_w
⟨compressed gases⟩ settled pressure, at a uniform temperature of 15 °C, for a full gas cylinder with the maximum permissible charge of compressed gas

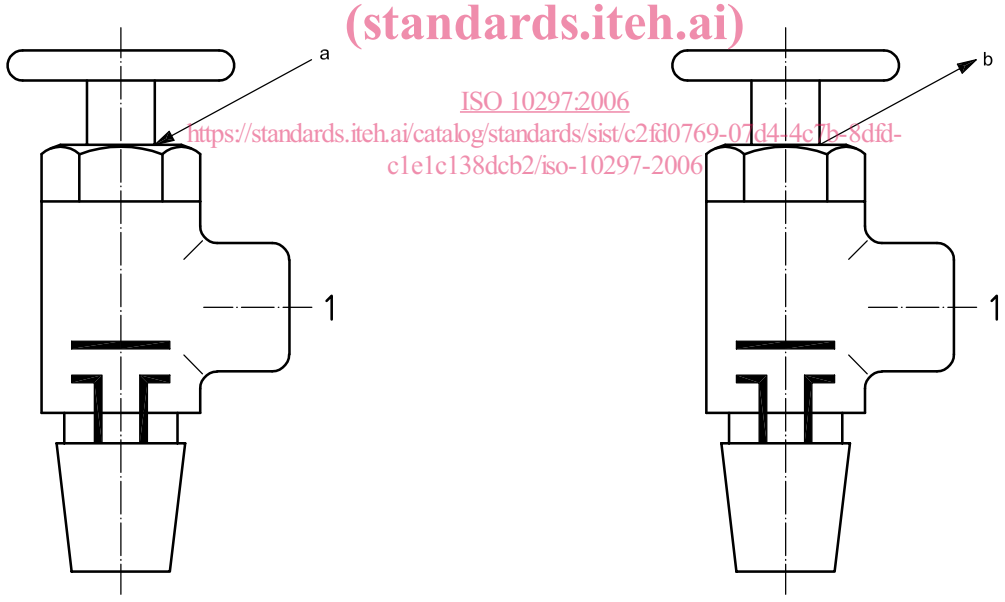
NOTE 1 In this International Standard, it corresponds to the maximum working pressure of the cylinders for which the valve is intended to be used.

NOTE 2 This definition does not apply to liquefied gases or dissolved gases (e.g. acetylene).

3.2
valve test pressure
p_{vt}
pressure applied to a valve through a gas (or a liquid medium for hydraulic pressure test only) during type testing

3.3
external leak tightness
leak tightness to atmosphere (leakage in and/or leakage out) when the valve is open

NOTE See Figure 1.



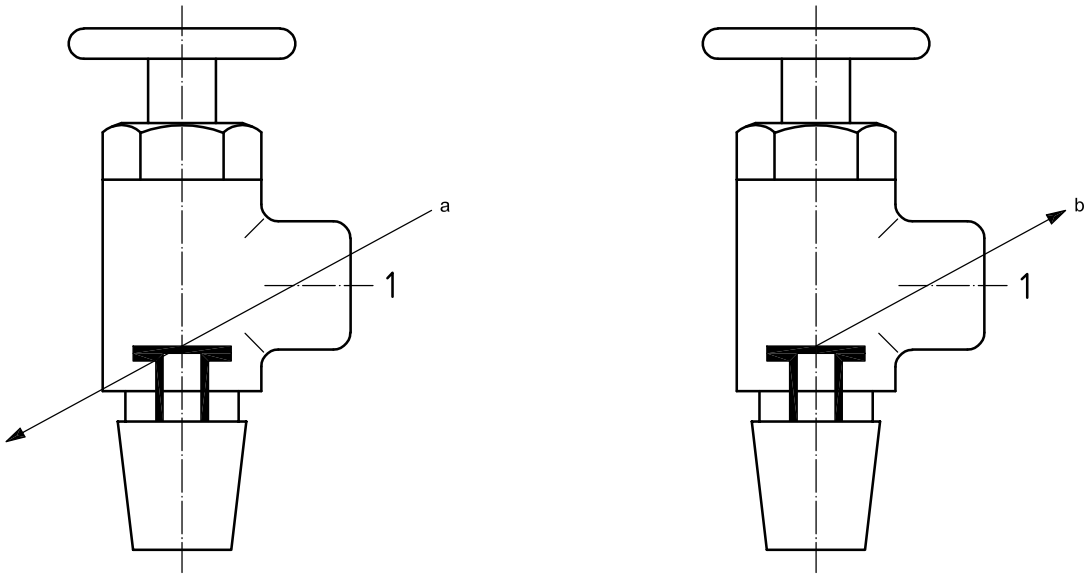
Key

1 connection to customer equipment (closed)
a Leakage in.
b Leakage out.
p = internal pressure
p_a = atmospheric pressure

Figure 1 — External leak tightness

3.4
internal leak tightness
leak tightness across the valve seat (leakage in and/or leakage out) when the valve is closed

NOTE See Figure 2.



$p \leqslant p_a$ $p \geqslant p_a$

Key

1 connection to customer equipment (open)

a Leakage in.

b Leakage out.

p = internal pressure

p_a = atmospheric pressure

Figure 2 — Internal leak tightness

3.5
minimum closing torque
T_c
torque necessary to be applied to a valve operating mechanism to obtain internal leak tightness

3.6
resistance torque
maximum opening or closing torque (whichever is the lesser) applied to a valve operating mechanism which the valve can withstand without damage

3.7
valve operating mechanism
mechanism which closes and opens the valve orifice

EXAMPLE A threaded valve spindle which, when rotated, raises and lowers a seal.

3.8
valve operating device
component which actuates the operating mechanism of the valve

EXAMPLE Handwheel or actuator.

3.9
total package mass
combined mass of a gas cylinder, its permanent attachment and its maximum allowed content

NOTE Valve and valve guard are examples of permanent attachments.

4 Valve design requirements

4.1 General

Valves shall operate satisfactorily over a range of service temperatures, from − 20 °C to + 65 °C in indoor and outdoor environments. The range may be extended for short periods (e.g. during filling). Where higher or lower service temperatures are required for longer periods, the purchaser shall specify accordingly. Valves shall be capable of withstanding the mechanical stresses or chemical attack they can experience during intended service, e.g. during storage, valving into cylinders, filling processes, transportation and end use of the cylinder.

4.2 Description

This International Standard does not prescribe the components that a cylinder valve shall comprise. A cylinder valve typically comprises the following:

a) body;

b) operating mechanism (to open and close the valve);

c) valve operating device;

d) means to ensure internal leak tightness;

e) means to ensure external leak tightness;

f) outlet connection(s) (to fill and discharge the cylinder);

g) inlet connection to the cylinder;

h) pressure-relief device (see ISO 11622 and/or other applicable standards, e.g. ISO 4126);

i) siphon tube;

j) screwed plug or cap on the outlet connection;

k) excess flow limiting device;

l) means to prevent the ingress of atmospheric air;

m) residual pressure retaining device (see ISO 15996);

n) outlet pressure reduction mechanism;

o) flow restricting orifice;

p) filter(s).

4.3 Materials

Metallic and non-metallic materials in contact with the gas shall be chemically and physically compatible with the gas, under all intended operating conditions (see, for example, ISO 11114-1, ISO 11114-2 and material specifications of the producer).

For medical and breathing applications, see ISO 15001, especially when selecting materials to reduce the risk of toxic products of combustion/decomposition from non-metallic materials including lubricants.

In medical or breathing applications, components which are in contact with the gas shall not be plated or coated unless means are provided to ensure that any particles generated by such surfaces are prevented from entering the gas stream.

Ignition resistance in oxygen or other highly oxidizing gases (see ISO 10156) of non-metallic materials and lubricants shall have been established by an appropriate test procedure (see ISO 11114-3).

Because of the risk of forming explosive acetylides, valves for acetylene may be manufactured from copper based alloys only if the copper content does not exceed 65 % (by mass). The manufacturer shall not use any procedure resulting in copper enrichment of the surface. For the same reasons, silver content of alloys, e.g. for brazing, shall be limited for acetylene valves. The acceptable limit shall be preferably 43 % (by mass), but in no case exceeding 50 %.

Non-metallic sealing materials for use with air, oxidizing (i.e. nitrous oxide) gases, oxygen and oxygen-enriched gases shall be capable of withstanding an ageing sensitivity test.

4.4 Dimensions

4.4.1 External dimensions

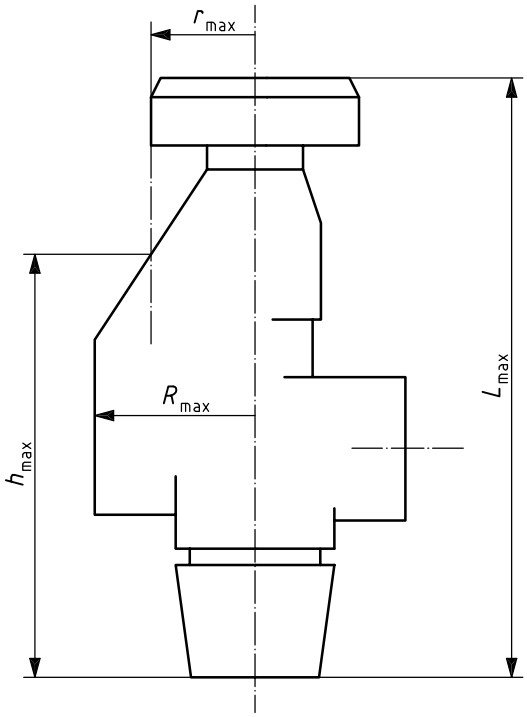
If the valve is intended to be protected by a cap complying with ISO 11117, the external dimensions shall comply with Figure 3. If the valve is of the ‘pin-index yoke-type’ for medical gases, the relevant external dimensions shall be in accordance with ISO 407.

4.4.2 Internal dimensions

The bore of the valve shall be adequate to meet the flow requirement (including that of any pressure-relief device fitted) without unacceptably reducing the strength of the stem connection.

4.5 Valve connections

Valves are normally connected to the cylinder by means of an inlet connection, e.g. taper thread in accordance with ISO 10920 for 25E or ISO 11116-1 for 17E, or parallel male thread in accordance with, for example, ISO 15245-1 for M30 or any relevant standard. They are connected to the filling and utilization appliances by means of one or more outlet connections complying with an accepted International Standard (e.g. ISO 407, ISO 5145, ISO 10692-1) or any relevant standard.



Key

r_{max} = 32,5 mm
R_{max} = 38 mm
h_{max} = 90 mm
L_{max} = 125 mm

When the axes of the valve stem thread and handwheel do not coincide, the distance between the two axes shall be added to r_{max}.

R_{max} shall be measured to the part of the valve furthest from the stem axis and includes any outlet plugs or caps if fitted.

NOTE 1 h represents the length of the lower part of the valve, when the maximum radius is greater than the radius of the handwheel.

NOTE 2 L_{max} is the maximum length of a valve in the closed position when not fitted to a cylinder.

Figure 3 — Maximum dimensions for cylinder valves protected by a cap in accordance with ISO 11117

4.6 Mechanical strength

4.6.1 Hydraulic pressure test

Cylinder valves shall be capable of withstanding for 2 min without permanent deformation, leak or rupture a hydraulic pressure test of 1,5 times the test pressure of the cylinder to which the valve is designed to be connected.

This pressure test shall be carried out at 450 bar for acetylene.

The hydraulic pressure test is given in 6.9.

4.6.2 Resistance to mechanical impact

For a valve used in a cylinder with water capacity greater than 5 l, and if the valve is not intended to be protected during transport by a cap or guard complying with ISO 11117, it shall withstand a mechanical impact with a minimum velocity of 3 m/s and an impact energy in joules equal to 3,6 times the total package mass (cylinder plus content) in kilograms or 40 J, whichever is the greater.

The impact test is given in Annex A.