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Gas cylinders — Cylinder valves — Specification and type testing

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

[Revision of second edition (ISO 10297:2006)]

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This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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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.

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

This third edition cancels and replaces the second edition (ISO 10297:2006).

The main technical modifications are the following:

- a) Scope: inclusion of cylinder valves with integrated pressure regulators (VIPR), exclusion of quick-release valves and non-return valves;
- b) Terms, definitions and symbols: new definitions added and some definitions adapted, e.g. for leak tightness and introduction of new definitions, e.g. valve burst test pressure and endurance torque;
- c) Valve design requirements:
 - 1) General: inclusion of additional requirement of internal leak tightness at -40 °C during transport and storage with additional requirement for impact value as material requirement;
 - 2) Materials: deletion of requirements already given in ISO 11114-1 and ISO 11114-2; deletion of ageing sensitivity test for non-metallic materials; addition of requirement on ductility of valve body material; addition of requirement on suitability of lubricants for valve test pressure; recommendations amended and now given as notes;
 - 3) Dimensions: deletion of requirement on bore of the valve with regard to flow requirement and adaption of requirements for valves fitted with a cap according to ISO 11117;
 - 4) Resistance to mechanical impact: addition of requirement for impact testing valves protected by a guard complying with ISO 11117 but fixed only to the valve;
 - 5) Valve operating mechanism: inclusion of allowance to increase the endurance torque for some special valve designs and to adjust compressed packed valves during endurance testing; replacement of acetylene flashback test by alternative tests without using acetylene and addition of acetylene decomposition test for main valves of an acetylene bundle;
 - 6) Valve operating device: addition of requirement on the handwheel diameter required to achieve the minimum closing torque;

- 7) Resistance to ignition: for highly oxidizing gases limitation of oxygen pressure surge test for cylinder valves for gas cylinders having a minimum cylinder test pressure of 30 bar; addition of requirement of oxygen pressure surge test for gas mixtures containing oxygen or other highly oxidizing gases as well as for air and of detailed information on acceptance criteria; addition of mandatory reference to oxygen pressure surge test for VIPR specified in ISO 22435 or ISO 10524-3 and for cylinder valves with residual pressure valves (RPV) specified in ISO 15996;
- d) Production requirements: deletion of all respective requirements but reference to ISO 14246 in scope;
- e) Type tests:
- 1) General: addition of detailed definition of valve family, changes and material variants within a valve family and of corresponding repetition of tests;
 - 2) Documentation: addition of detailed information on documentation required;
 - 3) Test samples: addition of requirement for preconditioning of test samples by the manufacturer;
 - 4) Test pressures: adaption of information on burst test pressure (former hydraulic test pressure);
 - 5) Test gas: addition of requirement for using helium or hydrogen or an inert mixture of these gases for the leak tightness tests for cylinder valves for helium and hydrogen and their mixtures; extension of requirements on gas quality;
 - 6) Test sequence: deletion of leak tightness test before ageing as preconditioning; addition of internal leak tightness test at -40 °C after endurance test; adaption of oxygen pressure surge test for cylinder valves with lubricants not rated for valve test pressure; listing of impact test;
 - 7) Hydraulic burst pressure test: additional testing with the valve seat of the test sample in closed position; adaption of test for valves equipped with actuators;
 - 8) Excessive torque tests: addition of requirement to carry out the test with the handwheel in place; differentiation between handwheel and key/toggle operated valves; extension of tests with requirement of 2 more test samples;
 - 9) Leak tightness tests: reference to informative Annex E for an example of a vacuum test; unification of the lower test pressure of 0,5 bar for all gases; implementation of internal leak tightness test at -40 °C; addition of information on required position of the valve operating mechanism for external leak tightness test; adaption of requirement for test order for all required test pressures; adaption of requirement for changing and maintaining the different test temperatures; adaption of requirement for minimum closing torque;
 - 10) Endurance test: addition of requirement to carry out the test with the handwheel in place and of description of procedure for increasing the endurance torque for some special valve designs;
 - 11) Visual examination: addition of separate subclause for visual examination with detailed information on acceptance criteria;
 - 12) Flame impingement test: addition of detailed information on acceptance criteria; addition of sealing interface degradation as non-acceptance criterion;
 - 13) Oxygen pressure surge test: information transferred to normative Annex C; addition of requirement for testing via different connections if they might be subjected to an oxygen pressure surge, for testing valves for gas mixtures containing oxygen and for previous endurance testing if the lubricants used are not suitable for the valve test pressure; addition of detailed information on calculation of pressurization time; addition of divergent installation requirements for testing main valves; addition of detailed information on acceptance criteria;

- 14) Acetylene test: information transferred to normative Annex B; replacement of acetylene flashback test by alternative tests (hydraulic burst pressure test and seat leakage test) without using acetylene;
- 15) Impact test: extension of test by using different valving torques according to ISO 13341 and subsequent hydraulic burst pressure test and internal leak tightness test with requirement of one additional test sample; addition of detailed information on point of impact; addition of acceptance criteria of being opened after the test;
- 16) Marking: addition of requirement for marking valves oxygen pressure surge tested from different directions; detailed information on marking of inlet and outlet connections;
- 17) Example of test sequence: information transferred from informative Annex B to informative Annex D and adaptation according to new requirements for valve families and changes and material specifications within a valve family;
- 18) Addition of informative Annex E, giving an example of a vacuum test;
- 19) Endurance test equipment and procedure: information transferred from normative Annex C to normative Annex F;
- 20) Addition of informative Annex H, giving guidance for updating valve conformity on the basis of the previous version of this International Standard.

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Introduction

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

This International Standard pays particular attention to:

- a) suitability of materials;
- b) safety (mechanical strength, impact strength, endurance, leak tightness, resistance to ignition, resistance to acetylene flashback);
- c) testing;
- d) identification.

This International Standard is intended to be used under a variety of national regulatory regimes but has been written so that it is suitable for use with the conformity assessment system of the UN Model Regulations for the Transportation of Dangerous Goods. Attention is drawn to requirements in specified relevant national regulations of the country (countries) where the cylinder valves are intended to be used that might override the requirements given in this International Standard.

This International Standard and the UN Model Regulations for the Transportation of Dangerous Goods only covers the main shut-off function of cylinder valves including cylinder valves with integrated pressure regulator (VIPR). Additional features of a cylinder valve like pressure regulators, residual pressure-retaining devices and non-return devices and pressure-relief devices might be covered by other standards and regulations.

In International Standards, weight is equivalent to a force, expressed in Newton. However, in common parlance (as used in terms defined in this International Standard), the word "weight" continues to be used to mean "mass", but this practice is deprecated (ISO 80000-4).

In this standard 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.

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

Gas cylinders — Cylinder valves — Specification and type testing

1 Scope

This International Standard specifies design, type test methods and marking requirements for cylinder valves including cylinder valves with integrated pressure regulators (VIPR) intended to be fitted to transportable gas cylinders or used as a main valve for bundles which convey compressed, liquefied or dissolved gases. Where cylinder valves are used for pressure drums or trailers this standard may be used as a guide.

This International Standard does not apply to cylinder valves for cryogenic equipment, for portable fire extinguishers, or for liquefied petroleum gas (LPG) and for quick-release valves and non-return valves. Additional features of a cylinder valve other than the main shut-off function are also excluded from the scope.

NOTE 1 Requirements for valves for cryogenic vessels are specified in ISO 21011 and on regional level e.g. in EN 1626. Requirements for valves for portable fire extinguishers on regional level are specified e.g. in EN 3 series. Requirements for quick-release valves and non-return valves might be specified in regional regulations/standards. For operational safety when filling and handling cylinders equipped with quick-release valves see EIGA SI 08/CGA SB-39.

NOTE 2 Requirements for manufacturing tests and examinations of cylinder valves and VIPR are given in ISO 14246.

NOTE 3 Additional requirements for VIPR are specified in ISO 22435 or ISO 10524-3. Additional requirements for residual pressure-retaining devices and non-return devices are specified in ISO 15996. Additional requirements for pressure-relief devices might be specified in regional regulations/standards.

NOTE 4 Additional specific requirements for cylinder valves for breathing apparatuses on regional level are specified e.g. in EN 144 series. Additional specific requirements for quick-release valves for fixed firefighting systems on regional level are specified e.g. in EN 12094-4.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 407, *Small medical gas cylinders — Pin-index yoke-type valve connections*

ISO 10286, *Gas cylinders — Terminology*

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

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

ISO 11114-2, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials*

ISO 11117:2008, *Gas cylinders — Valve protection caps and valve guards — Design, construction and tests*

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

ISO 15615:2002, *Gas welding equipment — Acetylene manifold systems for welding, cutting and allied processes — Safety requirements in high-pressure devices*

ISO 15996, *Gas cylinders — Residual pressure valves — General requirements and type testing*

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

3 Terms, definitions and symbols

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

3.1

valve operating mechanism

mechanism which closes and opens the valve orifice

Note 1 to entry: For VIPR the pressure regulator can act as valve operating mechanism.

Note 2 to entry: In ISO 22435 the valve operating mechanism is called shut-off mechanism.

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

3.2

valve operating device

component which actuates the *valve operating mechanism* (3.1)

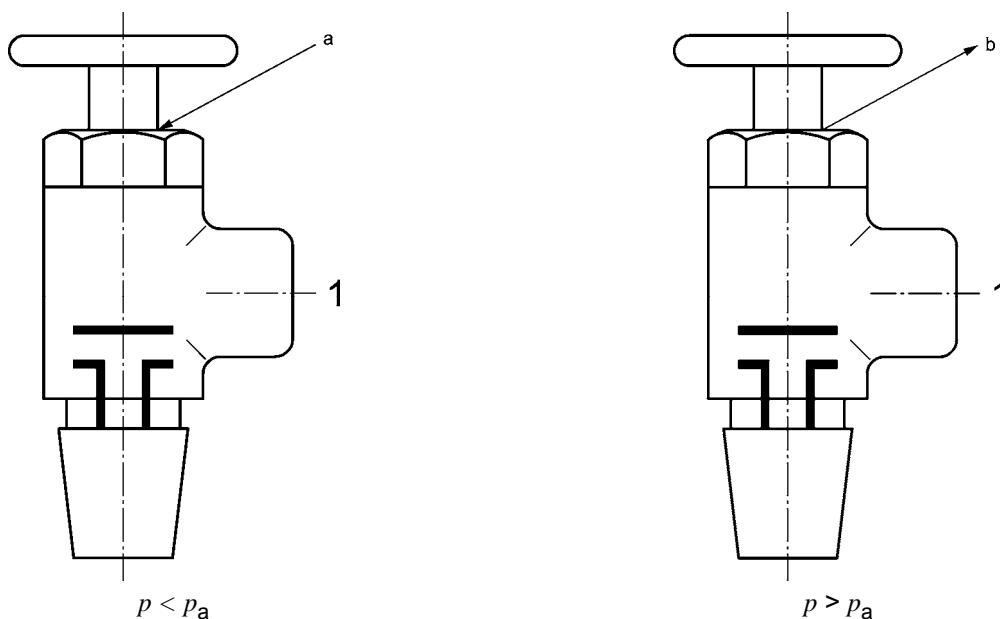
EXAMPLE Handwheel, key, knob or actuator.

3.3

external leak tightness

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

Note 1 to entry: See Figure 1.



Key

- 1 outlet connection (sealed)
- a leakage in (vacuum test)
- b leakage out

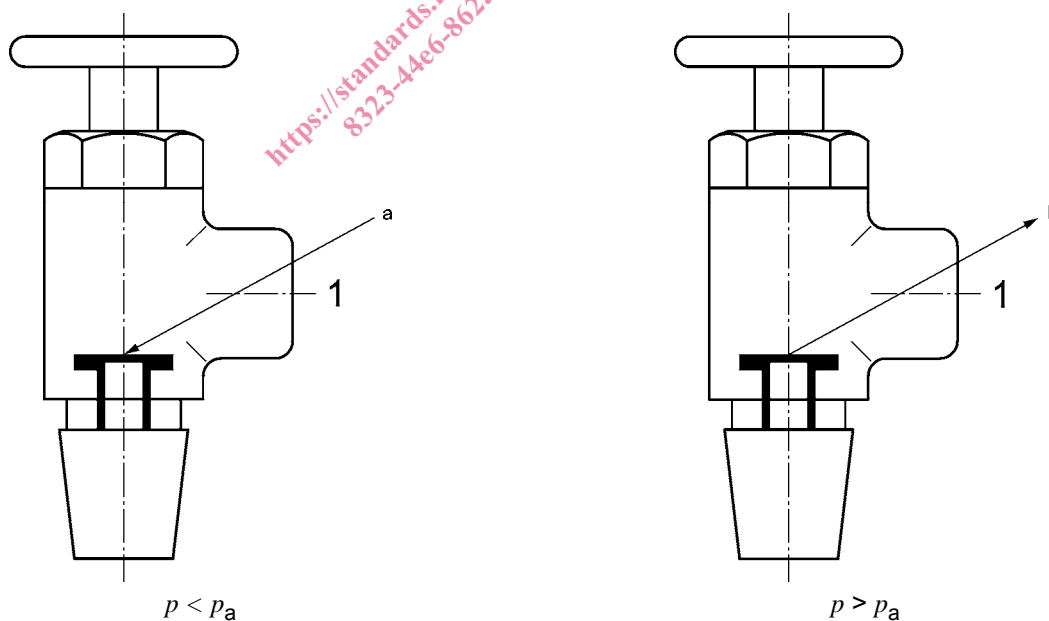
- p internal pressure
- p_a atmospheric pressure

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 1 to entry: See Figure 2.



Key

- 1 outlet connection (open)
- a leakage in (vacuum test)
- b leakage out

- p internal pressure
- p_a atmospheric pressure

Figure 2 — Internal leak tightness

**3.5
valve working pressure**

p_w
settled pressure of a compressed gas at a uniform reference temperature of 15 °C in a full gas cylinder 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).

Note 2 to entry: The valve working pressure is expressed in bar.

**3.6
valve burst test pressure**

P_{vbt}
minimum pressure applied to a valve through a liquid medium during burst pressure test

Note 1 to entry: The valve burst test pressure is expressed in bar.

**3.7
valve test pressure**

P_{vt}
minimum pressure applied to a valve through a gas during testing

Note 1 to entry: The valve test pressure is expressed in bar.

**3.8
handwheel diameter**

D
nominal value of twice the largest radius from the centre of the handwheel

Note 1 to entry: The handwheel diameter is expressed in mm.

**3.9
minimum closing torque**

T_c
torque necessary to be applied to a *valve operating mechanism* (3.1) to obtain *internal leak tightness* (3.4)

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

**3.10
endurance torque**

T_e
closing torque used during the endurance test

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

**3.10.1
endurance torque at start**

$T_{e,start}$
endurance torque (3.10) to be applied at the beginning of the endurance test

**3.10.2
endurance torque at end**

$T_{e,end}$
endurance torque (3.10) achieved at the end of the endurance test