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Gas cylinders — Cylinder valves — Manufacturing tests and examinations

Bouteilles à gaz — Robinets de bouteilles à gaz — Essais de fabrication et contrôles

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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).

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).

This third edition cancels and replaces the second edition (ISO 14246:2014), which has been technically revised. It also incorporates Amendment ISO 14246:2014/Amd 1:2017. The main changes are as follows:

— in Clause 4, a maximum level of hydrocarbon contamination of 220 mg/m^2 and a maximum particle size of 200 µm has been introduced for valves for oxygen and other oxidizing gases for general purpose applications, and the mandatory reference to ISO 15001 has been changed to an example for medical applications;

— in 5.2, indent c), the value of the test pressure for specific acetylene valves has been reduced from 37 bar to 35 bar;

— in 5.4, the requirements concerning the verification of the assembly with regard to the use of correct components and assembly torques have been clarified.

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 valve as a closure (defined by the UN Model Regulations). Additional features of valves (e.g. pressure regulators, residual pressure-retaining devices, non-return devices and pressure relief devices) might be covered by other standards and/or regulations.

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

This document pays particular attention to manufacturing tests and examinations of valves designed and type tested in accordance with ISO 10297.

This document has been written so that it is suitable to be referenced in the UN Model Regulations[1].

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.

Gas cylinders — Cylinder valves — Manufacturing tests and examinations

1 Scope

This document specifies the procedures and acceptance criteria for manufacturing tests and examinations (sometimes called "initial inspection and tests") of valves designed and type tested in accordance with ISO 10297.

This document is applicable to:

a) cylinder valves intended to be fitted to refillable transportable gas cylinders;

b) main valves (excluding ball valves) for cylinder bundles;

c) cylinder valves or main valves with integrated pressure regulator (VIPR);

d) valves for pressure drums and tubes.

NOTE Where there is no risk of ambiguity, cylinder valves, main valves, VIPR and valves for pressure drums and tubes are addressed with the collective term “valves” within this document.

The principles of these manufacturing tests and examinations can be beneficially applied to cylinder valves type tested to national or International Standards other than ISO 10297.

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 10286, *Gas cylinders — Vocabulary*

ISO 10297, *Gas cylinders — Cylinder valves — 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 https://www.electropedia.org/

3.1
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).

[SOURCE: ISO 10297:2014, 3.6, modified — “or cylinder bundle” has been deleted from the definition and Note 2 to entry has been deleted.]

3.2
valve test pressure
p_{vt}
minimum pressure applied to a valve through a gas during testing

[SOURCE: ISO 10297:2014, 3.8, modified — "through a gas" has been added to the definition and the note to entry has been deleted.]

3.3
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 and Figure 1 have been deleted.]

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

[SOURCE: ISO 10297:2014, 3.5, modified — Note 1 to entry and Figure 2 have been deleted.]

3.5
batch
quantity of valves of the same type tested design and production order, which is produced as a controlled number in a specified time period

3.6
sample
quantity of valves selected from a *batch* (3.5) according to a recognized sampling procedure

Note 1 to entry: The ISO 2859 series specifies sampling procedures for inspection.

4 Cleanliness

The manufacturing process including all tests shall be such that the valves are supplied clean and dry to meet the requirements of the intended service, e.g. see ISO 15001 for medical applications.

Gas wetted components of valves for oxygen and other oxidizing gases (see ISO 10156) shall be clean of oil and grease so that the level of hydrocarbon contamination is not greater than 220 mg/m^2. In addition, components shall be free from particles of a size larger than 200 µm. This shall be verified by an appropriate method, e.g. as given in ISO 15001.

Consideration shall be given to minimize the introduction of particles and the risk of contamination during the assembly process.

5 Manufacturing tests and examinations

5.1 General

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

Manufacturing tests and examinations, which are further specified in 5.3, 5.4 and 5.5, shall include:

— tests to be performed on each valve;

— inspections and examinations to be performed on a sample, and verification of the batch documentation;

— procedures to verify materials of construction and components.

The respective results shall be recorded.

5.2 Valve test pressure

Testing shall be conducted at p_{vt} as given in Table 1.

Table 1 — Valve test pressures

Gas	p_{vt}[a] bar
Fluorine Oxygen difluoride	160
Nitric oxide	180
All other compressed gases	$1{,}2 \times p_w$
Liquefied gases	at least equal to the minimum test pressure of the pressure receptacle for that gas or gas group[b]
Acetylene and other dissolved gases	at least equal to the minimum test pressure of the pressure receptacle for that gas or gas group[bc]

[a] For valves that are equipped with a pressure activated pressure relief device, p_{vt} shall be 0,8 times the lowest value of the range of the set pressure of the pressure relief device.

[b] Minimum values can be found in the relevant transport regulation. Where a minimum test pressure is not specified, the test pressure marked on the pressure receptacle for which the valve is intended shall be used or the manufacturer shall specify p_{vt}.

[c] p_{vt} for acetylene shall be at least 35 bar if the valve is fitted with a cylinder pressure gauge/contents indicator rated to a pressure lower than the minimum test pressure.

NOTE Transport regulations can require the valve test pressure to correspond with the valve outlet connection pressure rating.

5.3 Tests to be performed on each valve

Each valve shall be subjected to both internal leak tightness and external leak tightness testing prior to dispatch.

For internal leak tightness, the valve shall be pressurized from the valve inlet gas passage.

For external leak tightness, the valve in open position shall be pressurized from the valve inlet gas passage with the valve outlet connection sealed or pressurized from the valve outlet connection with the valve inlet connection sealed. The external leak tightness of valves fitted with accessories which form the pressure envelope, e.g. pressure relief devices and pressure gauges, shall be determined with these accessories in place.

For specific designs where the external sealing system is independent of the position of the valve operating mechanism (open or closed), the external leak tightness test may be replaced by an alternative test with the valve in closed position and pressurized from the valve outlet connection. In this case the leak tightness of any components located upstream of the seat shall be tested separately, e.g. as part of the internal leak tightness test.

EXAMPLE O-ring gland seal valve (see ISO 10297:2014, Figure 3).

In addition, the presence of a through passage shall be verified.

Leak tightness tests shall be performed at ambient temperature (usually between 15 °C and 30 °C).

Valves shall be closed with the closing torque specified by the manufacturer but not exceeding the endurance torque at start, $T_{e,start}$, as used during type testing in accordance with ISO 10297.

The internal leakage rate shall not exceed 6 cm^3/h.

The total external leakage (typically comprising that from the external valve sealing system plus, for example, PRD, RPV, pressure indicating devices and pressure regulating or reduction system) shall not exceed 6 cm^3/h for a cylinder valve or main valve or 12 cm^3/h for a VIPR.

For pure or toxic gases, lower leakage rates may be agreed between manufacturer and customer.

NOTE 1 For electronic applications, leakage rates are typically $1 \cdot 10^{-7}$ He mbar·l/s.

Additionally, an extra tightness test to measure the value of leakage into the valve under vacuum may be agreed between manufacturer and customer.

These tests are usually conducted with oil free dry air or nitrogen but other suitable test gases may be used.

An example of a test protocol is given in Annex A. Other qualified or accepted methods that conform to this clause may also be used.

NOTE 2 Additional testing can be required for valves with special features, e.g. residual pressure valves or VIPRs.

5.4 Inspections and examinations to be performed on a sample and verification of the batch documentation

Inspections and examinations shall be performed on a sample. In addition, a verification of the batch documentation shall be carried out.

The sampling plan, the sequence and the detailed content of all these procedures shall be specified in the manufacturer's quality assurance system.

The inspections, examinations and verifications shall be carried out to verify the manufacturing process with regard to at least:

— for acetylene, if the test to be performed on every valve (see 5.3) has been performed at a pressure below the minimum test pressure quoted in the relevant transport regulation, an internal and external leak tightness batch test shall be carried out using at least the minimum test pressure quoted in the relevant transport regulation;

— compliance with production or customer orders by comparison with the general assembly drawing and other documentation;

— metallic and non-metallic materials by verification of supplier documentation, e.g. material certificates;

— stress relieving (if required) by verification of manufacturing documentation;

— machining by visual and metrological inspection;

— dimensions by metrological inspection;

— cleanliness by visual examination and verification of manufacturing documentation;

— components, lubricants, sealants and adhesives;

— assembly torques;

— testing by verification of manufacturing documentation;

— marking by visual examination.