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Gas cylinders — Compatibility of cylinder and valve materials with gas contents —

Part 6: Oxygen pressure surge testing

Bouteilles à gaz — Compatibilité des matériaux des bouteilles et des robinets avec les contenus gazeux —

Partie 6: Essai de compression adiabatique à l'oxygène

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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).

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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*, 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).

A list of all parts in the ISO 11114 series can be found on the ISO website.

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

Oxygen pressure surge testing has been required by a number of different product standards covering:

— valves used for gas cylinders, tubes, pressure drums and cylinder bundles;

— residual pressure valves (RPVs);

— self-closing valves;

— industrial and medical valves with integrated pressure regulators (VIPRs);

— industrial and medical pressure regulators;

— hoses.

Oxygen pressure surge testing is also described in other testing standards such as ISO 21010, ASTM G175 and ASTM G74.

NOTE A list of standards is given in the Bibliography.

Requirements for the test facility and test procedures differ from standard to standard due to modifications introduced over the years and lack of coordination. This can result in a need to modify the testing procedures and equipment depending on the product (e.g. valves, hoses, pressure regulators) knowing that the aim of the test remains the same.

This document aims to standardize the test equipment and the test procedure so that, in future, product standards can refer to this document and only give additional requirements, e.g. test pressure, number of test samples needed to be submitted for the test.

Gas cylinders — Compatibility of cylinder and valve materials with gas contents —

Part 6: Oxygen pressure surge testing

1 Scope

This document specifies requirements for the test apparatus and test procedure in order to apply oxygen pressure surges consistently to devices being tested for resistance to ignition by adiabatic compression and to materials for oxygen compatibility.

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*

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 terminology 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
surge tube
<cannon> metallic tube of defined internal diameter and length installed between the outlet plane of the quick-opening valve (QOV) or the calibrated orifice (if applicable) and the intermediate connector to ensure a reproducible severity of the test condition

Note 1 to entry: In some documents, the term “connecting tube” is used for this purpose.

3.2
test pressure
static pressure upstream of the quick-opening valve in the closed conditions

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

Note 2 to entry: The test pressure is given in the *product standard* (3.4) (see the Bibliography).

3.3
pressure rise time
time required for the pressure to rise

Note 1 to entry: This is as measured in 5.5.

3.4
product standard
standard that specifies requirements to be fulfilled by materials and/or accessories to establish their fitness for purpose

Note 1 to entry: See examples of product standards given in the Bibliography.

4 Test installation

4.1 Test gas

4.1.1 Test gas specification

The pressure surge test shall be carried out with oxygen.

Oxygen specification shall correspond to Table 1.

Table 1 — Gas specification

Parameter	Requirement
Minimum purity	≥ 99,5 % by volume
Hydrocarbon content	≤ 0,01 % by volume
Maximum particle size	See 5.1
NOTE Most industrial oxygen grades meet the above specifications.	

4.1.2 Temperature of test gas

The oxygen used for calibration and testing shall be at a temperature of (60 ± 3) °C unless otherwise specified by the appropriate product standard.

4.2 Condition of test sample

In general, test samples are (before test series) at room temperature.

NOTE Room temperature is typically between 15 °C and 30 °C.

Some standards require the test sample to be heated, e.g. at (60 ± 3) °C.

4.3 Surge tube (cannon)

The surge tube shall be suitable for oxygen and rated for the maximum pressure and temperature which the material of the surge tube reaches during the test.

Surge tubes are usually made of Monel or with Monel liner materials. Other oxygen compatible materials may be used.

The surge tube should be nominally straight. A smooth bend in the surge tube is sometimes used to retain test samples (such as oil) in position.

The product standards listed in the Bibliography require the use of different geometries for the surge tube:

— Type A: nominal length of 1 m and an internal nominal diameter of 5 mm (or nominal fractional inch equivalent);

— Type B: nominal length of 0,75 m and an internal nominal diameter of 14 mm (or nominal fractional inch equivalent).

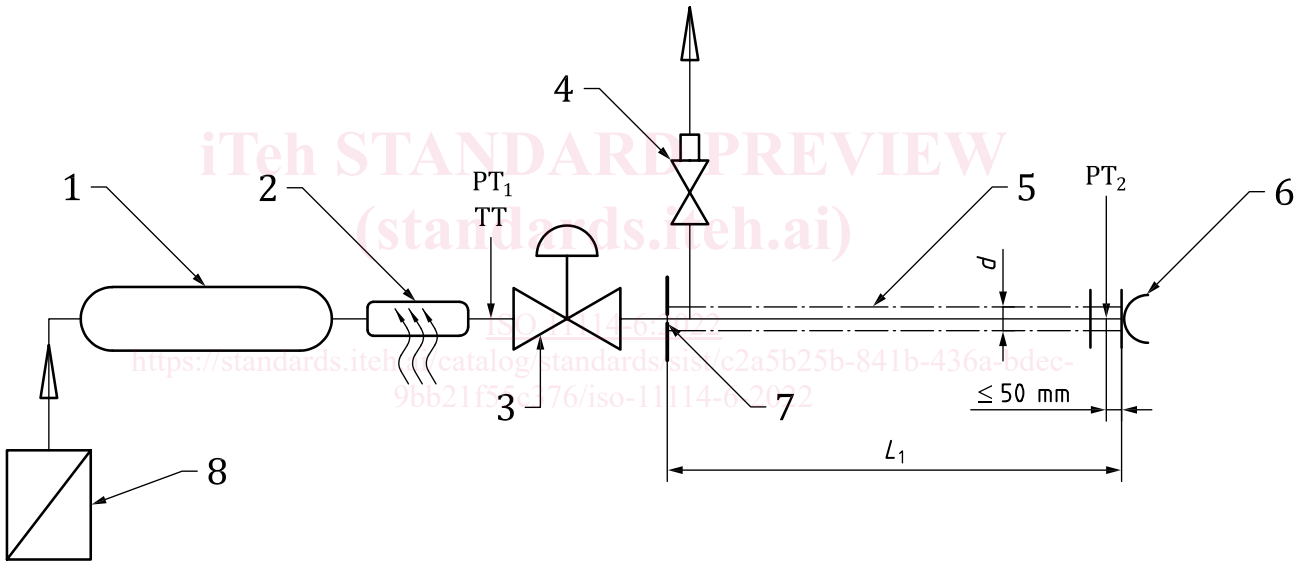
For other applications, different sizes (diameters and/or lengths) may be specified, e.g. by the manufacturer/the user/test laboratories.

Surge tube dimensions should be as close as possible to nominal dimensions. Due to the manufacturing process, some differences in inner diameters or length can occur. Such minor dimensional differences shall not lead to a reduction in the severity of the test. This can be demonstrated by having an internal volume of the surge tube no less than the volume calculated by using the nominal length and diameter.

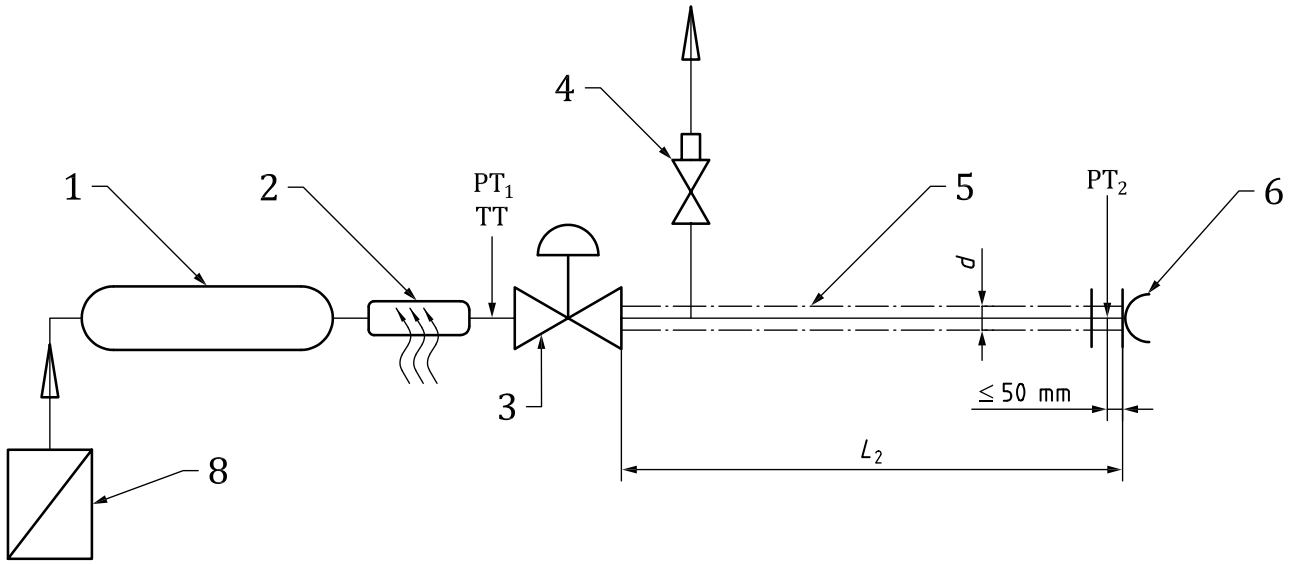
5 Design of the test facility

5.1 General

The test facility room shall be adequately designed such that, in case of failure of either the sample or the test apparatus, the operator is protected. The room shall be adequately ventilated to maintain a safe environment for personnel, in particular to evacuate combustion products that could potentially be toxic. To prevent cross contamination between test programmes and to reduce the risk of a fire propagating into the test apparatus from a failed test sample, it shall be ensured that the test apparatus is clean for oxygen service. Figure 1 provides two examples of a test apparatus.



a) Test apparatus with an optional orifice



b) Test apparatus without orifice

Key

1	oxygen buffer	8	filter
2	heating device	TT	thermocouple measuring the oxygen temperature
3	quick-opening valve	L_1	nominal length of the surge tube (cannon) – distance measured from the orifice to the inlet of the intermediate connector
4	pressure release valve	L_2	nominal length of the surge tube (cannon) – distance measured from the outlet plane of valve 3 to the inlet of the intermediate connector
5	surge tube (cannon) – with an overall length of L_1 or L_2 and a continuous inner diameter of d	d	nominal inner diameter of the surge tube (cannon)
6	intermediate connector	PT_1	pressure transducer or gauge – measuring the test pressure upstream of the quick-opening valve (slow measurement)
7	orifice	PT_2	pressure transducer for determination of the pressure rise time (fast measurement)

NOTE If there is no orifice, the effective length commences at the valve outlet sealing plane.

Figure 1 — Examples of test apparatus

A (40 ± 20) µm filter shall be installed upstream of the oxygen buffer or other equivalent means shall be provided to prevent particle contamination.

Another valve can be added in-line upstream of valve 3 to provide additional safety during maintenance. The inner diameter shall be such to not interfere with the performance test apparatus.

In order to remove air from the surge test apparatus, an additional valve (i.e. purge oxygen supply valve) can be added using a branch connection located either upstream or downstream of valve 3.