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Plinske jeklenke - Združljivost materialov za ventil in jeklenko s plinom - 1. del: Kovinski materiali (ISO 11114-1:2020)

Gas cylinders - Compatibility of cylinder and valve materials with gas contents - Part 1: Metallic materials (ISO 11114-1:2020)

Gasflaschen - Verträglichkeit von Werkstoffen für Gasflaschen und Ventile mit den in Berührung kommenden Gasen - Teil 1: Metallische Werkstoffe (ISO 11114-1:2020)

Bouteilles à gaz - Compatibilité des matériaux des bouteilles et des robinets avec les contenus gazeux - Partie 1: Matériaux métalliques (ISO 11114-1:2020)

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This European Standard was approved by CEN on 11 May 2020.

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European foreword

This document (EN ISO 11114-1:2020) has been prepared by Technical Committee ISO/TC 58 "Gas cylinders" in collaboration with Technical Committee CEN/TC 23 “Transportable gas cylinders” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2020, and conflicting national standards shall be withdrawn at the latest by December 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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Endorsement notice

The text of ISO 11114-1:2020 has been approved by CEN as EN ISO 11114-1:2020 without any modification.

INTERNATIONAL STANDARD

ISO 11114-1

Third edition
2020-05

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

Part 1: Metallic materials

Bouteilles à gaz — Compatibilité des matériaux des bouteilles et des robinets avec les contenus gazeux —
Partie 1: Matériaux métalliques

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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).

This third edition cancels and replaces the second edition (ISO 11114-1:2012), which has been technically revised. It also incorporates the Amendment ISO 11114-1:2012/Amd.1:2017. The main changes compared to the previous edition are as follows:

— inclusion of all changes in ISO 11114-1:2012/Amd.1:2017;

— clarification of the definition of dry;

— addition of notes in Table 1.

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

Industrial, medical and special gases (e.g. high-purity gases, calibration gases) can be transported or stored in gas cylinders. An essential requirement of the material from which such gas cylinders and their valves are manufactured is compatibility with the gas content.

Compatibility of cylinder materials with gas content has been established over many years by practical application and experience. Existing national and international regulations and standards do not fully cover this aspect.

This document is based on current international experience and knowledge.

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

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

Part 1: Metallic materials

1 Scope

This document provides requirements for the selection of safe combinations of metallic cylinder and valve materials and cylinder gas content.

The compatibility data given is related to single gases and to gas mixtures.

Seamless metallic, welded metallic and composite gas cylinders and their valves, used to contain compressed, liquefied and dissolved gases are considered.

NOTE In this document the term "cylinder" refers to transportable pressure receptacles, which also include tubes and pressure drums.

Aspects such as the quality of delivered gas product are not considered.

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

ISO 10286, *Gas cylinders — Terminology*

ISO 10297, *Gas cylinders — Cylinder valves — Specification and type testing*

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

ISO 11114-3, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 3: Autogenous ignition test for non-metallic materials in oxygen atmosphere*

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
competent person
person who has the necessary technical knowledge, experience and authority to assess and approve materials for use with gases and to define any special conditions of use that are necessary

3.2
acceptable
A
material/gas combination that is safe under normal conditions of use, provided that any indicated non-compatibility risks are taken into account

Note 1 to entry: Low levels of impurities can affect the acceptability of some single gases or gas mixtures.

3.3
not acceptable
N
material/single gas combination that is not safe under all normal conditions of use

Note 1 to entry: For gas mixtures special conditions may apply (see 6.2 and Table 1).

3.4
dry
state in which there is no free water in a cylinder under any service conditions, including at the highest expected operating pressure and at the lowest expected operating temperature

Note 1 to entry: For compressed gases at, for example, 200 bar and –20 °C, the maximum moisture content is not to exceed 5 ppmV, to avoid condensation of free water. For other temperatures and pressures, the maximum moisture content needed to avoid condensation of water will be different. Another source of moisture to be considered is the cylinder itself which implies appropriate drying procedures such as purging and vacuuming.

3.5
wet
state in which the conditions as defined for *dry* (3.4) are not met

3.6
gas mixture
combination of different single gases deliberately mixed in specified proportions

3.7
single gas
gas which does not contain deliberately added content of another gas or gases

4 Materials

4.1 General

The compatibility of most materials used to manufacture gas cylinders and valves is identified in this document.

Other materials whose compatibility is not identified in this document may be used if all compatibility aspects have been considered and validated by a competent person.

4.2 Cylinder materials

The most commonly used metallic materials for cylinders are (among others) carbon manganese steel, chromium molybdenum steel, chromium molybdenum nickel steel, stainless steel and aluminium alloys, as specified in the following documents:

— aluminium and aluminium alloys: ISO 6361-2, ISO 7866 and ISO 11118;

— steel: ISO 4706, ISO 9328-5, ISO 9809-1, ISO 9809-2, ISO 9809-3, ISO 11118 and ISO 11120;

— stainless steel: ISO 9809-4 and ISO 15510.

4.3 Valve materials

4.3.1 General

The most commonly used metallic materials for valve bodies and internal gas wetted parts are brass and other similar copper-based alloys, carbon steel, stainless steel, refined nickel and nickel alloys, Cu–Be (2 %) and aluminium alloys.

4.3.2 Particular considerations

4.3.2.1 In special cases, non-compatible materials may be used for non-oxidizing gases if suitably plated, protected or coated. This may only be done if all compatibility aspects have been considered and validated by a competent person for the entire life of the valve.

4.3.2.2 Special precautions, in accordance with ISO 11114-3 (which addresses testing, not precautions per se), shall be taken for oxidizing gases as specified in ISO 10156. In this case, non-compatible materials are *not acceptable* (see 3.3) for use in valves, even if plated, protected or coated.

4.3.2.3 For cylinder valves, compatibility in wet conditions shall be considered because of the high risk of contamination by atmospheric moisture and an airborne contaminant.

NOTE Reference is made in this document to stainless steels by their commonly used AISI identification numbers, i.e. 304. For example, the equivalent grades according to EN 10088-1 are as follows:

304	1.4301
304L	1.4306 and 1.4307
316	1.4401
316L	1.4404
316Ti	1.4571
321	1.4541
904L	1.4539

5 Compatibility criteria

5.1 General

Compatibility between a gas and the cylinder/valve material is affected by chemical reactions and physical influences, which can be classified into five categories:

— corrosion;

— stress corrosion cracking;

— hydrogen embrittlement;

— generation of dangerous products through chemical reaction;

— violent reactions, such as ignition.

Non-metallic components (valve sealing, gland packing, O-ring, etc.) shall be in accordance with ISO 11114-2.

Sealing or lubricating materials (when used) at the valve stem shall be compatible with the gas content.

NOTE Annex A gives the gas/materials NQSAB compatibility codes, for information.