SLOVENSKI STANDARD
oSIST prEN 17533:2023

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Plinasti vodik - Jeklenke in velike jeklenke za stacionarno shranjevanje

Gaseous hydrogen - Cylinders and tubes for stationary storage

Gasförmiger Wasserstoff - Flaschen und Großflaschen zur ortsfesten Lagerung

Hydrogène gazeux - Bouteilles et tubes pour stockage stationnaire

Ta slovenski standard je istoveten z: **prEN 17533**

ICS:

23.020.35	Plinske jeklenke	Gas cylinders
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Will supersede EN 17533:2020

English Version

Gaseous hydrogen - Cylinders and tubes for stationary storage

Hydrogène gazeux - Bouteilles et tubes pour stockage stationnaire

Gasförmiger Wasserstoff - Flaschen und Großflaschen zur ortsfesten Lagerung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 23.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17533:2023) has been prepared by Technical Committee CEN/TC 23 “Transportable gas cylinders”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 17533:2020.

prEN 17533:2023 includes the following significant technical changes with respect to EN 17533:2020:

— requirements for new design have been revised;

— addition of Figure A.1 Concept of Annex A;

— Annexes B and C have been revised.

Introduction

As the use of gaseous hydrogen evolves from the chemical industry into various emerging applications, such as fuel for fuel cells, internal combustion engines and other speciality hydrogen applications, new requirements are foreseen for seamless and composite pressure vessels, including higher number of pressure cycles.

Requirements covering pressure vessels for stationary storage of compressed gaseous hydrogen are listed in this document and are mainly intended to maintain or improve the level of safety for this application.

1 Scope

This document specifies the requirements for the design, manufacture and testing of cylinders, tubes and other pressure vessels of steel, stainless steel, aluminium alloys or of non-metallic construction material. These are intended for the stationary storage of gaseous hydrogen of up to a maximum water capacity of 10 000 l and a maximum allowable working pressure not exceeding 1 100 bar, of seamless metallic construction (Type 1) or of composite construction (Types 2, 3 and 4), hereafter referred to as pressure vessels.

NOTE Additional requirements with regard to assemblies (manifolded cylinders and tubes and other pressure vessels) are not covered by this document.

This document is not applicable to Type 2 and 3 vessels with welded liners.

This document is not applicable to pressure vessels used for solid, liquid hydrogen or hybrid cryogenic-high pressure hydrogen storage applications.

This document is not applicable to external piping which can be designed according to recognized standards.

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.

EN ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST) (ISO 306)*

EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2)*

EN ISO 1519, *Paints and varnishes — Bend test (cylindrical mandrel) (ISO 1519)*

EN ISO 2808, *Paints and varnishes — Determination of film thickness (ISO 2808)*

EN ISO 2812-1, *Paints and varnishes — Determination of resistance to liquids — Part 1: Immersion in liquids other than water (ISO 2812-1)*

EN ISO 4624, *Paints and varnishes — Pull-off test for adhesion (ISO 4624)*

EN ISO 6272-2, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 2: Falling-weight test, small-area indenter (ISO 6272-2)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1)*

EN ISO 7225, *Gas cylinders — Precautionary labels (ISO 7225)*

EN ISO 7866, *Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing (ISO 7866)*

EN ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227)*

EN ISO 9809 (all parts), *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing (ISO 9809)*

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

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

EN ISO 11114-4, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 4: Test methods for selecting steels resistant to hydrogen embrittlement (ISO 11114-4)*

ISO 11119-1, *Gas cylinders — Design, construction and testing of refillable composite gas cylinders and tubes — Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l*

ISO 11119-2, *Gas cylinders — Design, construction and testing of refillable composite gas cylinders and tubes — Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners*

ISO 11119-3, *Gas cylinders — Design, construction and testing of refillable composite gas cylinders and tubes — Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with non-load-sharing metallic or non-metallic liners or without liners*

EN ISO 11120, *Gas cylinders — Refillable seamless steel tubes of water capacity between 150 l and 3000 l — Design, construction and testing (ISO 11120)*

EN ISO 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature and step height (ISO 11357-2)*

EN ISO 11439, *Gas cylinders — High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles (ISO 11439)*

EN ISO 14130, *Fibre-reinforced plastic composites — Determination of apparent interlaminar shear strength by short-beam method (ISO 14130)*

EN ISO 16474-1, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 16474-1)*

EN ISO 16474-3, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps ()*

EN 13322-2, *Transportable gas cylinders — Refillable welded steel gas cylinders — Design and construction — Part 2: Stainless steel (ISO 16474-3)*

ASTM D3170/D3170M-14, *Standard Test Method for Chipping Resistance of Coatings*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

3.1.1
stationary storage
<stationary pressure vessel>
pressurized storage in a fixed location for a fixed purpose that is not transported while pressurized

3.1.2
Type 1 pressure vessel
metal seamless cylindrical pressure vessel

Note 1 to entry: All metal multi-layered non-seamless vessels are not covered in this document. For reference, several types of multi-layered pressure vessels are addressed by ASME BPVC Section VII and Chinese standards GB 150 and GB/T 26466.

3.1.3
Type 2 pressure vessel
hoop wrapped cylindrical pressure vessel with a load-sharing metal *liner* (3.1.12) and composite reinforcement on the cylindrical part only

3.1.4
Type 3 pressure vessel
fully wrapped cylindrical pressure vessel with a load-sharing metal *liner* (3.1.12) and composite reinforcement on both the cylindrical part and dome ends

3.1.5
Type 4 pressure vessel
fully wrapped cylindrical pressure vessel with a *non-load-sharing liner* (3.1.14) and composite reinforcement on both the cylindrical part and the dome ends

3.1.6
finished pressure vessel
pressure vessel, which is ready for use, typical of normal production, complete with identification marks and external coating including integral insulation specified by the manufacturer, but free from non-integral insulation or protection

Note 1 to entry: In the framework of this document, a tube or a cylinder is a finished pressure vessel.

3.1.7
batch of pressure vessels
batch of pressure liners
set of manufactured *finished pressure vessels* (3.1.6) or *liners* (3.1.12) subject to a manufacturing quality pass/fail criterion based on the results of specified tests performed on a specified number of units from that set

3.1.8
matrix
material that is used to bind and hold the fibres in place

3.1.9
composite overwrap
combination of fibres (including steel wire) and matrix (3.1.8)

3.1.10
thermoplastic material
plastic capable of being repeatedly softened by an increase of temperature and hardened by a decrease of temperature

3.1.11
thermosetting material
material capable of being changed into a substantially infusible and insoluble product when cured by heat or by other means, such as radiation and catalysts

Note 1 to entry: These materials are resins and include polymers such as polyesters, epoxides, acrylics, urethanes and phenolics.

Note 2 to entry: The resins may incorporate non-fibrous fillers, flame-retardants, pigments and stabilizers.

[SOURCE: ISO 25762:2009, 3.2.1]

3.1.12
liner
inner portion of the composite cylinder, comprising a metallic or non-metallic vessel, whose purpose is both to contain the gas and transmit the gas pressure to the fibres

3.1.13
load-sharing liner
liner (3.1.12) that has a *burst pressure* (3.1.33) of at least 5 % of the minimum burst pressure of the finished composite cylinder

3.1.14
non-load-sharing liner
liner (3.1.12) that has a *burst pressure* (3.1.33) less than 5 % of the nominal burst pressure of the finished composite cylinder

3.1.15
boss
dome shaped metallic component mounted on one end or on the two ends of a non-metallic *liner* (3.1.12) with a neck providing an opening and/or an external element of mechanical support

3.1.16
autofrettage
pressure application procedure which strains the metal *liner* (3.1.12) past its yield point sufficiently to cause permanent plastic deformation, resulting in the liner having compressive stresses and the fibres having tensile stresses when at zero internal gauge pressure

3.1.17
autofrettage pressure
pressure within the overwrapped composite pressure vessel at which the required distribution of stresses between the *liner* (3.1.12) and the *composite overwrap* (3.1.9) is established

3.1.18
pre-stress
process of applying *autofrettage* (3.1.16) or *controlled tension winding* (3.1.19)