Gaseous hydrogen - Cylinders and tubes for stationary storage

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NATIONAL FOREWORD

See Eesti standard EVS-EN 17533:2020 sisaldab Euroopa standardi EN 17533:2020 ingliskeelset teksti.	This Estonian standard EVS-EN 17533:2020 consists of the English text of the European standard EN 17533:2020.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 03.06.2020.	Date of Availability of the European standard is 03.06.2020.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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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 European Standard was approved by CEN on 13 August 2019.

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

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Contents

European foreword

This document (EN 17533:2020) has been prepared by 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of an identical text or by endorsement, at the latest by December 2020, and conflicting national standards shall be withdrawn at the latest by December 2020.

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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 standalone or manifolded (for some specific tests such as bonfire) 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 110 MPa, of seamless metallic construction (Type 1) or of composite construction (Types 2, 3 and 4), hereafter referred to as pressure vessels.

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)*

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

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

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

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

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

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

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

EN ISO 7225, *Gas cylinders — Precautionary labels*

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

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

EN ISO 9809-1, Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 *MPa*

EN ISO 9809-2, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa*

EN ISO 9809-3, *Gas cylinders —Refillable seamless steel gas cylinders — Design, construction and testing — Part 3: Normalized steel cylinders*

ISO 9809-4, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa*

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

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

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

ISO 11119-2, *Gas cylinders — Refillable composite gas cylinders and tubes — Design, construction and testing — 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 — Refillable composite gas cylinders and tubes — Design, construction and testing — Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450L with non-load-sharing metallic or non-metallic liners*

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

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

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

ISO 12108, *Metallic materials — Fatigue testing — Fatigue crack growth method*

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

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

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*

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

ASTM E647, *Standard Test Method for Measurement of Fatigue Crack Growth Rates*

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 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/

3.1.1
autofrettage
pressure application procedure which strains the metal *liner* (3.1.13) 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

3.1.2
autofrettage pressure
pressure within the overwrapped composite pressure vessel at which the required distribution of stresses between the *liner* (3.1.13) and the *composite overwrap* (3.1.6) is established

3.1.3
batch of pressure vessels
batch of pressure liners
set of manufactured *finished pressure vessels* (3.1.10) or *liners* (3.1.13) 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

3.1.4
boss
dome shaped metallic component mounted on one end or on the two ends of a non-metallic *liner* (3.1.13) with a neck providing an opening and/or an external element of mechanical support

3.1.5
burst pressure
highest pressure reached in a cylinder during a burst test

3.1.6
composite overwrap
combination of fibres (including steel wire) and *matrix* (3.1.15)

3.1.7
controlled tension winding
process used in manufacturing composite pressure vessels with metal *liners* (3.1.13) by which compressive stresses in the liner and tensile stresses in the *composite overwrap* (3.1.6) at zero internal pressure are obtained by winding the reinforcing fibres under controlled tension