

Transportable gas cylinders – Hoop wrapped and fully wrapped carbon composite cylinders and tubes for hydrogen

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>See Eesti standard EVS-EN 17339:2024 sisaldab Euroopa standardi EN 17339:2024 ingliskeelset teksti.</p> <p>Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 13.11.2024.</p> <p>Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.</p>	<p>This Estonian standard EVS-EN 17339:2024 consists of the English text of the European standard EN 17339:2024.</p> <p>This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.</p> <p>Date of Availability of the European standard is 13.11.2024.</p> <p>The standard is available from the Estonian Centre for Standardisation and Accreditation.</p>
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EUROPEAN STANDARD

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English Version

## Transportable gas cylinders - Hoop wrapped and fully wrapped carbon composite cylinders and tubes for hydrogen

Bouteilles à gaz transportables - Bouteilles et tubes frettés et entièrement bobinés en matériaux composites carbonés pour l'hydrogène

Ortsbewegliche Gasflaschen - Vollumwickelte Flaschen und Großflaschen aus Kohlenstoff-Verbundwerkstoffen für Wasserstoff

This European Standard was approved by CEN on 6 October 2024.

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## European foreword

This document (EN 17339:2024) 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of an identical text or by endorsement, at the latest by May 2025, and conflicting national standards shall be withdrawn at the latest by May 2025.

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.

This document supersedes EN 17339:2020.

EN 17339:2024 includes the following significant technical changes with respect to EN 17339:2020: introduction of Type 2 cylinders (hoop wrapped cylinders).

This document has been submitted for reference in:

- the RID and
- the technical annexes of the ADR.

**NOTE** These regulations take precedence over any clause of this document. It is emphasized that RID/ADR are being revised regularly at intervals of two years which may lead to temporary non-compliances with the clauses of this document.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

## Introduction

The purpose of this document is to provide a specification for the design, manufacture, inspection and testing of refillable, transportable carbon fully wrapped composite cylinders and tubes filled with hydrogen and protected in a frame such as a bundle or a trailer.

The specifications given are based on knowledge of, and experience with, materials, design requirements, manufacturing processes and control during manufacture of cylinders and tubes in common use in the countries of the CEN members.

For gas cylinders covered by RID/ADR, the maximum service pressure (maximum developed pressure at 65 °C) should not exceed the test pressure. Consequently, the safety factor applies to the test pressure since, whatever the gas, the maximum developed pressure ( $p_{\max}$ ) is, in any case, lower than or equal to the test pressure.

This document only covers compressed hydrogen (dedicated service), therefore, the safety factor is applied to the maximum developed pressure at 65 °C ( $p_{\max}$ ), which is the maximum accepted temperature by transport regulations.

Additionally, for assembly purposes, where the cylinders and tubes are transported with an inert gas at a limited pressure (e.g. no more than 30 bar) other than hydrogen, there may be special requirements, in the applicable regulation.

## 1 Scope

This document specifies minimum requirements for the materials, design, construction, type testing and routine manufacturing inspections of composite gas cylinders and tubes for compressed hydrogen.

NOTE 1 Unless specified in the text, for the purposes of this document, the word “cylinder” includes tubes.

This document applies to:

- fully wrapped composite cylinders (Type 3 and Type 4);
- hoop wrapped cylinders (Type 2);

with carbon fibres, intended to be permanently mounted in a frame (e.g. bundle or trailer) with a test pressure of not less than 300 bar, with:

- non-metallic liners (Type 4) or seamless metallic liners (for Type 2 and Type 3);
- a maximum water capacity of 3 000 l;
- a maximum working pressure of 1 000 bar;
- the product of working pressure times water capacity ( $p \times V$ ) not exceeding 1 000 000 bar.l.

NOTE 2 A glass fibre protective layer is sometimes applied to the external surface of the cylinder.

## 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 13807, *Transportable gas cylinders - Battery vehicles and multiple-element gas containers (MEGCs) - Design, manufacture, identification and testing*

EN ISO 75-1, *Plastics - Determination of temperature of deflection under load - Part 1: General test method (ISO 75-1)*

EN ISO 75-3, *Plastics - Determination of temperature of deflection under load - Part 3: High-strength thermosetting laminates (ISO 75-3)*

EN ISO 527-1, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1)*

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

EN ISO 1133-1, *Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method (ISO 1133-1)*

EN ISO 1183 (all parts), *Plastics — Methods for determining the density of non-cellular plastics*

EN ISO 1628-3, *Plastics - Determination of the viscosity of polymers in dilute solution using capillary viscometers - Part 3: Polyethylenes and polypropylenes (ISO 1628-3)*

EN ISO 2884-1, *Paints and varnishes - Determination of viscosity using rotational viscometers - Part 1: Absolute viscosity measurement with cone-plate measuring geometry at high shear rates (ISO 2884-1)*

EN ISO 3146, *Plastics - Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers by capillary tube and polarizing-microscope methods (ISO 3146)*

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

EN ISO 9809-1, *Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa (ISO 9809-1)*

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

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

EN ISO 10961, *Gas cylinders - Cylinder bundles - Design, manufacture, testing and inspection (ISO 10961)*

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)*

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 13341, *Gas cylinders - Fitting of valves to gas cylinders (ISO 13341)*

EN ISO 13769, *Gas cylinders - Stamp marking (ISO 13769)*

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

ISO 6721-11, *Plastics — Determination of dynamic mechanical properties — Part 11: Glass transition temperature*

ISO 10618, *Carbon fibre — Determination of tensile properties of resin-impregnated yarn*

ASTM D 2196-10, *Test methods for rheological properties of non-newtonian materials by rotational (Brookfield) viscometer*

ASTM D 2344/D 2344M-13, *Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates*

### 3 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

##### **ambient temperature**

temperature of surroundings varying between 0 °C and 35 °C (for test purposes only)

#### 3.2

##### **autofrettage**

pressure application procedure which strains the metal liner past its yield strength sufficient to cause permanent plastic deformation, and results in the liner having compressive stresses and the fibres having tensile stresses when at zero internal gauge pressure

[SOURCE: EN ISO 10286:2021, 3.3.4]

#### 3.3

##### **batch**

<of fibres, pre-impregnated fibres or components of the matrix system> homogeneous quantity of material, identified and certified as such by the supplier

#### 3.4

##### **batch**

<of metallic liners> quantity of liners of the same nominal diameter, thickness, length and design, made successively from the same material cast and subjected to the same heat treatment for the same length of time

#### 3.5

##### **batch**

<of non-metallic liners> quantity of liners of the same nominal diameter, thickness, length and design, made successively from the same batch of materials and subjected to the same manufacturing process

#### 3.6

##### **batch**

<of finished cylinders with liners> quantity of up to 200 finished cylinders, plus cylinders for destructive testing, of the same nominal diameter, thickness, length and design which may contain different batches of liners (providing the batches are nominally the same and have had the same treatments), fibres and matrix materials

#### 3.7

##### **burst pressure**

highest pressure reached in a cylinder or liner during a burst test

[SOURCE: EN ISO 10286:2021, 3.5.26, modified — “or liner” has been added.]