SLOVENSKI STANDARD
SIST EN 12245:2022

01-september-2022

Nadomešča:
SIST EN 12245:2009+A1:2012

Premične plinske jeklenke - Popolnoma obvite jeklenke iz kompozitnih materialov

Transportable gas cylinders - Fully wrapped composite cylinders

Ortsbewegliche Gasflaschen - Vollumwickelte Flaschen aus Verbundwerkstoffen

Bouteilles à gaz transportables - Bouteilles entièrement bobinées en matériaux composites

Ta slovenski standard je istoveten z: **EN 12245:2022**

ICS:

23.020.35	Plinske jeklenke	Gas cylinders

SIST EN 12245:2022 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12245

May 2022

ICS 23.020.35

Supersedes EN 12245:2009+A1:2011

English Version

Transportable gas cylinders - Fully wrapped composite cylinders

Bouteilles à gaz transportables - Bouteilles entièrement bobinées en matériaux composites

Ortsbewegliche Gasflaschen - Vollumwickelte Flaschen aus Verbundwerkstoffen

This European Standard was approved by CEN on 17 January 2022.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Turkey and United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 12245:2022 E

Contents

Page

European foreword

This document (EN 12245:2022) 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 November 2022, and conflicting national standards shall be withdrawn at the latest by November 2022.

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 12245:2009+A1:2011.

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 standard. 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 standard.

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, Turkey 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 fully wrapped composite cylinders and tubes.

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.

1 Scope

This document specifies minimum requirements for the materials, design, construction, prototype testing and routine manufacturing inspections of fully wrapped composite gas cylinders for compressed, liquefied and dissolved gases.

NOTE 1 For the purposes of this document, the word "cylinder" includes tubes (seamless transportable pressure receptacles of a water capacity exceeding 150 l and of not more than 3 000 l).

This document is applicable to cylinders that comprise a liner of metallic material (welded or seamless) or non-metallic material (or a mixture thereof), reinforced by a wound composite consisting of fibres of glass, carbon or aramid (or a mixture thereof) embedded in a matrix.

This document is also applicable to composite cylinders without liners.

This document is not applicable to gas cylinders which are partially covered with fibres and commonly called "hoop wrapped" cylinders. For hoop wrapped composite cylinders, see EN 12257.

NOTE 2 This document does not address the design, fitting and performance of removable protective sleeves. Where these are fitted, they are considered separately.

This document is primarily for compressed, liquefied and dissolved gases other than LPG.

NOTE 3 For dedicated LPG cylinders, see EN 14427.

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 12862, *Transportable gas cylinders - Specification for the design and construction of refillable transportable welded aluminium alloy gas cylinders*

EN 13322-1, *Transportable gas cylinders - Refillable welded steel gas cylinders - Design and construction - Part 1: Carbon steel*

EN 13322-2, *Transportable gas cylinders - Reffilable welded steel gas cylinders - Design and construction - Part 2: Stainless steel*

EN 14638-1, *Transportable gas cylinders - Refillable welded receptacles of a capacity not exceeding 150 litres - Part 1: Welded austenitic stainless steel cylinders made to a design justified by experimental methods*

EN 14638-3, *Transportable gas cylinders - Refillable welded receptacles of a capacity not exceeding 150 litres - Part 3: Welded carbon steel cylinders made to a design justified by experimental methods*

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

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 rotary viscometers - Part 1: Cone-and-plate viscometer operated at a high rate of shear (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 10156, *Gas cylinders - Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets (ISO 10156)*

EN ISO 10618, *Carbon fibre - Determination of tensile properties of resin-impregnated yarn (ISO 10618)*

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

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 11114-5:2022, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 5: Test methods for evaluating plastic liners (ISO 11114-5:2022)*

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

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

ISO 3341, *Textile glass — Yarns — Determination of breaking force and breaking elongation*

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

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*

ASTM D 2196-18e1, *Standard test method for rheological properties of non-Newtonian materials by rotational (Brookfield) viscosimeter*

ASTM D 2290-19a, *Standard test method for apparent hoop tensile strength of plastic or reinforced plastic pipe*

ASTM D 2291/D 2291M-16, *Standard practice for fabrication of ring test specimens for glass-resin composites*

ASTM D 2344/D 2344M-16, *Standard test method for short-beam strength of polymer matrix composite materials and their laminates*

ASTM D 4018-17, *Standard test methods for properties of continuous filament carbon and graphite fiber tows*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms, definitions and symbols 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 https://www.electropedia.org/

3.1.1
ambient temperature
temperature of surroundings varying between 10 °C and 35 °C (for test purposes only)

3.1.2
autofrettage
pressure application procedure which strains the metal liner past its yield point sufficiently 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 – “yield strength” has been replaced with “yield point”]

3.1.3
batch
<fibres, pre-impregnated fibres or components of the matrix system> homogeneous quantity of material, identified and certified as such by the supplier

3.1.4
batch
<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

3.1.5
batch
<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

3.1.6
batch
<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

3.1.7
batch
<finished cylinders with no liners> production quantity of up to 200 finished cylinders, plus cylinders for destructive testing, of the same nominal diameter, thickness, length and design

3.1.8
burst pressure
highest pressure reached in a cylinder or liner during the relevant burst test

[SOURCE: EN ISO 10286:2021, definition 732, modified — "or liner" and "relevant" have been added.]

3.1.9
composite overwrap
fibres and matrix taken together as a combined unit

3.1.10
cylinder without liner
cylinder having no liner and consisting wholly of the composite winding

3.1.11
elastomer
material which at ambient temperature can be stretched repeatedly to at least twice its original length and will return with force to approximately its original length immediately upon release of the stress

3.1.12
exterior coating
layer of clear or pigmented material applied to the cylinder as protection or for cosmetic purposes

3.1.13
fibre or strand
load-carrying part of the composite overwrap e.g. glass, aramid or carbon

3.1.14
fully wrapped cylinder
cylinder reinforced by wrapping to take both circumferential and longitudinal stress

3.1.15
liner
metallic or non-metallic vessel that contains the gas but can also contribute to the mechanical behaviour of the cylinder

[SOURCE: EN ISO 10286:2021, 3.1.3.3 modified]

3.1.16
non-load sharing liner
liner that has a burst pressure less than 5 % of the nominal burst pressure of the finished composite cylinder

3.1.17
non-metallic liner
liner made from thermoplastic, thermosetting or elastomer material, or a combination thereof

3.1.18
matrix
material that is used to bind and hold the fibres in place

[SOURCE: EN ISO 10286:2021, 3.1.3.2]

3.1.19
neck ring
ring securely attached externally to the cylinder or boss, with external thread or other means for attaching valve cap or guard

Note 1 to entry: Neck rings are not common on type 4 composite gas cylinders.

3.1.20
permanent protective attachment
integral part of the cylinder design affixed to composite cylinders, covering part of or the entire surface of the cylinder, providing functions during handling, transport and use

3.1.21
thermoplastic
plastics capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature

3.1.22
thermosetting material
plastics which, when cured by the application of heat or chemical means, change into a substantially infusible and insoluble product

3.1.23
test pressure
required pressure applied during a pressure test

[SOURCE: EN ISO 10286:2021, 3.5.24]

3.2 Symbols

p_b	actual burst pressure of composite cylinder, in bar above atmospheric pressure (1 bar = 10^5 Pa = 0,1 MPa)
p_{bL}	burst pressure of liner, in bar above atmospheric pressure (1 bar = 10^5 Pa = 0,1 MPa)
p_{bmin}	minimum burst pressure of composite cylinder obtained during design variant approval testing, in bar above atmospheric pressure (1 bar = 10^5 Pa = 0,1 MPa)
p_h	hydraulic test pressure of composite cylinder, in bar above atmospheric pressure (1 bar = 10^5 Pa = 0,1 MPa)
p_{max}	maximum developed pressure at 65 °C, in bar above atmospheric pressure (1 bar = 10^5 Pa = 0,1 MPa)

4 Design and manufacture

4.1 General

A fully wrapped composite gas cylinder may be manufactured with a metallic or non-metallic liner or without a liner. The composite overwrap shall not be manufactured from two or more parts joined together regardless of the joining methods (e.g. using adhesive).

An optional exterior coating or additional fibre layers may be used to provide external protection. When this is an integral part of the design, it shall not be removed.

The cylinder may also include additional parts (e.g. neck rings and foot rings).

Cylinders shall be designed with one or two openings along the central axis only.

A permanent protective attachment (PPA) is always an integral part of the cylinder design. It shall be permanently fixed to the cylinder such that they cannot be removed during service without destroying them, or by use of special tools. Under certain conditions, such PPA can be replaced following the manufacturer's instructions.

4.2 Liner

4.2.1 Metallic liners

Metallic liners shall be manufactured in accordance with the relevant sections of:

a) seamless steel liners: EN ISO 9809-1, EN ISO 9809-2, EN ISO 11120, as appropriate;

b) seamless stainless steel liners: ISO 9809-4;

c) seamless aluminium alloy liners: EN ISO 7866;

d) welded steel liners: EN 13322-1 or EN 14638-3, as appropriate;

e) welded stainless steel liners: EN 13322-2 or EN 14638-1, as appropriate;

f) welded aluminium liners: EN 12862.

The relevant sections are those covering materials, thermal treatments, neck design, construction and workmanship and mechanical tests.

The liner material shall be compatible with the gases intended to be used as determined by EN ISO 11114-1.

Steel liners with a tensile strength above 950 MPa shall be qualified according to EN ISO 11114-4 for embrittling gases.

NOTE This excludes the design requirements, since these are specified by the manufacturer for the design of the composite cylinder. For liners with water capacity above 150 l manufactured of stainless steel, aluminium or welded steel, the relevant sections of the appropriate standard also apply.

4.2.2 Non-metallic liners

A cylinder with a non-metallic liner shall be designed as if the liner will be non-load sharing. The liner material shall be compatible with the gases intended for use as recommended in EN ISO 11114-2 or it can be demonstrated by suitable testing.

NOTE EN ISO 11114-5:2022 specifies some gas compatibility test methods (on samples and/or cylinders) to evaluate plastic materials suitable for use in the manufacture of liners.

Where a metal end boss is used in a non-metallic liner, it shall be considered part of the liner material and shall fulfil the material requirements specified in the relevant standard, as listed in 4.2.1. Other materials are acceptable if compatibility is demonstrated by testing according to EN ISO 11114-4 or if it is accepted by design standards (e.g. EN ISO 7866). When the metal end boss is made of brass, the material shall fulfil the requirements in relevant sections of EN ISO 11114-1 and EN 12165.

The drawing of the liner shall include the specification of the material and material properties of the boss. Important material properties shall be specified in the design and are those such as:

a) minimum yield stress;

b) minimum tensile strength;

c) minimum elongation of the boss material;

d) compatibility with the contained gas as determined by EN ISO 11114-1.

The metal end boss bearing the cylinder thread shall be designed to withstand the torque applied in fitting the valve to the cylinder and the tests specified in Test 16 (for taper threads only see 5.2.16) and Test 17 (see 5.2.17).

4.2.3 Design drawing

A fully dimensioned drawing of the liner shall be supplied which includes the specification of the material and material properties. Material and liner properties to be specified on the drawing are:

a) for metallic liners:

   1) minimum yield stress;

   2) minimum tensile strength;

   3) minimum elongation;

   4) liner proof pressure defined by the manufacturer for the leak test (for welded liners);

   5) minimum burst pressure;

   6) weld profile (see ISO 11119-4:2016, 7.3.1) and procedure specification, if applicable;

   7) compatibility with the contained gas as determined by EN ISO 11114-1;

b) for non-metallic liners:

   1) density;

   2) melting point for thermoplastics as determined by EN ISO 3146 (or EN ISO 11357-3);

   3) heat distortion temperature for thermosetting materials as determined by EN ISO 75-1, (EN ISO 75-2);

   4) auto-ignition temperature in oxygen as determined by EN ISO 11114-3 (for cylinders intended for air and oxidising gases (see EN ISO 10156 for definition of oxidising gases));

   5) glass transition temperature as determined by ISO 6721-11 (or EN ISO 11357-2) (differential scanning calorimetry);

   6) composition (e.g. datasheet); additive systems constituting more than 10 % of the total composition shall be defined individually as components of the liner;

   7) compatibility with the contained gas as recommended by EN ISO 11114-2 or demonstrated by suitable testing;

   8) end boss design in accordance with 4.2.2.