SLOVENSKI STANDARD
SIST EN ISO 11623:2002

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Premiļne plinske jeklenke - Periodiļni nadzor in preskus jeklenk iz kompozitnih mas (ISO 11623:2002)

Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders (ISO 11623:2002)

Ortsbewegliche Gasflaschen - Wiederkehrende Prüfung von Gasflaschen aus Verbundwerkstoffen (ISO 11623:2002)

Bouteilles a gaz transportables - Contrôles et essais périodiques des bouteilles a gaz en matériaux composites (ISO 11623:2002)

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Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders (ISO 11623:2002)

Bouteilles à gaz transportables - Contrôles et essais périodiques des bouteilles à gaz en matériau composite (ISO 11623:2002)

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This European Standard was approved by CEN on 8 March 2001.

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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 Management Centre has the same status as the official versions.

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Contents

Foreword

This document (EN ISO 11623:2002) has been prepared by Technical Committee CEN/TC 23 "Transportable gas cylinders", the secretariat of which is held by BSI, in collaboration with Technical Committee ISO/TC 58 "Gas cylinders".

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of an identical text or by endorsement, at the latest by September 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports the objectives of the framework Directives on Transport of Dangerous Goods.

This European Standard has been submitted for reference into the RID and/or or in the technical annexes of the ADR. Therefore in this context the standards listed in the normative references and covering basic requirements of the RID/ADR not addressed within the present standard are normative only when the standards themselves are referred to in the RID and/or in the technical annexes of the ADR.

Annexes A, C and D are informative.

Annex B and ZA are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The principal aim of periodic inspection and testing is that at the completion of the test the cylinders may be reintroduced into service for a further period of time. It is not possible to identify all considerations for inspecting and re-testing of composite cylinders in this publication. Questions regarding specific cylinders should be directed to the manufacturer.

1 Scope

This standard specifies the requirements for periodic inspection and testing of hoop wrapped and fully wrapped composite transportable gas cylinders, with aluminium, steel or non-metallic liners or of linerless construction, intended for compressed, liquefied or dissolved gases under pressure, of water capacity from 0,5 l up to 450 l.

NOTE As far as practicable, this standard may also be applied to cylinders of less than 0,5 l water capacity.

This standard specifies the requirements for periodic inspection and testing to verify the integrity of such gas cylinders for further service.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 629-2:1996, *Transportable gas cylinders - 25E taper thread for connection of valves to gas cylinders - Part 2: Gauge inspection*

EN 1089-1, *Transportable gas cylinders — Gas cylinder identification (excluding LPG) — Part 1: Stampmarking*

EN 1089-2, *Transportable gas cylinders — Gas cylinder identification (excluding LPG) — Part 2: Precautionary labels*

EN 1089-3, *Transportable gas cylinders — Gas cylinder identification — Part 3: Colour coding*

EN 1795, *Transportable gas cylinders (excluding LPG) — Procedures for change of gas service*

prEN 1802, *Transportable Gas cylinders — Periodic inspection and testing of seamless aluminium alloy gas cylinders*

prEN 1968, *Transportable gas cylinders — Periodic inspection and testing of seamless steel gas cylinders*

prEN 13096, *Transportable gas cylinders — Filling conditions for single gases*

ISO 32:1977, *Gas cylinders for medical use — Marking for identification of content*

ISO 6406: 1992, *Periodic inspection and testing of seamless steel gas cylinders*

ISO 7225:1994, *Gas cylinders — Precautionary labels*

ISO 10461: 1993, *Seamless aluminium-alloy gas cylinders; periodic inspection and testing*

ISO 11114-1:1997, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*

ISO 11114-2:1997, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials*

ISO 11191:1997, *Gas cylinders — 25E taper thread for connection of valves to gas cylinders — Inspection gauges*

ISO 11621: 1997, *Gas cylinders — Procedures for change of gas service*

ISO 13341:1997, *Transportable gas cylinders — Fitting of valves to gas cylinders*

ISO 10298, *Determination of toxicity of a gas or gas mixture*

ISO 13769, *Gas cylinders — Stamp marking*

3 Terms and definitions

For the purposes of this European standard, the following terms and definitions apply.

3.1
burst pressure
maximum pressure attained during a burst test

3.2
composite overwrap
fibres and matrix taken together as a combined unit

3.3
exterior coating
layer of material applied to the cylinder as a protective coating or for cosmetic purposes

NOTE Not all composite cylinders will have a special exterior coating.

3.4
fibre
load-carrying part of the composite overwrap e.g. glass, aramid and carbon

3.5
fully wrapped composite cylinder without liner
cylinder manufactured only from continuous fibre strands in a resin matrix wrapped in both circumferential and longitudinal directions

3.6
fully wrapped composite cylinder with liner
steel, aluminium alloy or non-metallic liner wrapped with continuous fibre strands in a resin matrix both circumferentially and longitudinally

3.7
hoop wrapped composite cylinder
seamless steel or aluminium alloy liner wrapped with continuous fibre strands or steel wire around only the cylindrical body of the liner, leaving the metal in the neck and base regions exposed. The fibre strands are embedded in a resin matrix

3.8
identification label
label containing the permanent markings required by the relevant design document and EN 1089-1 or ISO 13769

3.9
LC_{50}
50 % lethal concentration, as defined in ISO 10298

3.10
lifetime
service life of the cylinder, if specified on the design drawing

3.11
liner
inner portion of the composite cylinder designed both to contain the gas and transmit the gas pressure to the composite overwrap. For hoop wrapped cylinders this provides a substantial structural strength.

3.12
non-metallic liner
liner made from thermoplastic, thermosetting, or elastomer material

3.13
protective sleeve
removable transparent or non-transparent sleeve fitted to the outside surface of the cylinder

3.14
repair
minor refurbishment performed by competent persons under controlled conditions as described in 7.4, e.g. repair of resin matrix

3.15
resin matrix
material which is used to bind and hold the fibres in place. It is usually a thermoplastic or thermosetting resin

3.16
rejected cylinder
cylinder not fit for service in its present condition

3.17
toxic gases
when LC_{50} > 200 p.p.m. V/V but ≤ 5 000 p.p.m. V/V, in accordance with ISO 10298

3.18
very toxic gases
when LC_{50} ≤ 200 p.p.m. V/V, in accordance with ISO 10298

4 Intervals between periodic inspection and testing

A cylinder shall fall due for periodic inspection and test on its first receipt by a filler after the expiry of the interval in Tables 1 to 4. However, a shorter period than that inTables 1 to 4 may be stipulated by the inspection body for the first re-test only.

There is no general requirement for the user to return a gas cylinder before the contents have been used even though the test interval may have lapsed. When the lifetime has expired, the cylinder shall not be refilled and shall be removed from service when presented for the next filling (see clause 13).

In the case of cylinders used for emergency purposes it is the responsibility of the owner or user to submit it for a periodic inspection within the specified interval.

The lists of gases in Tables 1 to 4 are intended as guides only. Reference shall be made to the manufacturer or inspection body if there is a question on the re-test period for specific gases.

Table 1 — Intervals for aluminium alloy liners ([a])

Description	Gas ([c])	Period (Years)
Compressed gases	e.g. Air, Ar, He, H_2, Ne, N_2, O_2, CH_4, CO and compressed gas mixtures	5 or 10 (see [b] and [d])
Liquefied gases	e.g. CO_2, N_2O and liquefied gas mixtures	
Very toxic gases $LC_{50} \leq 200$ p.p.m. V/V	e.g. AsH_3, PH_3	3

[a] Certain requirements may necessitate a shorter time interval e.g. presence of mercury in hydrogen, polymerisation and decomposition reactions. The compatibility of the gas to be filled with aluminium alloys shall be checked in accordance with ISO 11114-1.
[b] For cylinders used for underwater operations and self-contained breathing apparatus, the re-test period shall not exceed five years.
[c] This list of gases is not exhaustive. Gases shall be categorized in accordance with prEN 13096.
[d] The longer test period may apply for cylinders of known designs and safe experience provided approval has been obtained from the competent authority and the manufacturer.

Table 2 — Intervals for steel liners ([a])

Description	Gas ([g])	Period (Years)
Compressed gases	e.g. Ar, Xe, Ne, N_2, CH_4, and compressed gas mixtures	5 or 10 (see [f])
	H_2	5 or 10 (see [e] and [f])
	Air, O_2	5 or 10 (see [b] and [f])
	CO	2,5 or 5 (see [d])
Underwater breathing apparatus	Air, O_2	2,5 (visual) and 5 (full)
Liquefied gases	e. g. CO_2, N_2O and liquefied gas mixtures	5 or 10 (see [c] and [f])
Corrosive gases (to cylinder material)	e. g. Cl_2, F_2, NO, SO_2, HF	3
Very toxic gases $LC_{50} \leq 200$ p.p.m. V/V	e. g. AsH_3, PH_3	3
Gas mixtures	a) All mixtures except b) below	a) Shortest period of any component
	b) Mixtures containing very toxic gases	b) If the toxicity of the final mixture is such that $LC_{50} > 200$ p.p.m. V/V, a 5 or 10 year period shall apply (see Note 6). If the toxicity of the final mixture is such that $LC_{50} \leq 200$ p.p.m. V/V, a three year period shall apply.

[a] Certain requirements may necessitate a shorter time interval e.g. the dew point of the gas, polymerisation reactions and decomposition reactions, cylinder design specifications, change of gas service etc. The compatibility of steel with the gas to be filled shall be checked in accordance with ISO 11114-1.

[b] For cylinders used for self-contained breathing apparatus, the re-test period shall not exceed five years.

[c] The longer test period may be used provided the dryness of the product and that of the filled cylinder are such that there is no free water. This condition shall be proven and documented within the quality system of the filler. If the conditions above cannot be fulfilled the cylinder shall be visually and internally inspected every five years and fully re-tested every 10 years.

[d] The longer test period may be used provided the dryness of the product and that of the filled cylinder are such that there is no free water. This condition shall be proven and documented within the quality system of the filler. If the conditions above cannot be fulfilled the cylinder shall be visually and internally inspected every 2,5 years and fully re-tested every five years.

[e] Particular attention shall be paid to the tensile strength and surface condition of such cylinders. Cylinders not conforming to the special hydrogen requirements specified in ISO 11114-1 shall be withdrawn from hydrogen service. Procedures for change of gas service shall be in accordance with EN 1795 or ISO 11621.

[f] The longer test period can apply for cylinders of known designs and safe experience provided approval has been obtained from the competent authority and the manufacturer.

[g] This list of gases is not exhaustive. Gases shall be categorized in accordance with prEN 13096.

Table 3 — Intervals for non-metallic liners ([a])

Description	Gas (d)	Period (Years)
Compressed gases	e. g. Air, Ar, He, H_2, Ne, N_2, O_2, CH_4, CO and compressed gas mixtures	5 or 10 (See b and e)
Liquefied gases	e. g. CO_2, N_2O and liquefied gas mixtures	
Very toxic gases $LC_{50} \leq 200$ p.p.m. V/V	e. g. AsH_3, PH_3	3 (See c and e)

[a] Certain requirements may necessitate a shorter time interval e. g. presence of mercury in hydrogen, polymerisation and decomposition reactions. The compatibility of the gas to be filled with non-metallic liners shall be checked in accordance with ISO 11114-2.
[b] For cylinders used for underwater operations and self-contained breathing apparatus, the re-test period shall not exceed five years.
[c] For mixtures involving these gases, if the toxicity of the final product $LC_{50} > 200$ p.p.m V/V, a 5 or 10 year period shall apply (see [e]).
[d] This list of gases is not exhaustive. Gases shall be categorized in accordance with prEN 13096.
[e] The longer test period may apply for cylinders of known designs and safe experience provided approval has been obtained from the competent authority and the manufacturer.

Table 4 — Cylinders without liners ([a])

Description ([e])	Gas ([c])	Period (Years)
Compressed gases	e. g. Air, Ar, He, H_2, Ne, N_2, O_2, CH_4, CO and compressed gas mixtures	5 or 10 (See [b] and [d])
Liquefied gases	e. g. CO_2, N_2O and liquefied gas mixtures	

[a] Certain requirements may necessitate a shorter time interval e. g. presence of mercury in hydrogen, polymerisation and decomposition reactions. The compatibility of the gas to be filled with non-metallic materials shall be checked in accordance with ISO 11114-2.
[b] For cylinders used for underwater operations and self-contained breathing apparatus, the re-test period shall not exceed five years.
[c] This list of gases is not exhaustive. Gases shall be categorized in accordance with prEN 13096.
[d] The longer test period may apply for cylinders of known designs and safe experience provided approval has been obtained from the competent authority and the manufacturer.
[e] Very toxic gases shall not be filled into this type of cylinder.

5 Procedures for periodic inspection and test

5.1 List of procedures

The inspection, testing and repair of composite cylinders shall be carried out only by persons competent in the subject to ensure that the cylinders are fit for continued safe use.

Each cylinder shall be submitted to periodic inspection and test. The following procedures form the requirement for such inspection and test and are explained more fully in later clauses:

– Identification of cylinder and preparation for inspection and test – (see clause 6);

– External visual Inspection – (see clause 7);

– Internal visual inspection – (see clause 8);

– Supplementary tests – (see clause 9);

– Pressure test – (see clause 10);

– Inspection of valve – (see clause 11);

– Final operations – (see clause 12);

– Rejection and rendering cylinders unserviceable – (see clause 13).

The internal visual examination (see clause 8) shall be carried out before the pressure test (see clause 10). It is recommended that the other tests are performed in the sequence listed above.

Cylinders which fail the inspection or testing shall be rejected (see clause 13). Where a cylinder passes the above listed procedures but when the condition of the cylinder remains in doubt, additional testing shall be performed to confirm its suitability for continued service or the cylinder shall be rendered unserviceable. Depending on the reason for the rejection cylinders may be recovered and/or repaired (see 7.4).

5.2 Heat exposure

When cylinders are refurbished during periodic inspection it may be necessary to expose them to heat, for example during initial cleaning, or as part of a stoving operation when painting or powder coating the cylinder. This heat exposure may affect the mechanical properties of the liners and/or the finished composite cylinder.

Therefore the maximum temperature to which these cylinders are exposed shall be controlled and shall not exceed 70° C for a period of 24 h, unless otherwise recommended by the cylinder manufacturer. In such cases the alternative limits shall be clearly indicated on the cylinder or otherwise.

6 Identification of cylinder and preparation for inspection and test

Before any work is carried out the relevant cylinder data (e. g. see EN 1089-1 or ISO 13769) and the gas contents (e.g. see EN 1089-2 or ISO 7225) shall be identified. The cylinder shall be depressurised and emptied in a safe controlled manner before proceeding. A method of dealing with cylinders with inoperative or blocked valves is outlined in annex A. The valve may then be removed.

Cylinders with unknown gas contents or those which cannot be safely emptied of gas shall be set aside for special handling.

7 External visual inspection

7.1 Preparation

The composite material and other integral parts of the composite cylinder shall not be removed prior to inspection. Where a transparent protective sleeve is used it may be left in place as long as the composite wrapping can be inspected effectively without removal. Where a non-transparent protective sleeve is used it shall be removed and only refitted after the pressure test.

Each cylinder shall be cleaned and have all loose paint, coatings, tar, oil or other foreign matter removed from its external surface by a suitable method (e.g. washing, brushing, controlled water jet cleaning, plastic bead blasting). Grit and shot blasting are not suitable. Chemical cleaning agents, paint strippers and solvents which are harmful to the composite cylinder or its materials shall not be used.

Composite cylinders also differ from their metal counterparts in that they may be repaired by a competent person where only limited damage has taken place (see 7.4). These limits are defined in Table 5 and following repair cylinders shall always be subjected to a pressure test before being returned to service.

7.2 Inspection procedures

The acceptance/rejection criteria given in Table 5 shall be followed, as a minimum. The inspection body shall contact the cylinder manufacturer to establish whether there are more stringent rejection criteria for the particular cylinder design. In case of doubt the inspection body shall make reference to the design drawing of the prototype. In the case where composite cylinders have been designed and manufactured for a limited lifetime, this is indicated on the cylinder marking. Therefore, the marking shall first be checked to ensure that such cylinders are within their lifetime. In the case of hoop wrapped cylinders the exposed external metal surfaces, especially the interface with the overwrapping, shall be inspected in accordance with the respective

parent periodic inspection and testing standard: i.e. prEN 1968 or ISO 6406 and prEN 1802 or ISO 10461 for steel and aluminium respectively.

The external surface shall be inspected for damage to the composite. There are three levels of damage that shall be considered of which only two may be repaired (see Table 5).

7.3 Types of damage

7.3.1 General

Damage to the composite overwrap can take a number of forms and examples of these are described in 7.3.2 to 7.3.5. The acceptance/rejection criteria are specified in Table 5, which refers to defined damage levels and the types of damage described in 7.3.2 to 7.3.5. Great care shall be taken to establish the total extent of damage from impact (see 7.3.4) and delamination (see 7.3.5) as surface appearance may not indicate the full extent of the damage. General damage to the cylinder is described in 7.3.6 to 7.3.11.

Annex B specifies additional damage criteria for steel wire wound aluminium alloy cylinders.

7.3.2 Abrasion damage (see Figures 1a) to 1c))

Abrasion damage is caused by wearing, grinding or rubbing away by friction. Minor abrasion damage to the protective coating or paint is shown in Figures 1a) and 1b). "Flat spots" evident on the surface could indicate excessive loss of composite overwrap thickness (see Figure 1c)).

7.3.3 Damage from cuts (see Figures 2a) to 2b))

Cuts or gouges are caused by contact with sharp objects in such a way as to cut into the composite overwrap, reducing its thickness at that point.

7.3.4 Impact damage (see Figures 3a) to 3b))

Impact damage may appear as hairline cracks in the resin, or delamination or cuts of the composite overwrap.

7.3.5 Delamination (see Figure 4)

Delamination is a separation of layers of strands, or of the strands themselves, of the composite overwrap. It may also appear as a whitish patch, like a blister or an air space beneath the surface.

7.3.6 Heat or fire damage (see Figures 5a) and 5b))

Heat or fire damage may be evident by discolouration, charring or burning of the composite overwrap, labels, paint or non-metallic components of the valve.

Where the composite overwrap is only soiled from smoke or other debris and is found to be intact underneath (e. g. no burning of the resin), the cylinder may be returned to service.
Cylinders with damage greater than this shall be rendered unserviceable.

7.3.7 Structural damage

A cylinder shall be rendered unserviceable if there is any evidence of abnormal bulges, distorted valve connections, depressions not originally designed, or if, by visual examination of the cylinder interior, there is evidence of damage involving deformation of the liner.

7.3.8 Chemical attack (see Figure 6)

Chemical attack would appear as the dissolution of the resin matrix surrounding the fibres, the cylinder surface feeling "sticky" when touched. The cylinder shall be rendered unserviceable and the manufacturer be contacted for guidance.