SLOVENSKI STANDARD
SIST EN 13110:2023

01-april-2023

Nadomešča:
SIST EN 13110:2012+A1:2017

Oprema in pribor za utekočinjeni naftni plin (UNP) - Premične ponovno polnljive varjene jeklenke iz aluminija za UNP - Konstruiranje in izdelava

LPG equipment and accessories - Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG) - Design and construction

Flüssiggas-Geräte und Ausrüstungsteile - Ortsbewegliche wiederbefüllbare geschweißte Flaschen aus Aluminium für Flüssiggas (LPG) - Auslegung und Bau

Equipements pour gaz de pétrole liquéfiés et leurs accessoires - Bouteilles soudées transportables et rechargeables en aluminium pour gaz de pétrole liquéfié (GPL) - Conception et construction

Ta slovenski standard je istoveten z: **EN 13110:2022**

ICS:

23.020.35	Plinske jeklenke	Gas cylinders
77.150.10	Aluminijski izdelki	Aluminium products

SIST EN 13110:2023 **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13110

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English Version

LPG equipment and accessories - Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG) - Design and construction

Équipements pour gaz de pétrole liquéfiés et leurs accessoires - Bouteilles soudées transportables et rechargeables en aluminium pour gaz de pétrole liquéfié (GPL) - Conception et construction

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This European Standard was approved by CEN on 28 November 2022.

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European foreword

This document (EN 13110:2022) has been prepared by Technical Committee CEN/TC 286 “Liquefied petroleum gas equipment and accessories”, the secretariat of which is held by NSAI.

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of an identical text or by endorsement, at the latest by June 2023, and conflicting national standards shall be withdrawn at the latest by June 2023.

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 13110:2012+A1:2017.

EN 13110:2022 includes the following significant technical changes with respect to EN 13110:2012+A1:2017:

— revision to 5.7 Neck design; and

— revision to 5.9 Valve protection.

This document has been submitted for reference in:

— the RID [10]; and/or

— the technical annexes of the ADR [9].

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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 might lead to temporary non-compliances with the clauses of this document.

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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.

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Introduction

This document calls for the use of substances and procedures that can be injurious to health and/or the environment if adequate precautions are not taken. It refers only to technical suitability: it does not absolve the user from their legal obligations at any stage.

Protection of the environment is a key political issue in Europe and elsewhere. For CEN/TC 286 this is covered in CEN/TS 16765 [2] and this Technical Specification is to be read in conjunction with this document. The Technical Specification provides guidance on the environmental aspects to be considered regarding equipment and accessories produced for the LPG industry and the following is addressed:

a) design;

b) manufacture;

c) packaging;

d) use and operation; and

e) disposal.

Users are advised to develop an environmental management policy. For guidance see ISO 14000 series.

Provisions need to be restricted to a general guidance. Limit values are specified in national laws.

It has been assumed in the drafting of this document that the execution of its provisions is entrusted to appropriately qualified and experienced people.

All pressures are gauged unless otherwise stated.

In this document the unit bar is used, due to its universal use in the field of technical gases. It should, however, be noted that bar is not an SI unit, and that the corresponding SI unit for pressure is Pa (1 bar = 10^5 Pa = 10^5 N/m^2).

NOTE This document requires measurement of material properties, dimensions and pressures. All such measurements are subject to a degree of uncertainty due to tolerances in measuring equipment, etc. It might be beneficial to refer to the leaflet “measurement uncertainty leaflet” SP INFO 2000 27 [12].

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1 Scope

This document specifies minimum requirements for material, design, construction and workmanship, testing and examination during the manufacture of transportable refillable welded aluminium liquefied petroleum gas (LPG) cylinders, having a water capacity from 0,5 l up to and including 150 l, exposed to ambient temperature.

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 10204:2004, *Metallic products — Types of inspection documents*

EN 12816, *LPG equipment and accessories — Transportable refillable LPG cylinders — Disposal*

EN 14717, *Welding and allied processes — Environmental check list*

EN 14784-1, *Non-destructive testing — Industrial computed radiography with storage phosphor imaging plates — Part 1: Classification of systems*

EN 14894, *LPG equipment and accessories — Cylinder and drum marking*

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EN ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test (ISO 4136)*

EN ISO 5173, *Destructive tests on welds in metallic materials — Bend tests (ISO 5173)*

EN ISO 5178, *Destructive tests on welds in metallic materials — Longitudinal tensile test on weld metal in fusion welded joints (ISO 5178)*

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EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

EN ISO 9606-2, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys (ISO 9606-2)*

EN ISO 9712:2022, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712:2021)*

EN ISO 10042:2018, *Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections (ISO 10042:2018)*

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

EN ISO 11117, *Gas cylinders — Valve protection caps and guards — Design, construction and tests (ISO 11117)*

EN ISO 14731:2019, *Welding coordination — Tasks and responsibilities (ISO 14731:2019)*

EN ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*

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EN ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1)*

EN ISO 15614-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys (ISO 15614-2)*

EN ISO 16371-2, *Non-destructive testing — Industrial computed radiography with storage phosphor imaging plates — Part 2: General principles for testing of metallic materials using X-rays and gamma rays (ISO 16371-2)*

EN ISO 17636-1:2022, *Non-destructive testing of welds — Radiographic testing — Part 1: X- and gamma-ray techniques with film (ISO 17636-1:2022)*

EN ISO 17636-2:2022, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors (ISO 17636-2:2022)*

EN ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints (ISO 17637)*

EN ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds (ISO 17639)*

EN ISO 19232-1, *Non-destructive testing — Image quality of radiographs — Part 1: Determination of the image quality value using wire-type image quality indicators (ISO 19232-1)*

EN ISO 19232-2, *Non-destructive testing — Image quality of radiographs — Part 2: Determination of the image quality value using step/hole-type image quality indicators (ISO 19232-2)*

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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
liquefied petroleum gas
LPG
low pressure liquefied gas composed of one or more light hydrocarbons which are assigned to UN 1011, UN 1075, UN 1965, UN 1969 or UN 1978 only and which consists mainly of propane, propene, butane, butane isomers, butene with traces of other hydrocarbon gases

3.1.2
cylinder
transportable pressure receptacle with a water capacity not exceeding 150 l

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3.1.3
yield strength
<aluminium> 0,2 % proof strength R_{ea} (non-proportional elongation) for aluminium alloys, and the 1 % proof strength for unalloyed aluminium in the unhardened state

3.1.4
heat treatment
solution heat treatment, quenching and artificial or natural ageing that ensures the strength values required

3.2 Symbols

a	Calculated minimum thickness of the cylindrical part, in mm.
A_a	Actual elongation after fracture, determined by the tensile test specified in 7.4, in %.
A_{min}	Minimum elongation after fracture, guaranteed by the manufacturer for the finished cylinder, in %.
b	Calculated minimum thickness of the end of the cylinder, in mm.
C	Shape factor (see Table 2, Figure 2 and Figure 3).
d	Outside diameter of the bend test former, in mm (see Figure 6 and Figure 7).
D	Outside diameter of the cylinder as given in the design drawing, in mm (see Figure 1).
h	Height of the cylindrical part of the end, in mm (see Figure 1).
H	Outside height of the domed part of the end, in mm (see Figure 1).
L	Length of the cylinder, in mm.
n	Ratio of diameter of bend test former to the thickness of the test piece (see Table 4).
P_b	Maximum pressure attained during the burst test, in bar.
P_h	Minimum permissible test pressure, in bar.
r	Inside knuckle radius of the end, in mm (see Figure 1).
R	Inside dishing radius of the end, in mm (see Figure 1).
R_{ea}	Actual value of yield strength, determined by the tensile test specified in 7.4, in N/mm^2.
R_{eg}	Minimum value of yield strength, guaranteed by the manufacturer for the finished cylinder, in N/mm^2.
R_{ma}	Actual value of tensile strength, determined by the tensile test specified in 7.4, in N/mm^2.
R_{mg}	Minimum value of tensile strength, guaranteed by the manufacturer for the finished cylinder, in N/mm^2.
v	Utilization factor for the permissible calculated tension (stress reduction factor).

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4 Materials

4.1 The manufacturer shall endeavour to acquire materials and components from suppliers who have a declared environmental policy.

NOTE For further guidance, see EN ISO 14021 [4], EN ISO 14024 [5] and EN ISO 14025 [6].

4.2 The alloys used shall be in accordance with Table 1, except as permitted in 4.3.

The pressure bearing parts of the cylinder shall be AlMgSi1 or AlMg1Si1, providing that for AIMgSi1 the requirements for corrosion resistance according to Annex A are satisfied. For non-pressure bearing parts AlMgSi0,5 may be used.

The manufacturer shall specify the guaranteed minimum values for the yield strength, tensile strength and elongation in the finished cylinders. In all cases, the elongation after fracture shall not be less than 12 %.

Table 1 — Cast analysis

Element	Material designation		
	AlMgSi1	AlMg1Si1	AlMgSi0,5
	Chemical composition		
Silicon %	0,7 – 1,3	1,2 – 1,6	0,3 – 0,6
Iron %	0,5 max.	0,5 max.	0,1 – 0,3
Copper %	0,1 max.	0,1 max.	0,1 max.
Manganese %	0,4 – 1,0	0,8 – 1,0	0,1 max.
Magnesium %	0,6 – 1,2	1,0 – 1,4	0,35 – 0,6
Chromium %	0,25 max.	0,1 max.	0,05 max.
Zinc %	0,2 max.	0,2 max.	0,15 max.
Titanium %	0,1 max.	0,2 max.	0,1 max.
Others %	each element 0,05 max., total 0,15 max.		
Aluminium	Remainder	Remainder	Remainder
NOTE Materials AlMgSi1 and AlMgSi0,5 are equivalent to alloys EN AW-6082 and EN AW-6060 respectively in EN 573-3 [1].			

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4.3 Unalloyed aluminium, containing at least 99,5 % aluminium, or aluminium alloys other than those specified in Table 1 may also be used, provided that all requirements of this document, with the exception of 4.2, are met and;

a) LPG/material compatibility is checked in accordance with EN ISO 11114-1;

b) the requirements for corrosion resistance according to Annex A are satisfied; and

c) the manufacturer shall demonstrate that the material used is suitable for the manufacture of cylinders, the expected service life and the likely conditions of use.

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4.4 The welding materials selected by the manufacturer shall be compatible with the base materials and shall produce welds which meet the minimum strength values used in the design of the cylinder and guaranteed by the manufacturer in the finished cylinders.

4.5 The manufacturer shall keep certificates in accordance with EN 10204:2004 type 3.1, or higher, covering ladle analysis and mechanical properties for material used for pressure retaining parts of the cylinder.

4.6 The manufacturer shall maintain a system of identification for materials used in the manufacture so that all materials used in the manufacture of the cylinder can be traced back to their origin.

5 Design

5.1 General requirements

5.1.1 Calculation of the wall thickness of the pressure bearing parts shall be related to the minimum guaranteed yield strength (R_{eg}) in the finished cylinder.

5.1.2 For calculation purposes the value of R_{eg} shall be limited to a maximum of 0,85 R_{mg}.

5.1.3 The calculation of wall thickness shall be based on the test pressure P_h of 30 bar.

5.1.4 A fully dimensioned drawing, including material specifications, shall be produced.

5.1.5 The design of the cylinder shall take the following into account:

a) minimizing the waste of materials;

b) the fittings required for the cylinder;

c) minimizing the environmental impact of in service maintenance and end of life disposal; and

d) efficient transport of finished product.

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5.2 Calculation of cylindrical wall thickness

The wall thickness of the cylindrical shell, including any cylindrical part of the ends, shall not be less than:

$$a = \frac{P_h D}{\left(\frac{20 R_{eg} v}{1,3}\right) + P_h}$$

where:

— For parts of the cylinder without longitudinal seam: v = 1,0

— For parts of the cylinder with longitudinal seam: v = 0,9

In no case shall the actual thickness be less than that specified in 5.5.