SLOVENSKI STANDARD
SIST EN 1442:2006+A1:2008

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Nadomešča:
SIST EN 1442:2006

Oprema in pribor za utekočinjeni naftni plin (UNP) - Ponovno polnljive varjene plinske jeklenke za UNP - Konstruiranje in izdelava

LPG equipment and accessories - Transportable refillable welded steel cylinders for LPG - Design and construction

Flüssiggas-Geräte und Ausrüstungsteile - Ortsbewegliche, wiederbefüllbare, geschweißte Flaschen aus Stahl für Flüssiggas (LPG) - Gestaltung und Konstruktion

Équipements pour GPL et leurs accessoires - Bouteilles en acier soudé transportables et rechargeables pour gaz de pétrole liquéfiés (GPL) - Conception et fabrication

Ta slovenski standard je istoveten z: **EN 1442:2006+A1:2008**

ICS:

23.020.35	Plinske jeklenke	Gas cylinders

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EUROPEAN STANDARD

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English Version

LPG equipment and accessories - Transportable refillable welded steel cylinders for LPG - Design and construction

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This European Standard was approved by CEN on 18 May 2006 and includes Amendment 1 approved by CEN on 20 December 2007.

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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 CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 1442:2006+A1:2008) 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of an identical text or by endorsement, at the latest by July 2008, and conflicting national standards shall be withdrawn at the latest by July 2008.

This document supersedes A1⟩ EN 1442:2006 ⟨A1.

This document includes Amendment 1, approved by CEN on 2007-12-20.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1⟩ ⟨A1.

This European Standard has been submitted for reference into the RID and/or in the technical annexes of the ADR. Therefore 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.

This European Standard has been extensively re-formatted to align with other more recent LPG cylinder standards.

The main technical changes are a widening of the range of materials permitted, reference to the latest ISO welding standards, the introduction of radioscopy as a permitted alternative to radiographic examination of welds, a reduction in the minimum required burst pressure from 50 bar to 35 bar and simplification of the marking requirements by reference to EN 14894.

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

Introduction

This European Standard calls for the use of substances and procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

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

All pressures are gauge unless otherwise stated.

1 Scope

This European Standard specifies the minimum requirements for the design, construction and testing during manufacture of transportable refillable welded steel Liquefied Petroleum Gas (LPG) cylinders, of water capacity from 0,5 l up to and including 150 l, exposed to ambient temperatures.

This European Standard applies only to cylinders having a circular cross-section.

2 Normative references

The following referenced documents are indispensable for the application 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 287–1, *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 462–1, *Non-destructive testing — Image quality of radiographs — Part 1: Image quality indicators (wire type) — Determination of image quality value*

EN 462–2, *Non-destructive testing — Image quality of radiographs — Part 2: Image quality indicators (step/hole type) — Determination of image quality value*

EN 473:2000, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

EN 895, *Destructive tests on welds in metallic materials — Transverse tensile test*

EN 910, *Destructive tests on welds in metallic materials — Bend tests*

EN 962:1996, *Transportable gas cylinders — Valve protection caps and valve guards for industrial and medical gas cylinders — Design, construction and tests*

EN 970, *Non-destructive examination of fusion welds — Visual examination*

EN 1321, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

EN 1418, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1435:1997, *Non-destructive examination of welds — Radiographic examination of welded joints*

EN 10002–1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10120, *Steel sheet and strip for welded gas cylinders*

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

[A1) EN 14784–1, *Non-destructive testing — Industrial computed radiography with storage phosphor imaging plates — Classification of systems*

EN 14784–2, *Non-destructive testing — Industrial computed radiography with storage phosphor imaging plates — General principles for testing of metallic materials using X-rays and gamma rays* (A1]

[A1) EN 14894:2006 (A1], *LPG equipment and accessories — Cylinder and drum marking*

EN ISO 643, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

EN ISO 5817:2003, *Welding — Fusion welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2003)*

EN ISO 6520–1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding (ISO 6520-1:1998)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613:2004)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1
yield strength
upper yield strength R_{eH} or
0,2 % proof strength (non-proportional elongation), $R_{p0,2}$, for steels that do not exhibit a defined yield

3.1.2
normalised
condition resulting from heat treatment in which a finished cylinder is heated to a uniform temperature above the upper critical point (Ac_3) of the steel and then cooled under controlled conditions

3.1.3
stress relieved
condition resulting from heat treatment in which a finished cylinder is heated to a uniform temperature below the lower critical point (Ac_1) of the steel and cooled in a still atmosphere, the object of which is to reduce the residual stresses without altering the metallurgical structure of the steel

3.1.4
weld-overrun zone
area on a circumferential weld where the weld metal deposition has carried on beyond the start point

3.2 Symbols

a calculated thickness of the cylindrical shell, in millimetres.

A percentage elongation after fracture.

b calculated thickness of the end of the cylinder, in millimetres.

C shape factor for ends (see Table 2, Figure 2 and Figure 3).

D outside diameter of the cylinder as given in the design drawing (see Figure 1), in millimetres.

D_p outside diameter of a bend test mandrel (see Figure 8), in millimetres.

e actual thickness of the material in the finished cylinder (at the point under consideration), in millimetres.

h height of the cylindrical part of the end (see Figure 1), in millimetres.

H outside height of the domed part of the end (see Figure 1), in millimetres.

J stress reduction factor.

L_O original gauge length of the test piece, in accordance with EN 10002–1, in millimetres.

n ratio of diameter of bend test former to the thickness of the test piece, (see Table 6).

P_c calculation pressure (1 bar = 10^5 Pa = 10^5 N/m$^{2)}$, used to calculate the minimum required thickness of the cylindrical shell and ends, in bar.

P_b maximum pressure attained during the burst test, in bar.

P_h actual test pressure applied to the cylinder by the manufacturer, in bar.

P_{hmin} minimum permissible test pressure, in bar.

r inside knuckle radius of the torispherical end, in millimetres.

R inside spherical radius of the torispherical end, in millimetres.

R_g minimum value of tensile strength guaranteed by the cylinder manufacturer for the finished cylinder, in newtons per square millimetre.

R_o minimum value of yield strength guaranteed by the cylinder manufacturer for the finished cylinder, in newtons per square millimetre.

R_m actual value of tensile strength determined by the tensile test specified in 7.4, in newtons per square millimetre.

R_{eH} upper yield strength, in newtons per square millimetre, as defined in EN 10002–1.

$R_{p0,2}$ Proof strength, non proportional extension in newtons per square millimetre, as defined in EN 10002–1.

4 Materials

4.1 Materials for shells and end pressings shall be in accordance with EN 10120 or other equivalent material specification or standard meeting the requirements of Table 1. Alternative material specifications shall, as a minimum, specify chemical composition, mechanical properties, heat treatment and delivery conditions.

NOTE "Materials" refers to materials in the state before any specific transformation occurring during the manufacturing process.

4.2 All parts welded to the cylinder shall be made of material compatible with the cylinder material.

4.3 The welding consumables shall be such that they are capable of giving consistent welds.

4.4 The cylinder manufacturer shall obtain certificates showing the chemical analysis and details of the mechanical properties of the steel supplied for the construction of the pressure retaining parts. The certificates/reports shall be in accordance with EN 10204:2004, Type 3.1 for shells and ends and Type 2.2 for the valve boss.

4.5 The manufacturer shall maintain a system of identification for the materials used in the fabrication in order that all materials for pressure parts in the completed cylinder can be traced to their origin.

Table 1 — Material requirements

Element	Limits %
Materials, other than according to EN 10120, used for the fabrication of cylinders shall be of weldable quality and the following limits shall not be exceeded in the cast analysis:	
Carbon	0,22 max.
Silicon	0,50 max.
Manganese	0,30 min. to 1,60 max.
Phosphorus	0,025 max.
Sulphur	0,020 max.
Phosphorous plus sulphur	0,040 max.
Use of micro-alloying elements such as niobium, titanium and vanadium shall be limited to the following contents:	
Niobium	0,05 max.
Titanium	0,05 max.
Vanadium	0,05 max.
Niobium plus vanadium	0,08 max.
Where other micro-alloying elements are used, their presence and amounts shall be reported, together with the above, in the steel manufacturer's certificate. Should check analyses be required, they shall be carried out either on specimens taken during manufacture from material in the form as supplied by the steel manufacturer to the cylinder manufacturer or from finished cylinders.	

5 Design

5.1 General requirements

5.1.1 The calculation of the wall thickness of the pressure parts shall be based on the yield strength of the material.

5.1.2 For calculation purposes, the value of the yield strength R_o is limited to a maximum of 0,85 R_g.

5.1.3 The calculation pressure (P_c) shall be not less than the higher of:

— absolute developed pressure at 65 °C of the highest pressure LPG mixture to be filled minus 1 bar, or

— 10 bar.

[A1] NOTE This requirement is in accordance with RID/ADR. Test pressures for tabulated mixtures of LPG (UN 1965) are listed in RID/ADR P200, Table 2. [A1]

5.1.4 A drawing, which includes full dimensions that define the cylinder type (see 8.2) and the specification of the material, shall be produced.

5.2 Calculation of cylindrical shell thickness

The wall thickness, a, of the cylindrical shell shall be not less than:

$$a = \frac{P_c \times D}{(15 \times R_o \times J) + P_c}$$

For cylindrical shells with a longitudinal weld: $J = 0,9$

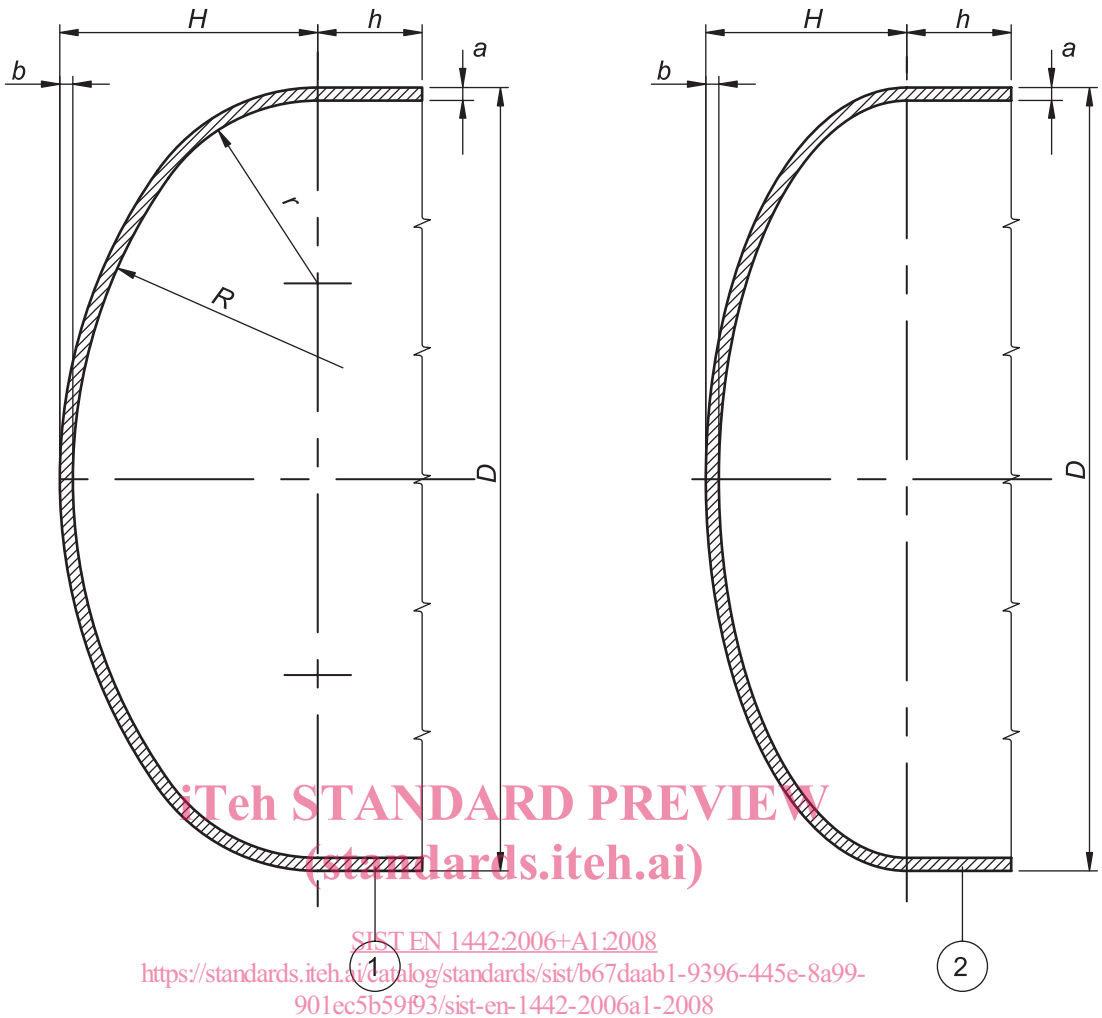
For cylindrical shells, including the cylindrical parts of ends, without a longitudinal weld: $J = 1,0$

5.3 Design of torispherical and semi-ellipsoidal ends concave to pressure

5.3.1 The shape of ends shall be such that the following conditions are fulfilled:

— for torispherical ends $R \leq D$; $r \geq 0,1\,D$; $h \geq 4b$ (see Figure 1);

— for semi-ellipsoidal ends $H \geq 0,2\,D$; $h \geq 4b$ (see Figure 1).



Key

1 torispherical end
2 semi-ellipsoidal end

Figure 1 — Illustration of cylinder ends concave to pressure

NOTE For torispherical ends the height *H* can be calculated using:

$$H = (R + b) - \sqrt{[(R + b) - \frac{D}{2}] \times [(R + b) + \frac{D}{2} - 2(r + b)]}$$

5.3.2 The wall thickness, *a*, of any cylindrical part shall be calculated in accordance with 5.2.

This requirement is not applicable where the length of the cylindrical portion of the cylinder, measured between the beginning of the domed parts of the two ends, is not more than $\sqrt{2bD}$. In this case the wall thickness shall be not less than that of the domed part.

The thickness, *b*, of the domed part shall be not less than:

$$b = \frac{P_c \times D \times C}{(15 \times R_o) + P_c}$$

In this equation, *C* is a shape factor, the value of which depends on the ratio *H*/*D*.