SLOVENSKI STANDARD
oSIST prEN 14140:2013

01-januar-2013

Oprema in pribor za utekočinjeni naftni plin (UNP) - Premične, ponovno polnljive varjene jeklenke iz jekla za UNP - Alternativni način konstruiranja in izdelava

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

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

Equipements pour GPL et leurs accessoires - Bouteilles en acier soudé transportables et rechargeables pour gaz de pétrole liquéfié (GPL) - Autres solutions en matière de conception et construction

Ta slovenski standard je istoveten z: **prEN 14140 rev**

ICS:

23.020.30	Tlačne posode, plinske jeklenke	Pressure vessels, gas cylinders

oSIST prEN 14140:2013 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 14140 rev

September 2012

ICS 23.020.30

Will supersede EN 14140:2003+A1:2006

English Version

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

Equipements pour GPL et leurs accessoires - Bouteilles en acier soudé transportables et rechargeables pour gaz de pétrole liquéfié (GPL) - Autres solutions en matière de conception et construction

Flüssiggas-Geräte und Ausrüstungsteile - Ortsbewegliche wiederbefüllbare geschweißte Flaschen aus Stahl - Alternative Auslegung und Bau

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 286.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Foreword

This document (prEN 14140:2012) has been prepared by Technical Committee CEN/TC 286 “Liquefied petroleum gas equipment and accessories”, the secretariat of which is held by NSAI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 14140:2003+A1:2006.

This European Standard has been submitted for reference into:

— the RID [9]; and

— the technical annexes of the ADR [10].

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

The major changes to this revision include:

— an update on the terminology;

— the addition of requirements for protected cylinders;

— the addition of the environmental checklist, Annex C

Introduction

This European Standard calls for the use of substances and procedures that may 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.

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.

This standard permits the use of new and higher strength steels and has the potential for cylinders to be thinner than the minimum thickness related to diameter, compared with cylinders in accordance with EN 1442. These changes in technology are justified by requiring a series of performance tests, including impact testing, to demonstrate the adequacy of the calculated pressure thickness for service and transport considerations.

NOTE 1 Reference should also be made to EN 1439, which requires the cylinder manufacturer to perform additional tests to determine the rejection limits for in-service damage and to include these limits in the documentation for the cylinder.

Protection of the environment is a key political issue in Europe and elsewhere around the world. Protection of the environment in this document is understood in a very broad sense. The phrase is used, for example, in relation to the total life-cycle aspects of a product on the environment, including expenditure of energy, and during all phases of its existence, from mining of raw materials, to fabrication, packaging, distribution, use, scrapping, recycling of materials, etc. Annex C comprises an environmental checklist which highlights the clauses of this European Standard that address environmental aspects.

It is recommended that manufacturers develop an environmental management policy. For guidance see ISO 14000 series, [4], [5] and [6].

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 European Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

All pressures are gauged unless otherwise stated.

NOTE 2 This European Standard 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 may be beneficial to refer to the leaflet “measurement uncertainty leaflet" SP INFO 2000 27 [13].

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. It allows alternative design and construction methods to those required in EN 1442.

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

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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: 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 473:2008, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

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 1439, *LPG equipment and accessories — Procedure for checking LPG cylinders before, during and after filling*

EN 10028-7, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

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

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

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

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

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

EN ISO 2409:2007, *Paints and varnishes — Cross-cut test (ISO 2409)*

EN ISO 2812-2, *Paints and varnishes - Determination of resistance to liquids - Part 2: Water immersion method (ISO 2812-2)*

EN ISO 3231:1997, *Paints and varnishes — Determination of resistance to humid atmospheres containing sulfur dioxide (ISO 3231)*

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

EN ISO 4624, *Paints and varnishes — Pull-off test for adhesion (ISO 4624)*

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

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

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

EN ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227)*

EN ISO 11117:2008, *Gas cylinders — Valve protection caps and valve guards — Design, construction and tests (ISO 11117)*

EN ISO 11997-2, *Paints and varnishes — Determination of resistance to cyclic corrosion conditions — Part 2: Wet (salt fog)/dry/humidity/UV light (ISO 11997-2)*

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

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

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)*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

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, refillable pressure receptacle with a water capacity from 0,5 l up to and including 150 l

3.1.3
protected cylinder
steel cylinder with an over-moulded protective case which is which is non-removable and bonded to the cylinder wall giving protection against impact and external corrosion

3.1.4
manufacturer
manufacturer of the cylinder, unless otherwise specified

3.1.5
yield stress
upper yield strength R_{eh} for carbon steels or 0,2 % proof stress (non-proportional elongation), $R_{p0,2}$, for steels that do not exhibit a defined yield, and 1 % proof stress for stainless steels, $R_{p1,0}$

3.1.6
heat treatment
solution heat treatment, quenching and artificial or natural ageing that ensures the strength values required

3.1.7
normalised
condition resulting from heat treatment to a uniform temperature above the upper critical point (Ac3) of the steel and then cooled under controlled conditions

3.1.8
stress relieved
condition resulting from heat treatment in which a finished cylinder is heated to a uniform temperature below the lower critical point (Ac1) 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

3.1.9
production batch
group of pressure parts or finished pressure vessels, made consecutively by the same manufacturer using the same manufacturing techniques to the same design, nominal size and material specifications on the same production machinery and subject to the same heat treatment conditions

NOTE In this context, 'consecutively' need not imply continuous production.

3.2 Symbols

a Calculated minimum thickness of the cylindrical shell, in millimetres.

A Percentage elongation after fracture.

b Calculated minimum thickness of the end of the cylinder, in millimetres.

C Shape factor for ends (see Table 1 and Figure 2).

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

D_p Outside diameter of a bend tests former (see Figure 8), in millimetres.

e Actual thickness of the material used, in millimetres.

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

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

J Stress reduction factor.

l Length of the cylinder, in millimetres.

L_O Original gauge length of the test piece, in accordance with EN ISO 6892-1, in millimetres.

n Ratio of diameter of bend test former to the thickness of the test piece, (see Table 5).

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_t Actual test pressure applied to the cylinder by the manufacturer, in bar.

P_{tmin} Minimum permissible test pressure, in bar.

r Inside knuckle radius of the end, in millimetres.

R Inside dishing radius of the end, in millimetres.

R_g Guaranteed tensile strength guaranteed by the cylinder manufacturer for the finished cylinder, in N/mm^2.

R_o Minimum value of yield stress guaranteed by the cylinder manufacturer for the finished cylinder, in N/mm^2.

R_m Actual value of tensile strength determined by the tensile test specified in 7.4, in N/mm^2.

4 Materials

4.1 Materials for shells and end pressings shall be:

a) carbon steel in accordance with EN 10120 or other appropriate standard providing they comply with the tests results described in this European Standard, or

b) stainless steel in accordance with EN 10028-7.

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. The strength characteristics of the welds in the finished cylinder shall fulfil all requirements for the design and calculation of the cylinder.

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 shall be in accordance with EN 10204:2004, certificate 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.

4.6 The manufacturer shall endeavour to acquire materials and components from suppliers who have a declared environmental policy, see EN ISO 14021, EN ISO 14024 and EN ISO 14025.

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 stress of the material.

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

5.1.3 The calculation pressure (P_c) shall be:

a) for cylinders restricted to LPG with a vapour pressure not exceeding 16 bar absolute at 70 °C:

$P_c = P_{tmin} = 15$ bar.

b) for all other LPG cylinders:

$P_c = P_{tmin}$ = 30 bar.

5.1.4 A fully dimensioned drawing including the specification of the material shall be produced.

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

— minimising the use of materials; and

— minimising the environmental impact of in service maintenance and end of life disposal.

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 cylinders with a longitudinal weld: J = 0,9

For cylinders 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 $H \geq 0{,}192\ D$; $h \geq 4b$ (see Figure 1).

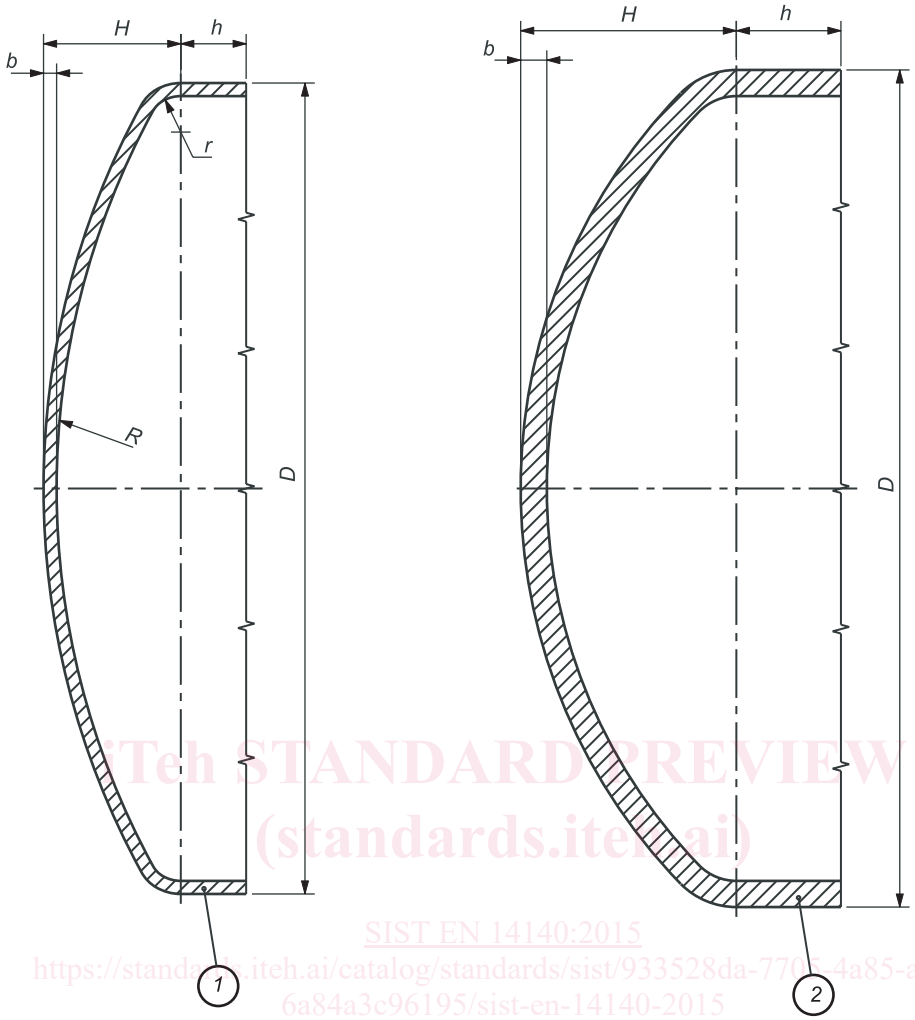
5.3.2 The wall thickness, b, shall be not less than:

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

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

For H/D values between 0,2 and 0,25 the value of C shall be obtained from Figure 2.

For H/D values between 0,25 and 0,5 the value of C shall be obtained from Table 1 or Figure 3.



Key

1 Torispherical end
2 Semi-ellipsoidal end

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

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

Figure 1 — Illustration of cylinder ends concave to pressure

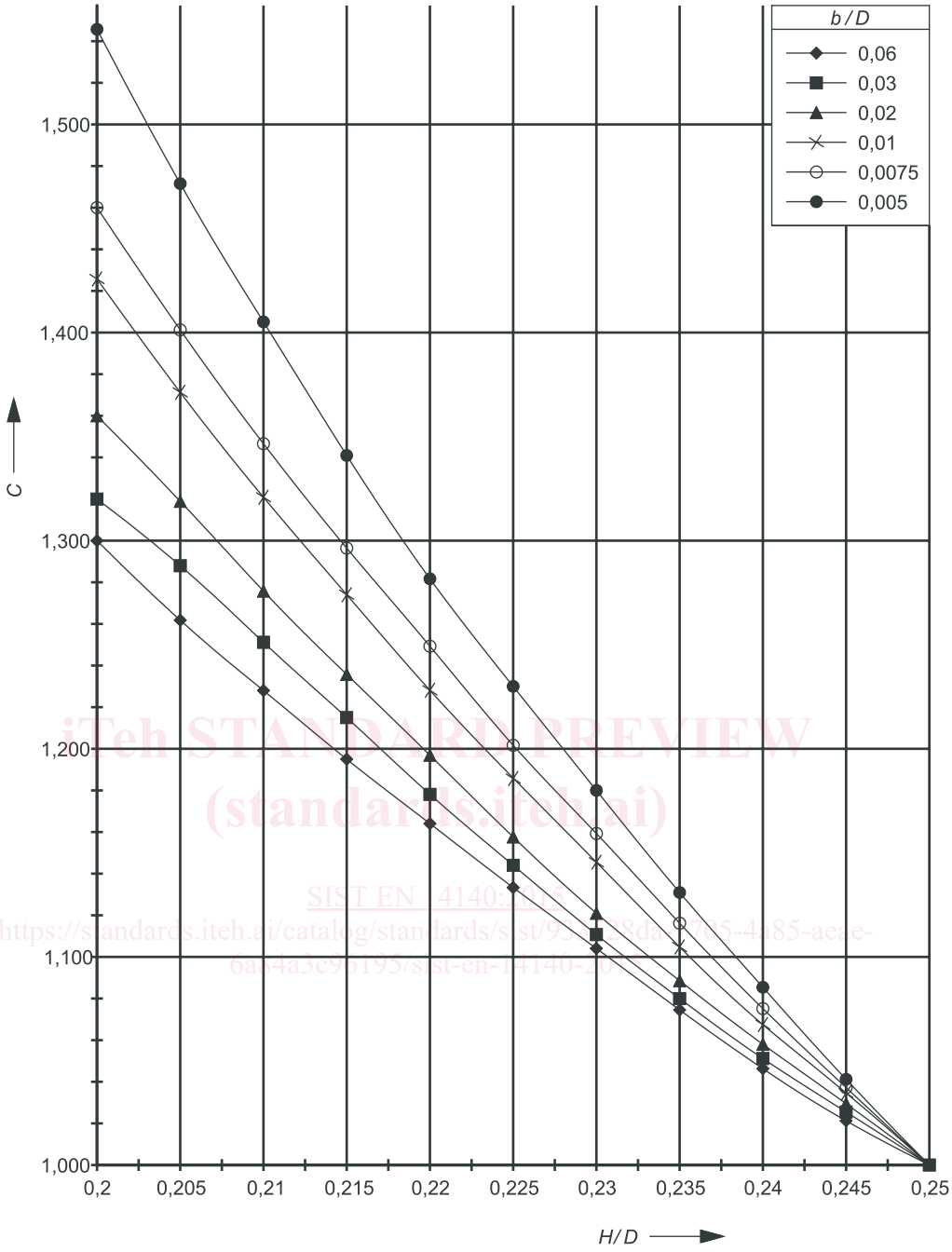


Figure 2 — Values of shape factor *C* for *H/D* between 0,2 and 0,25