SLOVENSKI STANDARD
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Oprema in pribor za utekočinjeni naftni plin (UNP) - Premični varjeni jekleni tlačni sodi za utekočinjeni naftni plin (UNP) s prostornino med 150 in 1000 litri

LPG equipment and accessories - Transportable Liquefied Petroleum Gas (LPG) welded steel pressure drums with a capacity between 150 litres and 1 000 litres

Flüssiggas-Geräte und Ausrüstungsteile - Ortsbewegliche, geschweißte Druckfässer aus Stahl für Flüssiggas (LPG) mit einem Fassungsraum zwischen 150 Liter und 1 000 Liter

Équipements pour GPL et leurs accessoires - Fûts à pression métalliques transportables pour GPL d'une capacité comprise entre 150 litres et 1 000 litres

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23.020.30	Tlačne posode, plinske jeklenke	Pressure vessels, gas cylinders

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English Version

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Page

Foreword

This document (EN 14893:2014) has been prepared by Technical Committee CEN/TC 286 “LPG 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of an identical text or by endorsement, at the latest by November 2014 and conflicting national standards shall be withdrawn at the latest by November 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14893:2006.

The major changes in this revision include:

— an update of the terminology; and

— the addition of an environmental checklist, Annex H.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This European Standard has been submitted for reference into:

— the RID [12]; and

— the technical annexes of the ADR [13].

NOTE These regulations take precedence over any clause of this European Standard. It is emphasized 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.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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.

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 environmental aspects of a product, 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 H 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 EN ISO 14000 series, [6], [7] and [8].

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 gauge unless otherwise stated.

NOTE 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 [16].

1 Scope

This European Standard specifies the minimum requirements for the material, design, construction, workmanship, equipping, inspection and testing at manufacture of transportable, refillable welded steel pressure drums of volumes over 150 l up to and including 1 000 l for Liquefied Petroleum Gases (LPG).

Vertical and horizontal cylindrical receptacles are covered.

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 549, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 837-2, *Pressure gauges - Part 2: Selection and installation recommendations for pressure gauges*

EN 1092-1, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges*

EN 10028-1, *Flat products made of steels for pressure purposes - Part 1: General requirements*

EN 10028-2, *Flat products made of steels for pressure purposes - Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3, *Flat products made of steels for pressure purposes - Part 3: Weldable fine grain steels, normalized*

EN 10028-5, *Flat products made of steels for pressure purposes - Part 5: Weldable fine grain steels, thermomechanically rolled*

EN 10204, *Metallic products - Types of inspection documents*

EN 13175, *LPG equipment and accessories - Specification and testing for Liquefied Petroleum Gas (LPG) tank valves and fittings*

EN 13799, *LPG equipment and accessories - Contents gauges for Liquefied Petroleum Gas (LPG) pressure vessels*

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

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

EN ISO 148-1, *Metallic materials - Charpy pendulum impact test - Part 1: Test method (ISO 148-1)*

EN ISO 636, *Welding consumables - Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels - Classification (ISO 636)*

EN ISO 2560, *Welding consumables - Covered electrodes for manual metal arc welding of non-alloy and fine grain steels - Classification (ISO 2560)*

EN ISO 3452-1, *Non-destructive testing - Penetrant testing - Part 1: General principles (ISO 3452-1)*

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)*

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

EN ISO 9016, *Destructive tests on welds in metallic materials - Impact tests - Test specimen location, notch orientation and examination (ISO 9016)*

EN ISO 9606-1, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1)*

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

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 14171, *Welding consumables - Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fine grain steels - Classification (ISO 14171)*

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

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)*

EN ISO 15995, *Gas cylinders - Specifications and testing of LPG cylinder valves - Manually operated (ISO 15995)*

EN ISO 17632, *Welding consumables - Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels - Classification (ISO 17632)*

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

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

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

EN ISO 17638, *Non-destructive testing of welds - Magnetic particle testing (ISO 17638)*

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

EN ISO 17640, *Non-destructive testing of welds - Ultrasonic testing - Techniques, testing levels, and assessment (ISO 17640)*

EN ISO 19232-3, *Non-destructive testing - Image quality of radiographs - Part 3: Image quality classes (ISO 19232-3)*

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose (Inch)*[1)]

3 Terms and definitions

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

3.1
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 and butene with traces of other hydrocarbon gases

3.2
pressure drum
welded transportable, refillable pressure receptacle with a water capacity from 150 l up to and including 1 000 l

3.3
competent authority
authority designated as such in each country in accordance with national regulation

3.4
pressure vessel
assembly of the pressure-retaining envelope (including the openings and their closures) and non-pressure-retaining parts attached directly to it

3.5
parent material
material in the state before any specific transformation with regards to the container manufacturing process

3.6
yield strength
upper yield strength R_{eH} or, for steels that do not exhibit a definite yield, the 0,2 % proof strength

3.7
manufacturer
manufacturer of the drum, unless otherwise specified

3.8
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

3.9
calculation pressure
gauge pressure used in design formulae

1) Issued by the American National Standards Institute (1983).

3.10
maintenance
minor repair, major repair or refurbishment

3.11
nominal diameter
DN
numerical designation of size, in millimetres, which is common to all components in a piping system other than components designated by outside diameters or by thread size

Note 1 to entry: It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions. The nominal size is designated by DN followed by a number.

3.12
heat treatment
solution heat treatment, quenching and artificial or natural ageing that ensures the strength values required

3.13
longitudinal weld
weld over the full length of the shell or cylindrical part of the shell, excluding welds for fittings

3.14
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 1 to entry: In this context, 'consecutively' need not imply continuous production.

3.15
hot forming
forming at temperatures above the maximum permissible temperature for stress relieving in accordance with the material specification

3.16
cold forming
forming at temperatures at least 30 °C below the maximum permissible temperature for stress relieving in accordance with the material specification

3.17
Ar_3
critical point, on the iron-iron carbide equilibrium diagram, representing the temperature at the end of transformation of austenite to ferrite on cooling of the steel

Note 1 to entry: The actual temperature varies with composition of the steel.

3.18
filler valve
valve system for liquid fill service

3.19
fixed liquid level gauge
control device, such as a dip tube in combination with a vent valve to indicate when a predetermined liquid level has been reached or surpassed

3.20
overfill protection device
device designed to automatically reduce the filling rate to a minimal flow when the fill level reaches a predetermined amount

3.21
tare mass
mass of the empty pressure vessel, its fittings and other parts that are permanently attached to the pressure vessel

3.22
accessories
devices connected to the system whose main function is not for the storage or conveyance of LPG

Note 1 to entry: Accessories are not “service equipment” or “structural equipment” (as defined by the RID/ADR); safety and pressure accessories are also defined in the PED [14].

4 Materials

4.1 Suitability

4.1.1 Unless otherwise specified, the design temperature range shall be –20 °C to +50 °C. The materials of construction shall be suitable for operating within the envisaged temperature range. If the drum could be subjected to more severe ambient or product temperatures, the design temperature range shall be –40 °C to +50 °C.

Guidance on selection of material grades is given in Annex A.

4.1.2 All materials which are in direct contact with LPG shall not be affected or weakened by it. The materials shall be resistant to brittle fracture, within the operating range, and to stress corrosion cracking during service (see also RID/ADR Clauses 6.2.1.2.1 and 6.2.1.2.2).

4.1.3 The manufacturer shall endeavour to acquire materials and components from suppliers who have a declared environmental policy (see EN ISO 14021 [6], EN ISO 14024 [7] and EN ISO 14025 [8]).

4.1.4 Steels shall be grouped in accordance with Table 1.

4.1.5 Where additional impact testing is required, it shall be carried out in accordance with EN ISO 148-1 to achieve the impact values specified in 6.16.

4.2 Pressure retaining parts

4.2.1 Pressure-retaining materials shall be of appropriate steels conforming to EN 10028-1, EN 10028-2, EN 10028-3 or EN 10028-5. All materials shall conform to the requirements of 6.16.

4.2.2 Steels in Table 1, sub-group 2.2 shall have a carbon equivalent limited to a maximum of 0,43 % when calculated in accordance with EN 10028-5.

4.3 Non-pressure retaining parts

All materials used for non-pressure retaining parts shall be compatible with the material of pressure retaining parts. Their suitability, to be used at low temperature, shall be established by:

— testing in accordance with EN ISO 148-1 to meet the impact requirements in 6.16; or

— reference to a recognized pressure vessel European Standard or specification, e.g. EN 13445 series.

4.4 Welding consumables

4.4.1 Welding consumables shall be such that they are capable of giving consistent welds with properties at least equal to those specified for the parent materials of the finished drum.

4.4.2 They shall be selected from EN ISO 2560, EN ISO 14171, EN ISO 17632 or EN ISO 636, as appropriate. Suitability of the chosen consumables shall be demonstrated in accordance with 6.7.3.

4.5 Non-metallic materials (gaskets)

All non-metallic materials in contact with LPG shall be compatible with LPG and shall not distort or harden. They shall also comply with the appropriate requirements of EN 549 and EN ISO 11114-2, including resistance to ozone (where gasket/seal is exposed to atmosphere).

4.6 Certification of materials

Pressure retaining parts and non-pressure retaining parts directly welded to the drum shall be provided with material manufacturers' certificates conforming to EN 10204, certificate type 3.1. Other parts shall have certificates conforming to EN 10204, certificate type 2.2.

Table 1 — Material grouping

Group	Sub-group	Type of steel
1		Steels with a specified minimum yield strength $R_{eH} \leq 460$ N/mm^2 [a] and with analysis in %: C ≤ 0,25 Si ≤ 0,60 Mn ≤ 1,70 Mo ≤ 0,70 [b] S ≤ 0,045 *P* ≤ 0,045 Cu ≤ 0,40 [b] Ni ≤ 0,5 [b] Cr ≤ 0,3 (0,4 for castings) [b] Nb ≤ 0,05 V ≤ 0,12 [b] Ti ≤ 0,05
	1.1	Steels with a specified minimum yield strength $R_{eH} \leq 275$ N/mm^2
	1.2	Steels with a specified minimum yield strength 275 N/mm^2 < $R_{eH} \leq 360$ N/mm^2
	1.3	Normalized fine grain steels with a specified minimum yield strength $R_{eH} > 360$ N/mm^2
2		Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $R_{eH} > 360$ N/mm^2
	2.1	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength 360 N/mm^2 < $R_{eH} \leq 460$ N/mm^2
	2.2	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $R_{eH} > 460$ N/mm^2
NOTE This table is an extract from CEN ISO/TR 15608:2013 [10].		

[a] In accordance with the specification of the steel product standards, R_{eH} may be replaced by $R_{p0,2}$.
[b] A higher value is accepted provided that Cr + Mo + Ni + Cu + V ≤ 0,75 %.

5 Design

5.1 General

5.1.1 Drums shall be designed in such a way that they are either;

— capable of being rolled (see 5.8); or

— prevented from rolling by the provision of support and lifting arrangements or a protective frame to permit safe handling by mechanical means, transport and use.

5.1.2 Drums shall be an assembly of a cylindrical shell and two ellipsoidal or torispherical dished ends. Dished ends convex to pressure (inwardly dished ends) are not permitted.

5.1.3 Dished ends shall be made from one piece of plate.

5.1.4 No internal corrosion allowance is required for drums intended to contain LPG which is supplied to a national or international standard or other equivalent specification that complies with the limitation on corrosive contaminants specified in ISO 9162 [11].

5.1.5 Drums shall be protected against external corrosion in accordance with 8.1. No external corrosion allowance is required.

5.1.6 The weld joint coefficient for the material used and the level of non-destructive testing to be adopted shall be selected in accordance with Table 2.

5.1.7 The drum shall be designed to withstand pressure, temperature and vacuum conditions in accordance with 5.2.1, 5.2.2 and 5.2.3 and support loadings in accordance with 5.4.

5.1.8 Where necessary to reduce stress concentrations, attachments to the drum shall be welded using a backing plate.

5.1.9 A design type specification, including a fully detailed, dimensional drawing, specifications of materials and equipment (fittings) shall be produced for the completed drum.

The design of the drum should take into account minimising the use of raw materials and minimising the environmental impact in service maintenance and end of life disposal.

5.2 Design conditions

5.2.1 Calculation pressure

The drum shall be designed for a calculation pressure of not less than the test pressure of 30 bar.

5.2.2 Design temperature

Generally the design temperature range shall be –20 °C to +50 °C. However, where temperatures lower than −20 °C are envisaged, the manufacturer shall demonstrate that the material from which the pressure containing parts of the drum are constructed have properties suitable for a range of temperatures –40 °C to +50 °C in accordance with a recognized pressure vessel standard or specification, e.g. EN 13445-2 [3].

5.2.3 Vacuum conditions

Drums shall be designed to withstand vacuum conditions generated by the product during operation or other conditions, but as a minimum, this shall be equivalent to an external pressure of at least 40 kPa (0,4 bar) gauge pressure.