



SLOVENSKI STANDARD

SIST EN 14893:2007

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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

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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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Ta slovenski standard je istoveten z: EN 14893:2006

ICS:

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b\ |^ } \ ^ Pressure vessels, gas cylinders

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English Version

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geschweißte Druckfässer aus Stahl für Flüssiggas (LPG)
mit einem Fassungsraum zwischen 150 Liter und 1 000
Liter

This European Standard was approved by CEN on 12 June 2006.

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Foreword

This document (EN 14893:2006) 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of an identical text or by endorsement, at the latest by January 2007, and conflicting national standards shall be withdrawn at the latest by January 2007.

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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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.

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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.

NOTE The maximum capacity of drums is 1 000 l. However the technical requirements of this standard can be applied for the safe design of receptacles larger than 1 000 l although these would not be classed as pressure drums under ADR.

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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 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 462-3, *Non-destructive testing — Image quality of radiographs — Part 3: Image quality classes for ferrous metals*

EN 473, *Non-destructive testing – Qualification and certification of NDT personnel - General principles.*

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

EN 571-1, *Non destructive testing - Penetrant testing - Part 1: General principles*

EN 756, *Welding consumables - Solid wires, solid wire-flux and tubular cored electrode-flux combinations for submerged arc welding of non alloy and fine grain steels - Classification*

EN 758, *Welding consumables - Tubular cored electrodes for metal arc welding with and without a gas shield of non alloy and fine grain steels - Classification*

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

EN 875, *Destructive tests on welds in metallic materials - Impact tests - Test specimen location, notch orientation and examination*

EN 876, *Destructive tests on welds in metallic materials - Longitudinal tensile test on weld metal in fusion welded joints*

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

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

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

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

EN 1290, *Non-destructive examination of welds - Magnetic particle examination of welds*

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 mechanised and automatic welding of metallic materials*

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

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EN 1668, *Welding consumables - Rods, wires and deposits for tungsten inert gas welding of non alloy and fine grain steels - Classification*

EN 1708-1, *Welding - Basic weld joint details in steel - Part 1: Pressurized components*

EN 1714, *Non-destructive examination of welds - Ultrasonic examination of welded joints*

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 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

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

EN 13153, *Specification and testing of LPG cylinder valves - Manually operated*

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

EN 13799, *Contents gauges for LPG tanks*

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

EN ISO 2560, *Welding consumables - Covered electrodes for manual metal arc welding of non-alloy and fine grain steels - Classification (ISO 2560:2002)*

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)*

ISO 9162, *Petroleum products - Fuels (Class F) - Liquefied Petroleum Gases - Specifications*

ANSI/ASME B1.20.1, *Pipe threads, general purpose (inch) issued by American National Standards Institute on 1983*

3 Terms and definitions

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

3.1

LPG (Liquefied Petroleum Gas)

mixture of predominantly butane or propane with traces of other hydrocarbon gases classified in accordance with UN number 1965, hydrocarbon gases mixture, liquefied, NOS or UN 1075, petroleum gases, liquefied

NOTE In some countries, UN numbers 1011 and 1978 may also be designated LPG.

3.2

yield strength

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

3.3

production-batch

group of pressure parts or finished drums, made consecutively by the same manufacturer using the same manufacturing techniques to the same design, nominal size and material specifications and, where applicable, weld procedures on the same production machinery and subject to the same heat treatment conditions

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

3.4

cold forming

forming at temperatures not less than 25 °C below the maximum permissible temperature for stress relieving in accordance with the material specification

3.5

hot forming

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

3.6

calculation pressure

gauge pressure used in design formulae

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3.7

manufacturer

manufacturer of the drum, unless otherwise specified

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3.8

A_{r3}

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 The actual temperature varies with composition of the steel.

4 Materials

4.1 Suitability

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.

Steels shall be grouped in accordance with Table 1

Table 1 — Material grouping

Group	Sub-group	Type of steel
1		Steels with a specified minimum yield strength $R_{eH} \leq 460 \text{ N/mm}^2$ ^a and with analysis in % : $C \leq 0,25$ $Si \leq 0,60$ $Mn \leq 1,70$ $Mo \leq 0,70^b$ $S \leq 0,045$ $P \leq 0,045$ $Cu \leq 0,40^b$ $Ni \leq 0,5^b$ $Cr \leq 0,3$ (0,4 for castings) ^b $Nb \leq 0,05$ $V \leq 0,12^b$ $Ti \leq 0,05$
	1.1	Steels with a specified minimum yield strength $R_{eH} \leq 275 \text{ N/mm}^2$
	1.2	Steels with a specified minimum yield strength $275 \text{ N/mm}^2 < R_{eH} \leq 360 \text{ N/mm}^2$
	1.3	Normalised fine grain steels with a specified minimum yield strength $R_{eH} > 360 \text{ N/mm}^2$
2		Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $R_{eH} > 360 \text{ N/mm}^2$
	2.1	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $360 \text{ N/mm}^2 < R_{eH} \leq 460 \text{ N/mm}^2$
	2.2	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $R_{eH} > 460 \text{ N/mm}^2$
<p>^a In accordance with the specification of the steel product standards, R_{eH} may be replaced by $R_{p0,2}$.</p> <p>^b A higher value is accepted provided that $Cr + Mo + Ni + Cu + V \leq 0,75 \%$.</p> <p>NOTE This table is an extract from CEN ISO/TR 15608:2005</p>		

If additional impact testing is required, it shall be carried out in accordance with EN 10045-1 to achieve the impact values specified in 7.8.

4.2 Pressure retaining parts

Pressure-retaining materials shall be of appropriate steels conforming to EN 10028 parts 1, 2, 3 or 5 or shall conform to specifications agreed with the competent authority. All materials shall conform to 7.8.

Steels in sub-group 2.2 shall have a carbon equivalent limited to 0,43%, maximum, 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 capability to be used at low temperature shall be established:

- by testing in accordance with EN 10045-1 to meet the impact requirements in 7.8, or
- by reference to a recognised pressure vessel standard or specification : e.g. EN 13445.

4.4 Welding consumables

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.

They shall be selected from EN ISO 2560, EN 756, EN 758, or EN 1668 as appropriate. Suitability of the chosen consumables shall be demonstrated in accordance with 6.6.3.

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 including resistance to ozone (where gasket/seal is exposed to atmosphere).

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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.

5 Design

5.1 General

Drums shall be designed such 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.

Drums shall be an assembly of a cylindrical shell and 2 ellipsoidal or torispherical dished ends. Dished ends convex to pressure (inwardly dished ends) are not permitted.

Dished ends shall be made from one piece of plate.

For drums intended to contain LPG that complies with the limitation on corrosive contaminants specified in ISO 9162, and which is supplied to a national or international standard or other equivalent specification, no internal corrosion allowance is required.

As drums are protected against external corrosion in accordance with 9.1, no external corrosion allowance is required.

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 .

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.

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

A fully detailed, dimensional drawing shall be produced.

5.2 Design conditions

5.2.1 Calculation pressure

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

5.2.2 Design temperature

Generally the design temperature range shall be $-20\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$. However, where temperatures lower than $-20\text{ }^{\circ}\text{C}$ are envisaged, the manufacturer shall demonstrate that the material from which the pressure containing parts of drum are constructed shall have properties suitable for a range of temperatures $-40\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ in accordance with a recognised pressure vessel standard or specification. e.g. EN 13445-2.

5.2.3 Vacuum conditions

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The drum shall be designed to withstand a minimum internal pressure of 0,1 bar absolute.

NOTE 1 This requirement can be demonstrated by meeting the requirements of a recognised pressure vessel standard such as EN 13445-3.

NOTE 2 This requirement ensures that the drum will withstand vacuum conditions generated by the product during operation or by normal maintenance.

5.3 Calculation of thicknesses

5.3.1 Calculation

Drum thicknesses shall be calculated in accordance with Annex E.

5.3.2 Minimum thickness for handling

5.3.2.1 The thicknesses of the shell and ends calculated from pressure considerations (see 5.2) shall be increased if they are less than the value calculated from the following formula:

$$e_h = 2,5 \left(\frac{D_o}{T} \right)^{0,5}$$

Where:

e_h is the minimum thickness of cylindrical shell or dished end to satisfy handling criteria

D_o is the outside diameter of the drum in mm

T is the minimum value of tensile strength in the finished drum in N/mm^2

In no case shall the thickness be less than 2,5 mm.

If the materials used for shell and ends are different, the calculation shall be carried out for each component using the appropriate properties.

5.4 Support loadings

The drum and supports, if any, shall be designed to withstand the greater of the following;

- 1) static load when the drum is filled with water.
- 2) maximum operating mass of the drum subject to 2g acceleration acting vertically down and horizontally, and 1g acting vertically up.

Where g is the acceleration due to gravity.

This shall be demonstrated by experimental testing or calculation in accordance with a recognised pressure vessel standard or specification, e.g. EN 13445-3.

Under the forces defined above, the stresses in the drum and its fastenings shall not exceed the following:

- a) for general membrane stress in the shell, remote from the supports – the normal design stress as defined in E.1;
- b) for stresses local to the supports, determined either by experimental analysis or calculation/special analysis – the limits specified in accordance with a recognised pressure vessel standard or specification. e.g. EN 13445-3.

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5.5 Lifting lug loadings

The lifting lugs shall be designed to accept the maximum loads anticipated during construction and handling in service, applying an acceleration of 2g vertically downwards and an assumed sling angle of 45°. This shall be demonstrated by experimental testing or calculation in accordance with a recognised pressure vessel standard or specification, e.g. EN 13445-3. Stress limits as specified in 5.4 apply.

5.6 Openings

5.6.1 General

Drums shall be provided with the minimum number of openings required to satisfy the need for fittings to meet service requirements.

Openings shall be positioned and/or grouped in such a way that their fittings can be protected as required by 5.7. For drums not fixed into a protective framework, the openings shall be located in the ends only.

5.6.2 Reinforcement

Each opening shall be reinforced by a boss, pad or compensating plate attached by welding and designed in accordance with Annex E.

5.6.3 Position of welds

The welds of opening reinforcements shall be clear of longitudinal and circumferential welds and welds of other opening reinforcements by a minimum of 40 mm between the weld edges.