



SLOVENSKI STANDARD SIST EN 12807:2002

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Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) - Design and construction

Ortsbewegliche, wiederbefüllbare, hartgelötete Flaschen aus Stahl für Flüssiggas (LPG) - Konstruktion und Aufbau

Bouteilles rechargeables et transportables en acier brasé pour gaz de pétrole liquéfiés - Conception et construction

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ICS:

23.020.30 V|æ } ^Á [• [á ^É] |ã • \ ^ Pressure vessels, gas cylinders
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EUROPEAN STANDARD

EN 12807

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Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) - Design and construction

Bouteilles transportables et rechargeables en acier brasé
pour gaz de pétrole liquéfiés (GPL) - Conception et
fabrication

Ortsbewegliche, wiederbefüllbare, hartgelötete Flaschen
aus Stahl für Flüssiggas (LPG) - Konstruktion und
Herstellung

This European Standard was approved by CEN on 5 March 2001.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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Foreword

This European Standard 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 October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the Free Trade Association, and supports the objectives of the framework Directives on Transport of Dangerous Goods.

The standard has been submitted for reference into the RID and/or in the technical annexes of the ADR.

Therefore in this context 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 document: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the 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.

1 Scope

This European Standard specifies minimum requirements concerning material, design, construction and workmanship, procedure and test at manufacture of transportable refillable brazed steel liquefied petroleum gas (LPG) cylinders of water capacity from 0,5 l up to and including 15 l. The limit of 15 l is related to manufacturing process available.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

[SIST EN 12807:2002](#)

EN 962, *Transportable gas cylinders – Valve protection caps and valve guards for industrial and medical gas cylinders – Design, construction and tests* [ac2f79252354/sist-en-12807-2002](#)

EN 1044, *Brazing - Filler metals*

EN 10002-1:1990, *Metallic materials - Tensile testing - Part 1: Method of test*

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

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

EN 12797, *Brazing – Destructive tests of brazed joints*

EN 12799:2000, *Brazing – Non-destructive examination of brazed joints*

EN 13133, *Brazing – Brazer approval*

EN 13134, *Brazing – Procedure approval*

prEN 13152, *Specification and testing for liquefied petroleum gas (LPG) – Cylinder valves self-closing*

prEN 13153, *Specification and testing for liquefied petroleum gas (LPG) – Cylinder valves-manually operated*

3 Terms and definitions and symbols

3.1 Terms and definitions

For the purposes of this standard the following terms and definitions apply:

3.1.1**yield stress**

the upper yield strength, R_{eH} or, for steels that do not exhibit a defined yield, the 0,2% proof stress (non-proportional elongation, see EN 10002-1)

3.1.2**normalising**

heat treatment in which a finished cylinder is heated to a uniform temperature above the upper critical point (A_{c3}) of the steel and then to the melting point of the brazing filler metal, followed by cooling in a controlled atmosphere

3.2 Symbols

<i>a</i>	Calculated minimum thickness of the cylindrical shell.	millimetres
<i>A</i>	Percentage elongation after fracture.	%
<i>b</i>	Calculated minimum thickness of the end of the cylinder	millimetres
<i>C</i>	Shape factor (see table 1, figure 2 and 3)	
<i>D</i>	Outside diameter of the cylinder as given in the design drawing (see figure 1)	millimetres
<i>D_p</i>	Diameter of the bend test mandrel	millimetres
<i>h</i>	Height of the cylindrical part of the end (see figure 1)	millimetres
<i>H</i>	Outside height of the domed part of the end (see figure 1)	millimetres
<i>L</i>	Length of the cylinder.	millimetres
<i>L₀</i>	Original gauge length of the test piece, in accordance with EN 10002-1	millimetres
<i>n</i>	Ratio : diameter of the bend test mandrel to the thickness of joint	
<i>P_c</i>	Calculation pressure, used to calculate the minimum required thickness of the cylindrical shell and ends.	bar (1 bar = 10 ⁵ Pa = 10 ⁵ N/m ²)
<i>P_b</i>	Maximum pressure, attained during the burst test.	bar
<i>P_t</i>	Actual test pressure above atmospheric pressure applied to the cylinder by the manufacturer	bar
<i>r</i>	Inside knuckle radius of the end.	millimetres
<i>R</i>	Inside dishing radius of the end.	millimetres
<i>R_{eH}</i>	Upper yield strength	N/mm ²
<i>R_g</i>	Minimum value of tensile strength	N/mm ²
<i>R_o</i>	Minimum value of yield stress	N/mm ²
<i>R_m</i>	Actual value of tensile strength determined by the tensile test specified in 7.1.2.2.	N/mm ²
<i>t</i>	Thickness of the test specimen at the joint	millimetres

4 Materials

4.1 Materials for shells and end pressings shall conform to EN 10120 with respect to the main elements of composition, and shall also meet the following additional requirement:

Materials shall be suitable for a brazing temperature of 1 100 °C for the duration of the brazing operation, without significant grain growth.

The term "materials" refer to materials in the state before any specific transformation which results from the manufacturing process.

4.2 All parts brazed to the cylinder shall be made of brazable, compatible material.

4.3 The brazing consumables (see EN 1044) in the form of wire or paste shall be such that they are capable of giving consistent joints with minimum tensile strength at least equal to that specified for the parent materials in the finished cylinder.

4.4 The cylinder manufacturer shall have certificates according to EN 10204 type 3.1 B. These certificates shall cover the ladle analysis and mechanical properties of the steel supplied for the construction of the pressure retaining parts of the cylinder.

4.5 Manufacturers shall maintain a system of identification for materials used in the construction so that materials for pressure retaining parts in the completed cylinder can be traced to their origin.

5 Design

5.1 General requirements

5.1.1 The calculation of the wall thickness of the pressure retaining parts to resist the internal pressure in the cylinders shall be related to the yield stress of the material.

5.1.2 For calculation purposes, the value of the yield stress R_o shall be limited to $0,9R_{eH} \leq R_o \leq 0,85R_g$.

5.1.3 The internal calculation pressure P_c for the wall thickness of cylinders shall be equal to the actual test pressure P_t .

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

5.1.5 The value of R_g and R_o shall be guaranteed by the cylinder manufacturer for the finished cylinder.

5.2 Calculation of cylinder shell thickness

The minimum wall thickness of the cylindrical shell shall be :

$$a = \frac{P_c \times D}{15R_o + P_c} \quad (1)$$

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

5.3 Design of ends concave to pressure

5.3.1 Design of ends concave to pressure

End shapes of cylinders shall fulfil the following conditions :

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

$$H = (R + b) - \sqrt{\left[(R + b) - \frac{D}{2} \right] \times \left[(R + b) + \frac{D}{2} - 2(r + b) \right]} \quad (\text{see figure 1a}) \quad (2)$$

— for semi-ellipsoidal ends $H \geq 0,192 D$; $h \geq 4b$ (see figure 1b).

5.3.2 The minimum wall thickness of the ends of cylinders shall be:

$$b = \frac{P_c \times D \times C}{15 R_o + P_c} \quad (3)$$

The value of C shall be obtained from table 1 or the graphs given in figures 2 and 3.

Table 1 — Relationship between *H/D* and shape factor *C*

<i>H/D</i>	<i>C</i>	<i>H/D</i>	<i>C</i>
0,25	1,000	0,38	0,612
0,26	0,931	0,39	0,604
0,27	0,885	0,40	0,596
0,28	0,845	0,41	0,588
0,29	0,809	0,42	0,581
0,30	0,775	0,43	0,576
0,31	0,743	0,44	0,572
0,32	0,713	0,45	0,570
0,33	0,687	0,46	0,568
0,34	0,667	0,47	0,566
0,35	0,649	0,48	0,565
0,36	0,633	0,49	0,564
0,37	0,621	0,50	0,564

NOTE Intermediate values may be obtained by linear interpolation.

5.4 Ends of other shapes

5.4.1 Ends of shapes other than those covered by 5.3 may be used provided that the adequacy of their design is demonstrated by a fatigue test in accordance with 7.6 or by appropriate stress analysis acceptable to the inspection body.

5.5 Minimum wall thickness

5.5.1 The minimum wall thickness of the cylindrical shell, *a* and of the end, *b*, shall not be less than the value derived from any of the following formulae:

for $D < 100$ mm:

$$a_{\min} = b_{\min} = 1,1 \text{ mm} \quad (4)$$

for $100 \leq D \leq 150$ mm:

$$a_{\min} = b_{\min} = 1,1 + 0,008 \times (D-100) \text{ mm} \quad (5)$$

for $D > 150$ mm:

$$a_{\min} = b_{\min} = \frac{D}{250} + 0,7 \text{ mm} \quad (6)$$

With an absolute minimum of 1,5 mm.

5.5.2 If the cylindrical portion of the cylinder, measured between the beginning of the domed parts of the two ends, is not more than $\sqrt{2bD}$ the wall thickness shall be in accordance with 5.3.2.

5.6 Design of openings

5.6.1 The location of openings shall be restricted to one end of the cylinder.

5.6.2 Each opening in the cylinder shall be reinforced, either by a valve boss or pad, securely attached by brazing and so designed as to be of adequate strength and to result in no harmful stress concentrations. This shall be confirmed by design calculations acceptable to the inspection body or a fatigue test in accordance with 7.6.

5.6.3 The brazing of the openings shall be clear of circumferential joints.

5.6.4 If the leak-tightness between the valve and the cylinder is assured by a metallic seal (e.g. copper), a suitable internal valve boss may be fitted to the cylinder by a method which need not independently guarantee leak-tightness between the boss and the cylinder.

5.6.5 Tolerance in positioning of openings shall be specified by the manufacturer in the design drawing.

6 Construction and workmanship

6.1 Brazing qualification

6.1.1 The manufacturer shall have the technical capability and have at his disposal all appropriate means, and properly qualified personnel necessary to satisfactorily carry out the manufacture of cylinders.

6.1.2 Each manufacturer, with the agreement of the inspection body, shall, before proceeding with the production of a given design of cylinder, approve the brazing procedures to EN 13134 for all brazing associated with the pressure envelope including non pressure containing parts.

Records of such qualification shall be kept on file by the manufacturer.

6.1.3 Brazing procedure approval tests shall be made in such a manner that the joints shall be representative of those made in production.

6.1.4 Brazers shall have passed the approval tests for the specific type of work and procedure concerned (see EN 13133).

6.2 Pressure retaining parts

Before assembly, the pressure retaining parts of the cylinders shall be visually examined for uniform quality and freedom from imperfections which may ultimately affect the cylinder integrity.

6.3 Brazed joints

6.3.1 Longitudinal joints are not permitted. Circumferential joints, of which there shall be no more than two, shall be of the joggled type having an overlap of four times the nominal sheet thickness (see figure 4).

6.3.2 The brazing material shall penetrate through the joint as specified in figure 4 and fill it sufficiently. This may be achieved by placing the brazing material inside the cylinder above the joint before brazing, as shown in figure 4.

6.3.3 Repair of the brazed joint may be carried out once. The procedure for the repair shall be in accordance with 8.3.3. b.