

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

The European Standard EN 12807:2001 has the status of a
British Standard

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PVE/19, LPG containers and their associated fittings, which has the responsibility to:

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pour gaz de pétrole liquéfiés (GPL) — Conception et
fabrication

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

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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of an identical text or by endorsement, at the latest by October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.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.

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).

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

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

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

normalizing

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

a	Calculated minimum thickness of the cylindrical shell	millimetres
A	Percentage elongation after fracture	%
b	Calculated minimum thickness of the end of the cylinder	millimetres
C	Shape factor (see Table 1, Figure 2 and Figure 3)	
D	Outside diameter of the cylinder as given in the design drawing (see Figure 1)	millimetres
D_p	Diameter of the bend test mandrel	millimetres
h	Height of the cylindrical part of the end (see Figure 1)	millimetres
H	Outside height of the domed part of the end (see Figure 1)	millimetres
L	Length of the cylinder	millimetres
L_o	Original gauge length of the test piece, in accordance with EN 10002-1	millimetres
n	Ratio: diameter of the bend test mandrel to the thickness of joint	
P_c	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)
P_b	Maximum pressure attained during the burst test	bar
P_t	Actual test pressure above atmospheric pressure applied to the cylinder by the manufacturer	bar
r	Inside knuckle radius of the end	millimetres
R	Inside dishing radius of the end	millimetres
R_{eH}	Upper yield strength	N/mm ²
R_g	Minimum value of tensile strength	N/mm ²
R_o	Minimum value of yield stress	N/mm ²

R_m	Actual value of tensile strength determined by the tensile test specified in 7.1.2.2	N/mm ²
t	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” refers 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 $0,9 R_{eH} \leq R_o \leq 0,85 R_g$.

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:

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

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