BS EN 1440:2016

BSI Standards Publication

# LPG equipment and accessories — Transportable refillable traditional welded and brazed steel Liquefied Petroleum Gas (LPG) cylinders — Periodic inspection

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**National foreword**

This British Standard is the UK implementation of EN 1440:2016. Together with BS EN 16728:2016, it supersedes BS EN 1440:2008 +A1:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PVE/19, LPG containers and their associated fittings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.


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**Compliance with a British Standard cannot confer immunity from legal obligations.**

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# EN 1440

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English Version

# LPG equipment and accessories - Transportable refillable traditional welded and brazed steel Liquefied Petroleum Gas (LPG) cylinders - Periodic inspection

Equipements pour GPL et leurs accessoires - Bouteilles de gaz de pétrole liquéfié (GPL) en acier soudé et brasé transportables et rechargeables - Contrôle périodique

Flüssiggas-Geräte und Ausrüstungsteile - Ortsbewegliche, wiederbefüllbare, herkömmlich geschweißte und hartgelötete Flaschen aus Stahl für Flüssiggas (LPG) - Wiederkehrende Inspektion

This European Standard was approved by CEN on 13 December 2015.

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

# Contents

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## European foreword

This document (EN 1440:2016) 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of an identical text or by endorsement, at the latest by August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

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 in conjunction with EN 16728:2016[1] supersedes EN 1440:2008+A1:2012.

This European Standard has been submitted for reference into the RID [1] and the technical annexes of the ADR [2].

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

This European Standard deals with the periodic inspection requirements for transportable refillable welded and brazed steel LPG cylinders.

For all other cylinder designs, EN 16728:2016[1] applies.

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.

[1] To be published in 2016.

# Introduction

The primary objective of the periodic inspection of transportable refillable liquefied petroleum gas (LPG) cylinders is that, on completion of the tests, the cylinders can be re-introduced into service for a further period of time.

The very large populations of traditional steel LPG cylinders in use have led to the development of alternative methods of inspection.

This European Standard has been prepared to reflect the current methodology for periodic inspection of LPG cylinders and is based on extensive operating experience.

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

Protection of the environment is a key political issue in Europe and elsewhere, for CEN/TC 286 this is covered in CEN/TS 16765 [3], and this Technical Specification should be read in conjunction with this standard.

It has been assumed in the drafting of this European Standard that the execution of its provisions is entrusted to appropriately qualified and competent persons.

Where judgements are called for, it has been assumed that they are made by competent persons who have been specifically trained for the tasks.

# 1 Scope

This European Standard specifies procedures for the periodic inspection and testing, of transportable refillable LPG cylinders with a water capacity from 0,5 l up to and including 150 l.

This European Standard is applicable to welded and brazed steel LPG cylinders with a specified minimum wall thickness designed according to EN 1442, EN 12807, EN 13322-1, or equivalent standard (e.g. national codes).

This European Standard is intended to be applied to cylinders complying with RID/ADR (including pi marked cylinders) and also to existing non RID/ADR cylinder populations.

NOTE The requirements of RID/ADR take precedence over those of this standard in the case of cylinders complying with that regulation, including pi marked cylinders.

This European Standard does not apply to cylinders permanently installed in vehicles.

# 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 837-1:1996, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*

EN 837-3:1996, *Pressure gauges - Part 3: Diaphragm and capsule pressure gauges - Dimensions, metrology, requirements and testing*

EN 1442, *LPG equipment and accessories — Transportable refillable welded steel cylinders for LPG — Design and construction*

EN 12807, *LPG equipment and accessories - Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) - Design and construction*

EN 12816, *LPG equipment and accessories - Transportable refillable LPG cylinders - Disposal*

EN 13322-1, *Transportable gas cylinders - Refillable welded steel gas cylinders - Design and construction - Part 1: Carbon steel*

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

EN 14912, *LPG equipment and accessories - Inspection and maintenance of LPG cylinder valves at time of periodic inspection of cylinders*

EN ISO 14245, *Gas cylinders - Specifications and testing of LPG cylinder valves - Self-closing (ISO 14245)*

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

# 3 Terms and definitions

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

**3.1**
**competent authority**
authority or authorities or any other body or bodies designated as such in each State and in each specific case in accordance with domestic law

**3.2**
**competent person**
person which by combination of appropriate qualification, training, experience, and resources, is able to make objective judgments on the subject

**3.3**
**inspection body**
independent inspection and testing body approved by the competent authority

**3.4**
**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

**3.5**
**periodic inspection**
activities carried out at defined intervals, such as examining, measuring, testing or gauging the characteristics of a pressure vessel and comparing these with specified requirements

**3.6**
**tare mass**
sum of the mass of the empty cylinder, the mass of the valve including a dip tube where fitted, and the mass of all other parts that are permanently attached to the cylinder when it is being filled, e.g. fixed valve guard

# 4 Requirements for periodic inspection

The interval between periodic inspections shall be dependent on the content of a written scheme.

NOTE 1 A written scheme describes work procedures, criteria, responsibilities and other minimum requirements.

The maximum interval between periodic inspections for LPG cylinders shall be 10 years; however it can be extended to 15 years under the following conditions:

— for LPG cylinders manufactured before the date 2015-01-01, provided the conditions of Annex B are fully met and approval from the relevant competent authority(ies) has been given; and

— for RID/ADR welded steel LPG cylinders, provided the requirements of Annex D are fulfilled and approval from the competent authority has been given.

Periodic inspections/tests shall be carried out by a competent person under the authorization of an inspection body based on a written scheme and in accordance with the requirements specified in Table 1.

NOTE 2 RID [1] and ADR [2] include detailed requirements on the qualification, obligations, accreditation and approval of these inspection bodies.

Cylinders rejected shall be segregated and shall be either reconditioned, re-tested or rendered unserviceable.

The decision to render a cylinder unserviceable can be taken at any stage during the periodic inspection procedure. With agreement by the owner, a cylinder shall be rendered unserviceable in accordance with EN 12816 such that it cannot be re-issued into service as a pressure vessel.

NOTE 3 In some countries render unserviceable means scrapping.

NOTE 4 With the agreement of the competent authority, the proof pressure test of cylinders can be replaced by an equivalent method based on acoustic emission testing, ultrasonic examination or a combination of acoustic emission testing and ultrasonic examination. EN ISO 16148 [4] can be used as a guide for acoustic emission testing procedures.

NOTE 5 Tests can be performed in any order as determined by the written scheme.

**Table 1 — Requirements for periodic inspection**

| Cylinder types | Maximum periodic inspection interval | Tests |
|---|---|---|
| Brazed steel cylinders in conformance with EN 12807 or equivalent standard. | 10 years | — External visual inspection as described in 5.1. and Annex A;<br>— Proof pressure test (hydraulic proof pressure test or, with the agreement of the competent authority, a pneumatic proof test followed by a leak test) as described in 5.2;<br>— Internal condition check as described in 5.3 and Annex A;<br>— Inspection of threads as described in 5.4;<br>— Inspection of valves as described in 5.5. |
| Welded steel cylinders in conformance with EN 1442, EN 13322–1 or equivalent standard (e.g. national codes). | — 10 years; or<br>— 15 years under the conditions of Annex B (cylinders manufactured before 1st January 2015); or<br>— 15 years under the conditions of Annex D. | |
| Welded steel cylinders with a water capacity of less than 6.5 l. | 10 years | As for welded steel cylinders in conformance with EN 1442 (see above), or with the agreement of the competent authority, as specified in Annex E. |
| Non RID/ADR welded and brazed steel cylinders. | As determined by the competent authority. | As specified in Annex C. |

# 5 Inspections and tests

## 5.1 General

Relevant cylinder data shall be identified before any inspections or tests are carried out.

Cylinders which cannot be safely emptied of gas shall be set aside for special handling.

Cylinders with inoperative or blocked valves shall be set aside for safe valve removal.

Before preparing for inspection, manufacturer's guidelines shall be taken into account to avoid any damage to the cylinders.

Any chemical solutions and/or cleaning methods used shall be selected to ensure that they do not adversely affect cylinder material.

## 5.2 External visual inspection

### 5.2.1 Preparation for external visual inspection

a) If necessary, the cylinder shall be cleaned and have all loose coatings or labels, corrosion products, tar, oil or other foreign matter removed from its external surface,

b) Care shall be taken to avoid damaging the cylinder,

c) When cylinders are treated by a process that might remove cylinder material, the inspection body shall decide whether a thickness test is required, e.g. ultrasonic thickness check.

NOTE Cleaning methods include wire brushing, shot blasting (in accordance with EN ISO 8504 [6] series and EN ISO 8501-1 [5]), water jet cleaning, chemical cleaning or other suitable methods, that do not adversely affect any part of the cylinders.

### 5.2.2 Inspection procedure

LPG cylinders shall be inspected for:

a) dents, cuts, gouges, bulges, cracks, laminations or punctures while applying the criteria for rejection in Annex A;

b) corrosion, applying the criteria for rejection given in Annex A; while giving special attention to areas where water can be trapped

EXAMPLE at the base of the cylinder;

the junction between the cylindrical shell and the foot-ring;

the junction between the cylindrical shell and the valve guard or shroud; and

hidden corrosion (e.g. under handles).

c) other defects (e.g. depressed bung or fire damage) while applying the criteria for rejection given in Annex A;

d) integrity of all permanent attachments; and

e) integrity of all mandatory permanent markings.

#### 5.2.3 Rejection criteria

The specific requirements for external visual inspection of LPG cylinders are described in Annex A including defect descriptions and rejection limits.

### 5.3 Proof pressure test

#### 5.3.1 General

The test shall consist of one of the proof pressure tests described in 5.3.2 and 5.3.3. Proof pressure testing, according to 5.3.3, requires the agreement of a competent authority. The pneumatic proof test as described in 5.3.3 shall only be implemented where such an operation does not entail any danger.

Pressure gauges that are used to read the cylinder test pressure, shall be in accordance with EN 837-1:1996 and EN 837-3:1996, accuracy class 1,6 or better. They shall be calibrated or checked for accuracy against a master gauge at regular intervals and not less frequently than once every six months. The master gauge shall be re-calibrated in accordance with national requirements.

All joints within the system shall be leak tight.

The test equipment shall not restrict the expansion of the cylinder.

#### 5.3.2 Hydraulic proof pressure test

##### 5.3.2.1 General

A non-corrosive liquid that is compatible with the material of construction of the cylinder shall be used as the test medium.

##### 5.3.2.2 Preparation of cylinders

a) Cylinders shall be depressurized in a safe and controlled manner before proceeding.

b) The external surface of the cylinder shall be in such a condition that any leak can be detected. If the cleaning method involves the wetting of the outside surface or if the outside surface is wet due to outdoor storage conditions, the outside surface shall be completely dried before commencing the test procedure.

##### 5.3.2.3 Test equipment

The design and installation of the equipment and the cylinders connected to it shall ensure that no air is trapped in the system.

A device shall be fitted to the test equipment to ensure that no cylinder is subjected to pressure in excess of its test pressure by more than the tolerance given in 5.3.2.4.

##### 5.3.2.4 Test procedure

a) The cylinder shall be positioned so that the welds are visible during the test.

b) The test pressure for a RID/ADR cylinder shall be at least the test pressure marked on the cylinder. For non-RID/ADR cylinders see Annex C.

c) The pressure shall be gradually increased in the cylinder until the test pressure is reached.

d) The test pressure shall not be exceeded by more than 20 % or 6 bar, whichever is the least. More than one cylinder can be tested at a time provided they all have a test pressure within the tolerance specified. If the cylinder is tested at a higher pressure than that marked, the owner of the cylinder shall calculate the maximum pressure not to be exceeded to ensure that the general membrane

stress in the cylinder wall does not exceed 90 % of the guaranteed minimum yield strength of the material used in the finished cylinder.

NOTE This can be demonstrated by the following formula:

$$\frac{P_h\left(D-e\right)}{20e} \leq 0,9 \times R_o \quad (1)$$

where

$P_h$ actual test pressure applied to the cylinder by the manufacturer, in bar.

$D$ outside diameter of the cylinder, in millimetres

$e$ actual thickness of the material in the finished cylinder (at the point under consideration), in millimetres

$R_0$ minimum value of yield strength guaranteed by the cylinder manufacturer for the finished cylinder, in newton's per square millimetre

e) Test pressure shall be held for the time necessary to inspect the cylinder and check it out for any leak and/or other defects, but not less than 15 s.

f) If there is leakage in the pressure system, it shall be corrected and the cylinders re-tested.

g) Cylinders, that do not leak or show any visible permanent distortion after the pressure has been released, shall be deemed to have passed this test. Cylinders showing visible defects shall be examined by a competent person.

h) Cylinders that fail this test shall be rejected.

i) Records of rejected cylinders shall be maintained.

### 5.3.3 Pneumatic proof test and leak test

#### 5.3.3.1 Preparation of cylinders

a) If cylinders have to be depressurized, it shall be carried out in a safe and controlled manner before proceeding.

b) Repainting before the pneumatic test shall be limited to a primer coat. The finishing coat shall be applied after the test in order not to mask potential leaks.

NOTE The valve can be fitted before the proof test or leak test, see 6.2.

#### 5.3.3.2 Procedure

##### 5.3.3.2.1 Proof test

a) Cylinders shall be tested in a safe enclosure to protect against rupture under pneumatic pressure. Adequate safety procedures and measures (e.g. hearing protection) shall be adopted to protect personnel in charge of the test.

b) The test pressure for a RID/ADR cylinder shall be at least the test pressure marked on the cylinder. For non-RID/ADR cylinders see Annex C.

c) Where a separate pressure relief valve is fitted, an adequate margin of safety shall be maintained between the pneumatic proof test pressure and the pressure setting of the pressure relief valve. Where necessary, the pressure relief valve shall be removed and the port plugged for testing.

d) After the cylinder has been placed in a safe enclosure, it shall be charged with the pneumatic test medium (e.g. air, nitrogen) to the test pressure and held at that pressure for at least 5 s. The gas to be used for testing shall be non-flammable to avoid any risk of internal explosion. The cylinder shall pass the proof test if it does not burst. The cylinder shall then be isolated from the pressure source.

NOTE Care needs to be taken to avoid corrosion if full water immersion is used.

#### 5.3.3.2.2 Leak test

a) The pressure shall be reduced to not less than 6 bar. The pressure drop shall be monitored in a safe and controlled manner.

b) The reduced pressure shall be held for the time necessary to inspect the cylinder and to check for any leaks.

c) Cylinders that do not leak or show any visible permanent distortion after the pressure has been released shall be deemed to have passed this test.

NOTE Care needs to be taken to avoid corrosion if full water immersion is used.

d) Cylinders that fail shall be rejected.

e) Records of rejected cylinders shall be maintained.

## 5.4 Check of the internal condition of the cylinder

### 5.4.1 Check of the internal condition of welded steel cylinders

#### 5.4.1.1 General

The check shall consist of one of the two tests, as described in 5.4.1.2 and 5.4.1.3.

#### 5.4.1.2 Internal visual inspection

#### 5.4.1.2.1 Preparation of cylinders

a) Cylinders shall be depressurized in a safe and controlled manner before proceeding.

b) Valves shall be removed from cylinders.

c) Where necessary, residual liquid and possible foreign matter shall be removed from the inside of the cylinder.

#### 5.4.1.2.2 Procedure

a) Cylinders shall be inspected internally for any sign of corrosion or other defects that can affect their integrity, using a safe inspection lighting system with appropriate internal illumination (e.g. an endoscope).

b) Cylinders showing signs of internal corrosion, except those having only superficial surface rust, shall be removed for further detailed evaluation, in accordance with Table A.2.

c) If cleaning is required, care shall be taken to avoid damaging the cylinder walls. Cylinders shall be re-inspected after cleaning.

#### 5.4.1.3 Check of the minimum wall thickness

The wall thickness shall be measured e.g. by ultrasonic method, according to a procedure agreed with the competent authority, in a sufficient number of places in order to guarantee the minimum wall thickness of the entire cylinder. The measurements shall be compared to the required calculated minimum wall thickness. If one of the measurements is lower than the required calculated minimum wall thickness, the cylinder shall be rejected.

The required calculated minimum wall thickness shall be provided by the owner of the cylinder.

### 5.5 Inspection of cylinder threads

#### 5.5.1 General

When the valve (and any other fitting) is removed during periodic inspection, the cylinder threads shall be inspected in accordance with 5.5.2, 5.5.3 and 5.5.4.

#### 5.5.2 Internal threads

The internal threads of the cylinder shall be visually inspected and cleaned of any foreign matter.

NOTE This can be performed at the test station or at the filling station.

#### 5.5.3 External threads

External neck threads, which are required for operational reasons, shall be examined for integrity and for thread damage.

#### 5.5.4 Damaged threads

Where necessary and where the design permits, damaged threads shall be repaired by a competent person or the cylinder shall be rendered unserviceable in accordance with EN 12816.

### 5.6 Inspection of valves

Valves shall be inspected, repaired, refurbished or scrapped in accordance with EN 14912.

## 6 Final operations

### 6.1 General

After hydraulic testing, effective precautions shall be taken to prevent internal corrosion and/or contamination.

### 6.2 Valving

If the valve is removed a new, inspected or refurbished valve, suitable for the intended use, shall be fitted to the cylinder using a sealing material/system and the optimum torque necessary to ensure a seal between the valve and the cylinder shall be applied.

The torque applied shall be compliant with both the cylinder and valve manufacturer's recommendations. The torque applied shall be checked at regular intervals using an appropriate and calibrated torque wrench. Records of such measurements shall be maintained according to Clause 8.

New valves shall be in conformance with EN ISO 14245 or EN ISO 15995.

The leak-tightness of the valve (or any other fitting) onto the cylinder shall be checked after valving.

NOTE This can be performed at the test station or at the filling station.

For cylinders complying with conditions of Annex D and fitted with self-closing valves, a new valve shall be fitted to the cylinder at time of periodic inspection.

### 6.3 Tare mass

The tare mass or indication of tare mass of the cylinder shall be re-established if any modification or re-valving has been made that affects the tare mass of the cylinder.

The scale used to confirm or determine the tare mass shall be calibrated according to national regulations.

The scale shall be checked at regular intervals using an appropriate and calibrated set of weights to ensure its compliance.

Records of such measurements shall be maintained according to Clause 8.

If the new tare indication is different from the old tare indication, steps shall be taken to ensure that the former tare is unreadable.

### 6.4 Marking

After successful completion of the periodic inspection, each cylinder shall be legibly and durably marked in accordance with EN 14894.

NOTE RID/ADR regulations on marking take precedence over this clause.

### 6.5 Purging

Air shall be removed from the cylinder, e.g. by evacuation or by displacement with LPG.

NOTE This may be performed at the test station or at the filling station.

## 7 Repair of welded steel cylinders

### 7.1 Major repairs

Major repairs such as de-denting, boss realignment, replacement of foot-rings and shrouds may be carried out, provided the integrity of the cylinder is not impaired.

All corrosion products shall be removed prior to repair.

If during the pressure test or at visual inspection, a cylinder leaks through a pinhole at the weld, it should be examined by a competent person to determine whether it can be repaired by welding or if it shall be rendered unserviceable in accordance with EN 12816. Welding or repairing should be carried out in accordance with the manufacturer's requirements. These types of repairs are not permitted by the RID/ADR.

### 7.2 Minor repairs

Minor repairs e.g. reforming damaged shrouds, carrying handles, not involving welding or hot-work on pressure containing parts, may be carried out provided the integrity of the cylinder is not impaired.

### 7.3 Requirements for repair

Major repairs as defined in 7.1 shall be carried out by a competent person following an approved procedure. After such repairs, which can involve high temperatures i.e. greater than 300 °C, a stress relieving or normalizing heat treatment shall be performed, if required. Finally, the cylinder shall be proof tested and inspected as necessary for the intended gas service.

When the repair involves welding onto the pressure wall, this shall be carried out by a suitably qualified welder using a suitably qualified welding procedure.

# 8 Records

The organization operating the periodic inspection station shall maintain records of the quality system, inspection reports, test data, calibration data and reports concerning the qualifications or approvals of the competent persons.

Inspection reports and test data for cylinders shall be held and maintained by the organization operating the periodic inspection station for at least the retest period plus an additional 2 years.

NOTE An inspection report or test data can cover one or more cylinders.

# Annex A
(normative)

# Specific requirements for external visual inspection

Rejection limits for physical, material and other defects on the cylinder wall are given in Table A.1, Table A.2 and Table A.3.

**Table A.1 — Physical defects in the cylinder wall**

| Defect | Description | Rejection limit |
|---|---|---|
| Bulge | Visible swelling of the cylinder | All |
| Dent | A depression in the cylinder that has neither penetrated nor removed metal, when its width at any point is greater than 2 % of the external cylinder diameter. | When the depth of the dent exceeds 25 % of its width at any point. [a] |
| Cut or gouge | A sharp impression where metal has been removed or redistributed. | Where the original calculated wall thickness is known:<br>— depth of cut or gouge is such that the undamaged (remaining) wall is less than the minimum calculated wall thickness.<br>Where the original calculated wall thickness is not known:<br>— all. |
| Dent containing cut or gouge | A depression in the cylinder within which there is a cut or gouge. | When the size of the dent, cut or gouge exceeds the dimensions for rejection as an individual defect. |
| Crack | A split or rift in the cylinder shell. | All |
| Lamination | Layering of the material within the cylinder wall appearing as a discontinuity, crack, lap or bulge at the surface. | All |

[a] Appearance (e.g. sharp dent) and location (e.g. on shoulder of the cylinder) also play a part in the evaluation of dent severity.

**Table A.2 — Corrosion on the cylinder wall**

| Type of corrosion | Description | Rejection limit |
|---|---|---|
| Isolated corrosion pits | A pitting of metal occurring in isolated areas at a concentration not greater than 1 pit per 500 $mm^2$ of surface area. | When the depth of discrete pits exceeds 0,6 mm. A greater depth of corrosion can be accepted provided that the depth of corrosion does not reduce the wall thickness below the minimum calculated wall thickness. |
| Area corrosion | Reduction in wall thickness over an area not exceeding 20 % of the cylinder surface. | When the depth of penetration of any pit exceeds 0,4 mm. A greater depth can be accepted provided that the depth of corrosion does not reduce the wall thickness below the minimum calculated wall thickness. |
| General corrosion | A reduction in wall thickness over an area exceeding 20 % of the cylinder surface. | When the depth of penetration of any pit exceeds 0,2 mm. A greater depth can be accepted providing that the depth of corrosion does not reduce the wall thickness below the minimum calculated wall thickness. |
| Chain pitting or line or channel corrosion | A series of pits or corroded cavities of limited width along the length or around the cylinder circumference. | 1) When the total length of corrosion in any direction exceeds 50 % of the circumference of the cylinder; or<br>2) When the depth of penetration exceeds 0,4 mm. A greater depth can be accepted providing that the depth of corrosion does not reduce the wall thickness below the minimum calculated wall thickness; or<br>3) When the depth of corrosion cannot be measured. |
| Crevice corrosion | Crevice corrosion occurs in the area of the intersection of the foot-ring or shroud with the cylinder. | When the depth of penetration exceeds 0,4 mm or when the depth of corrosion cannot be measured. |

**Table A.3 — Other defects**

| Defect | Description | Rejection limit |
|---|---|---|
| Depressed bung | Damage to the bung which has altered the profile of the cylinder. | A limited level of depression/alignment deviation, as agreed by the competent authority;<br>Otherwise, all. |
| Arc or torch burns | — Burning of the cylinder base metal;<br>— A hardened heat affected zone;<br>— The addition of extraneous weld metal; or<br>— The removal of metal by scarfing or cratering. | All |
| Fire damage [a] | Excessive general or localized heating of a cylinder usually indicated by:<br>— charring or burning of paint;<br>— fire damage of the metal;<br>— distortion of the cylinder;<br>— melting of metallic valve parts;<br>— melting of any plastic components, e.g. date ring, plug or cap. | All |
| Damaged foot-ring | Not firmly attached foot-ring. | All |
| | Badly deformed foot-ring. | Unstable or unbalanced cylinder |
| Damaged shroud | Loose or badly deformed shroud. | Preventing proper operation or protection of valve. |
| [a] If paint is only superficially charred, a cylinder may be accepted by a competent person. | | |

# Annex B
(informative)

# Requirements for 15 year periodic inspection interval for cylinders manufactured before January 1st 2015

## B.1 General

For a cylinder to qualify for a 15-year time interval, the following specific requirements shall apply:

a) Cylinders shall be filled in accordance with the criteria contained in EN 1439 [7] or an equivalent standard as approved by a competent authority with particular emphasis on:

   — cylinder identification e.g. design code, tare mass mark of the competent authority, (see EN 14894);

   — external cylinder condition, see 5.1;

   — cylinders are designed, manufactured and tested to EN 1442, or equivalent;

   — a system of external protection against corrosion, which is being maintained.

b) The LPG quality shall comply with the limitations on corrosive contaminants specified in ISO 9162 [8].

c) Cylinders shall be under the control of a competent gas organization responsible for their distribution, filling and maintenance. The concept of control of cylinders is detailed in B.2.

d) Other conditions to be met are listed in B.3.

## B.2 Concept of control

a) Cylinders shall be owned by, and be under the responsibility of, a competent gas organization for checking, filling and maintenance and that loans or hires them to distribution undertakings, consumers or other users under the conditions used in B.3; or

b) Cylinders are not owned by, but their distribution, filling and maintenance are under the responsibility of a competent gas organization; and

c) The responsible competent gas organization may contract the filling, maintenance and/or testing to other competent organisations, ensuring that the cylinders are filled, maintained and tested only as contracted in accordance with the procedures of that competent gas organization.

## B.3 Conditions

The following conditions shall be fulfilled:

a) The responsible competent gas organization shall take practicable measures to ensure that the cylinders are returned for filling, maintenance and/or testing to the responsible competent gas organization or an authorized contractor, or shall be exchanged for a full cylinder at a retail outlet serviced by the responsible competent gas organization or an authorized contractor.

b) The responsible competent gas organization or their contractor shall have established appropriate filling, maintenance and test facilities under their control.

c) The responsible competent gas organization shall have a policy of taking all necessary measures to ensure that their cylinders are filled, maintained and tested only at the facilities stated in b).

NOTE 1 15-year periodic inspection interval is allowed under conditions of ADR 2009 P200 v, which takes precedence over any clause of this annex.

NOTE 2 The application of this annex is subject to the agreement by the relevant competent authority.

# Annex C
(normative)

# Periodic inspection procedure for cylinder populations not covered by the RID/ADR

Procedures for periodic inspection of cylinder populations not covered by RID/ADR shall consist of inspections as described in Table C.1 plus a replacement of the valve or an inspection of the valve in accordance with EN 14912.

**Table C.1 — Procedures for periodic inspection**

| Cylinders | Procedures |
|---|---|
| Welded and brazed steel LPG cylinders | — External visual inspection as described in 5.2; and<br>— Additionally, at least one of the tests described in 5.3 [a] and 5.4 [b] |

[a] Where lower reference temperatures are permitted by a national competent authority for use within its territory, in accordance with EU Council Directive 2008/68/EC [9] the common test pressure shall not be less than 22,5 bar for cylinders in Propane service and 7,7 bar for cylinders in Butane service

[b] Only cylinders where the wall thickness is equal to or greater than the minimum calculated wall thickness and the design burst pressure is known or can be shown to be at least 35 bar for commercial butane cylinders and 70 bar for commercial propane cylinders can be exempted from the proof pressure test described in 5.3.

# Annex D
(informative)

# Requirements to be fulfilled to extend period between two periodic inspections to 15 years for RID/ADR welded steel LPG cylinders

## D.1 General

The interval between periodic inspections may be extended to 15 years if the owner of a group of cylinders has the agreement of the competent authority and where it can be ensured that the requirements of this Annex are fulfilled.

NOTE A group of cylinders is defined by the production dates of identical cylinders for a period, during which the applicable provisions of RID/ADR and of the technical code accepted by the competent authority have not changed in their technical content.

## D.2 Design and manufacturing

Cylinders manufactured since 1st January 1999 shall have been manufactured in conformity with the following standards:

— EN 1442;

— EN 13322-1.

Other cylinders manufactured before 1st January 2009 in conformance with the RID/ADR in accordance with a technical code accepted by the competent authority can be accepted for a 15 year interval, if they are of equivalent safety to the provisions of RID/ADR as applicable at the time of application.

## D.3 Operational provisions

Cylinders shall only be filled in filling centres applying a documented quality system to ensure that all cylinders are filled in accordance with EN 1439.

NOTE RID/ADR regulations on filling take precedence over this clause.

LPG quality shall comply with the limitations on corrosive contaminants specified in ISO 9162 [8].

## D.4 Periodic inspection

Cylinders shall be periodically inspected according to Clause 4. The following additional requirements shall be fulfilled:

— if a cylinder with a 15 year interval fails the hydraulic pressure test during a periodic inspection e.g. by bursting or leakage, the owner shall investigate and produce a report on the cause of the failure and record if other cylinders, e.g. of the same type or group, are affected. In the latter case, the owner shall inform the competent authority who shall determine the appropriate measures to be taken;

— cylinders having been granted a 15 year interval shall only be fitted with valves designed and manufactured for a minimum 15 year period of use according to EN ISO 14245 or EN ISO 15995. After a periodic inspection, a new valve shall be fitted to the cylinder, with the exception of manually operated valves which can be re-fitted provided that the valves have been refurbished or inspected in accordance with EN 14912 and it can be demonstrated that they are suitable for another 15 year period of use. Refurbishment or inspection shall only be carried out by the manufacturer of the valves or in accordance with technical instruction from an organization qualified for such work and operating under a documented quality system.

## D.5 Marking

Cylinders granted a 15 year interval for periodic inspection in accordance with this paragraph shall additionally be marked clearly and legibly with “P15Y”. This marking shall be removed if the cylinder is no longer authorized for a 15 year interval.

NOTE 1 The text of this annex is based on the RID/ADR special packing provision P200 (12) which includes additional provisions and information and which takes precedence over any clause of this standard.

NOTE 2 The application of this annex is subject to the agreement of the competent authority.

# Annex E
(informative)

# Alternative test applicable to commercial butane cylinders with less than 6,5 l water capacity

## E.1 General

**CAUTION — This test is only applicable to cylinders with less than 6,5 l water capacity, and has been agreed by the competent authority.**

The pneumatic leak test is applicable to dedicated commercial butane cylinders whose owner shall ensure that the wall thickness is equal to or greater than the minimum calculated wall thickness and that the design burst pressure is known, or can be shown to be at least 50 bar.

## E.2 Preparation of cylinder

**E.2.1** If required, the cylinder shall be cleaned and have all loose coatings or labels, corrosion products, tar, oil or other foreign matter removed from its external surface.

**E.2.2** Cylinders shall be depressurised in a safe and controlled manner before proceeding, where applicable.

**E.2.3** Cylinders with inoperative or blocked valves shall be set aside for safe valve removal.

**E.2.4** For inspection, maintenance and scrapping of cylinder valves see EN 14912.

## E.3 Procedure

**E.3.1** The pneumatic leak test may be carried out while the valve is fitted to a pressurized cylinder. Cylinders shall be filled with a pneumatic test medium (e.g. natural gas, air, nitrogen) in such a way that the internal pressure developed in the cylinders at the time they are checked for leakage shall not be less than 7 bar.

If another flammable gas than the one already in the cylinder is to be used for the test it should:

— be used in such a small quantity that the product into the cylinder after filling meets the requirements of commercial butane; or

— be partly or completely withdrawn from the cylinder after testing.

NOTE Propane vapour can be used as the test medium provided the ambient temperature is at least 20 °C.

**E.3.2** Cylinders shall be isolated from the pressure source.

**E.3.3** The test shall consist of a full immersion of the cylinder in water or an equivalent detection system. The gas tightness check shall be capable of detecting any leak from any part of the cylinder.

NOTE Care needs to be taken to avoid corrosion if full water immersion is used.

**E.3.4** Cylinders that do not leak or show any visible permanent distortion after the pressure has been released shall be deemed to have passed the test.

**E.3.5** Cylinders that fail shall be rejected.

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[1] Regulations concerning the International Carriage of Dangerous Goods by Rail (RID), appearing as Appendix C to the Convention concerning International Carriage by Rail (COTIF), Vilnius, 3 June 1999, as amended

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[3] CEN/TS 16765, *LPG equipment and accessories - Environmental considerations for CEN/TC 286 standards*

[4] EN ISO 16148, *Gas cylinders - Refillable seamless steel gas cylinders - Acoustic emission testing (AT) for periodic inspection (ISO 16148)*

[5] EN ISO 8501-1, *Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings (ISO 8501-1)*

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[7] EN 1439, *LPG equipment and accessories - Procedure for checking LPG cylinders before, during and after filling*

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