
**Gas cylinders — Refillable welded steel
cylinders for liquefied petroleum gas
(LPG) — Periodic inspection and testing**

*Bouteilles à gaz — Bouteilles rechargeables soudées en acier pour gaz
de pétrole liquéfié (GPL) — Contrôles et essais périodiques*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 10464 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

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Introduction

The primary objective of the periodic inspection of transportable refillable welded steel liquefied petroleum gas (LPG) cylinders is that, at the completion of the test, the cylinders can be reintroduced into service for a further period of time.

The original periodic inspection and test procedures for transportable refillable welded steel LPG cylinders were based on those for gas cylinders or other pressure vessels, including those used for high-pressure industrial gases. These early methods relied on a periodic hydraulic proof pressure test being carried out at intervals as frequently as two years (pre-1940). With increasing experience and confidence so gained, together with improved cylinder manufacturing quality, it has been possible to allow the extension of the intervals between periodic tests to 15 years.

Periodic inspection is normally carried out at a test station operating under the supervision of a competent body.

This International Standard has been prepared to reflect the current state of the art for the periodic inspection of LPG cylinders and is based on the operating experience of millions of cylinders in service over many years.

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Gas cylinders — Refillable welded steel cylinders for liquefied petroleum gas (LPG) — Periodic inspection and testing

WARNING — This International 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. It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

1 Scope

This International Standard specifies the intervals and inspection and testing procedures for the periodic inspection of refillable welded steel dedicated LPG cylinders of water capacity from 0,5 l up to and including 150 l.

It applies to cylinders protected by a system to prevent external corrosion and designed and manufactured in accordance with ISO 4706, ISO 22991 or an equivalent design and construction standard. This International Standard may also apply to other refillable welded steel cylinder designs for LPG with the approval of the national authority. Cylinders for the on-board storage of LPG as a fuel for vehicles are excluded from this standard, except cylinders used for fork-lift truck applications.

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.

ISO 4706, *Refillable welded steel gas cylinders*

ISO 8501-1:1988, *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 8504-2, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 2: Abrasive blast-cleaning*

ISO 9162, *Petroleum products — Fuels (class F) — Liquefied petroleum gases — Specifications*

ISO 10691, *Gas cylinders — Refillable welded steel cylinders for liquefied petroleum gas (LPG) — Procedures for checking before, during and after filling*

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

ISO 15995, *Gas cylinders — Specifications and testing of LPG cylinder valves — Manually operated*

ISO 22991, *Gas cylinders — Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) — Design and construction*

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

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

3 Terms and definitions

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

3.1 competent body
person or corporate body, defined by the national or relevant authority, which by combination of appropriate qualification, training, experience and resources is able to make objective judgments on a subject

3.2 competent person
person who by a combination of training, experience and supervision is able to make objective judgments on a subject

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

NOTE In some countries, UN number 1011 and UN number 1978 may also be used to designate LPG.

3.4 periodic inspection
activities carried out at defined intervals including but not limited to examining, measuring, testing or gauging the characteristics of a cylinder and comparing these with specified requirements as defined in the cylinder design standard and marking to attest conformity with the standard

3.5 periodic inspection test station
place where cylinders are tested and periodically inspected

3.6 tare mass
sum of the empty mass, 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. the fixed valve guard

4 Intervals between periodic inspections

The determination of the interval between periodic inspections shall be dependent on the content of a written scheme that shall be approved by a competent body as complying with the conditions outlined in Annex A.

The interval between periodic inspections shall be 15 years provided the conditions of Annex A are fully met. A shorter time interval not exceeding 10 years shall apply if any of the conditions specified in Annex A are not met.

5 Procedures for periodic inspection

5.1 General

The determination of the periodic inspection procedures shall be dependent on the content of a written scheme approved by a competent body.

5.2 Test procedures

In all cases, periodic inspection procedures shall consist of an external visual inspection as given in 5.3. Additionally, where required by national regulations, one of the following test procedures shall be performed:

- a) hydraulic proof pressure test (see 5.4.2);
- b) internal visual inspection (see 5.4.3) provided that cylinders have an adequate wall thickness and the design burst pressure is known or the actual burst pressure is proven equal to or exceeding:
 - 1) 35 bar for cylinders designed for dedicated butane service,
 - 2) 70 bar for cylinders designed for propane service;
- c) pneumatic proof test and leak test (see 5.4.4);
- d) pneumatic leak test for LPG cylinders of water capacity 6,5 l or less (see 5.4.5) where the actual burst pressure is equal to or exceeds:
 - 1) 35 bar for cylinders designed for dedicated butane service,
 - 2) 70 bar for cylinders designed for propane service;
- e) volumetric expansion test (see 5.4.6) where authorized by the national or other relevant authority.

5.3 External visual inspection

5.3.1 Preparation for external visual inspection (see also Annex B)

Where the cylinder surface has loose coatings, corrosion products, tar, oil or other foreign matter, these shall be removed by steel wire brushing, shot blasting in accordance with ISO 8504-2, water jet abrasive cleaning, chemical cleaning or other suitable methods.

Care shall be taken to avoid damaging the cylinder.

Cylinders treated by a process that may remove cylinder material shall be checked by a suitable means, e.g. a thickness check.

5.3.2 Inspection procedure

The entire surface of the cylinder shall be inspected by a competent person for:

- a) dents, cuts, gouges, bulges, cracks, laminations or punctures, applying the guidelines for rejection in Table 1;
- b) corrosion, giving special attention to areas where water can be trapped, at the base of the cylinder, the junction between the body and the foot ring, the junction between the body and the valve guard or shroud, and in particular hidden corrosion (e.g. behind the data plate), applying the criteria for rejection given in Table 2;
- c) other defects (e.g. depressed bung or fire damage), applying the criteria for rejection given in Table 3;
- d) the integrity of all permanent attachments.

Any cylinder rejected by the competent person shall be segregated for reconditioning, for further testing or to be rendered unserviceable (see Clause 8).

NOTE In some countries, to render unserviceable means to scrap.

5.3.3 Visible defects

Rejection criteria for physical and material defects on the cylinder shell are contained in Tables 1, 2 and 3. Under exceptional conditions and with the approval of a competent person, the wall thickness may be less than the minimum design value, in which case the cylinder shall pass the pressure test specified in 5.4.2.

Table 1 — Physical defects in the cylinder wall

Defect	Description	Rejection limit
Bulge	Visible swelling of the cylinder	Rejection in all cases
Dent	A depression in the cylinder that has neither penetrated nor removed metal, and 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: where depth of cut or gouge is such that the undamaged (remaining) wall is less than the minimum calculated wall thickness Where the original calculated wall thickness is not known: rejection in all cases
Intersecting cut or gouge	The point of intersection of two or more cuts or gouges	Rejection in all cases
Dent containing cut or gouge	A depression in the cylinder within which there is a cut or gouge	When the size of the dent or cut or gouge exceeds the dimensions for rejection as an individual defect
Crack	A split or rift in the cylinder shell	Rejection in all cases
Lamination	Layering of the material within the cylinder wall appearing as a discontinuity, crack, lap or bulge at the surface	Rejection in all cases

^a Consideration of appearance and location also plays a part in the evaluation of dents.

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