BS EN 14334:2014

BSI Standards Publication

LPG equipment and accessories — Inspection and testing of LPG road tankers

National foreword

This British Standard is the UK implementation of EN 14334:2014. It supersedes BS EN 14334:2005 which is withdrawn.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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Flüssiggas-Geräte und Ausrüstungsteile - Inspektion und Prüfung von Straßentankwagen für Flüssiggas (LPG)

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

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Foreword

This document (EN 14334:2014) 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of an identical text or by endorsement, at the latest by May 2015 and conflicting national standards shall be withdrawn at the latest by May 2015.

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 supersedes EN 14334 :2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been submitted for reference into the technical annexes of the ADR [1].

The main modifications with regard to EN 14334:2005 are:

a) the definitions in Clause 3 were updated;

b) Clause 4, Table 1 was adapted to ADR requirements;

c) subclause 5.4 was adapted to ADR requirements;

d) subclause 5.5 was reviewed to provide detailed prerequisites and requirements on NDT techniques used as an alternative to hydraulic pressure test;

e) subclause 5.7.2 was corrected to accommodate for typical working pressures for LPG pressure vessels;

f) an environmental checklist (Annex B) was added;

g) document was adapted to current CEN regulations.

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Introduction

This document 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.

The frequencies of the different types of pressure vessel inspection are given by the relevant international regulations concerning the transport of dangerous goods.

Protection of the environment is a key political issue in Europe and elsewhere. Protection of the environment is taken in a very broad sense. What is meant is the total life cycle aspects of, e.g. a product on the environment, including expenditure of energy and during all phases from mining of raw materials, fabrication, packaging, distribution, use, scrapping, recycling of materials, etc.

NOTE Annex B indicates which clauses in this standard address environmental issues. Clauses addressing environmental issues are restricted to a general guidance. Limiting values can be specified in national laws.

It is recommended that companies using this standard develop an environmental management policy. For guidance, see EN ISO 14001.

It has been assumed in the drafting of this document that the execution of its provisions is entrusted to appropriately qualified and experienced people.

1 Scope

This European Standard specifies minimum requirements for the inspection and testing of the LPG road tanker, which includes its pressure vessel, accessories and vehicle LPG equipment.

This European Standard does not specify requirements for the initial inspection (after manufacture) of a pressure vessel, see EN 12493, or for service equipment on the road tanker, see EN 12252.

This European Standard does not apply to compartmented road tankers.

NOTE 1 There is no upper size limit for the pressure vessel as this will be determined by the gross vehicle weight limitation.

NOTE 2 For inspection and testing requirements of equipment other than the pressure vessel, accessories and vehicle LPG equipment, see applicable regulations.

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 1711, *Non-destructive examination of welds - Eddy current examination of welds by complex plane analysis*

EN 12252, *LPG equipment and accessories - Equipping of LPG road tankers*

EN 12493, *LPG equipment and accessories - Welded steel pressure vessels for LPG road tankers - Design and manufacture*

EN 13109, *LPG equipment and accessories - LPG tanks and drums - Disposal*

EN ISO 3452-1, *Non-destructive testing - Penetrant testing - Part 1: General principles (ISO 3452-1)*

EN ISO 5579, *Non-destructive testing - Radiographic testing of metallic materials using film and X- or gamma rays - Basic rules (ISO 5579)*

EN ISO 9712, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 17636-2, *Non-destructive testing of welds - Radiographic testing - Part 2: X- and gamma-ray techniques with digital detectors (ISO 17636-2)*

EN ISO 17638, *Non-destructive testing of welds - Magnetic particle testing (ISO 17638)*

EN ISO 17640, *Non-destructive testing of welds - Ultrasonic testing - Techniques, testing levels, and assessment (ISO 17640)*

3 Terms and definitions

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

3.1
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

3.2
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

3.3
intermediate inspection
inspection carried out between the initial and first periodic inspection, or between two periodic inspections, the results of which are recorded

3.4
vehicle LPG equipment
equipment and pipework on the road tanker which is in contact with LPG and forms part of the LPG operating system, shut-down system or safety system, but which is not directly connected to the pressure vessel and is not part of the automotive LPG system

3.5
accessories
devices connected to the system whose main function is not for the storage or conveyance of LPG

Note 1 to entry: Referred to as “service equipment” in ADR.

3.6
repair
correction of a defect

Note 1 to entry: It does not include normal service and maintenance operations of the shell or service equipment or replacement of gaskets or service equipment to the same specification.

3.7
road tanker
rigid vehicle, semi-trailer or trailer comprising of one or more fixed pressure vessels

Note 1 to entry: Referred to as fixed tanks (tank-vehicles) and demountable tanks in the ADR.

3.8
exceptional check
inspection/test after repair of the vessel, vessel accessories, vehicle LPG equipment or structural equipment

3.9
gas-free
less than 20 % of the lower explosive limit of LPG in air

3.10
inspector
individual or a body approved by the competent authority to perform designated inspections and tests

3.11
inspection body
independent inspection and testing body approved by the competent authority

3.12
structural equipment
external reinforcing, fastening or stabilizing member of the shell, being an integral part of and directly welded to the shell, or to a backing plate on the shell

3.13
hot work
any work that requires a flame or other ignition source for its execution, or which could produce or expose a possible source of ignition (e.g. sparks) capable of igniting flammable gases, liquids or other materials

4 Inspection and testing

The requirements for inspection and testing, as detailed below, shall apply to pressure vessels designed and manufactured in accordance with EN 12493 and equipped in accordance with EN 12252, but can also be used for existing pressure vessel designs.

The following inspections/tests/checks shall be carried out, under the supervision of the inspector, in accordance with Table 1.

NOTE According to ADR testing, inspection and certification duties are allocated to either the competent authority or to inspection bodies. ADR includes detailed requirements on the qualification, obligations, accreditation and approval of these inspection bodies as well as the frequency for inspections and tests.

Table 1 — Required inspections/tests

Inspections/Tests	Clause	Intermediate	Periodic	Exceptional checks [a]
Necessary documents	5.2	X	X	X
Interior of the pressure vessel	5.3	–	X	X
Exterior of the pressure vessel	5.4	X	X	X
Hydraulic pressure	5.5	–	X	X
Accessories	5.6	X	X	X
Vehicle LPG equipment	5.6	X	X	X
Leakproofness	5.7	X	X	X
Structural equipment – after repair	5.8	–	–	X

[a] As appropriate to the repair. If the pressure vessel is being remounted then all inspections shall be as for the original construction.

An exceptional check can be required when the safety of the accessories, vehicle LPG equipment, the pressure vessel, or structural equipment may have been impaired as a result of repairs, alterations or accidents.

5 Inspection and testing requirements

5.1 General

Additional inspections/tests/checks can be required, subject to the results of the inspections/tests/checks required by this clause.

Precautions shall be taken for the safety of the inspecting personnel, and any other personnel in the vicinity of the road tanker, when inspections/tests are carried out.

5.2 Inspection of the necessary documents

The following documents shall be provided for the inspection:

— certificate of initial inspection,

— type approval documentation,

— certificate of last periodic inspection, or

— certificate of intermediate inspection/ exceptional check, if applicable.

The documents shall be inspected to ensure that they are relevant to the pressure vessel, accessories and vehicle LPG equipment, and that they are satisfactory. Additional requirements and remarks in these documents shall be taken into account.

5.3 Inspection of the interior of the pressure vessel

The pressure vessel shall be empty, clean, certified gas-free and safe to enter at the time of inspection. Suitable methods for gas freeing are described in EN 13109.

A complete visual internal inspection shall be performed.

The entire surface of the pressure vessel shall be inspected for:

— surface defects such as dents, cuts, gouges, bulges, cracks;

— other defects indicating possible abnormal operating conditions.

NOTE The inspector can request that this inspection is supplemented by NDT-techniques (see 5.5.8).

Surface defects deemed to impair the integrity of the pressure vessel shall be repaired or the pressure vessel shall be rejected from service and disposed of safely in accordance with EN 13109.

5.4 Inspection of the exterior of the pressure vessel

5.4.1 External visual inspection

A complete visual inspection shall be performed.

The visual inspection of the exterior of the pressure vessel shall include:

— the identification of any surface defect;

NOTE In case of doubt, appropriate non-destructive methods can be used.

— the condition of the protective coating;

— the fastenings of the pressure vessel and its structural equipment;

— the marking of the pressure vessel, which shall be in accordance with 6.2.

5.4.2 Inspection of earthing

Road tankers with an earth connection shall be inspected for conformity of the connection with the design requirements. The electrical resistance between the earth connection and the metallic parts of the pressure vessel / vehicle chassis shall not exceed 10 Ω.

5.4.3 Pressure vessel inspection procedures

The entire surface of the pressure vessel shall be inspected for:

— surface defects such as dents, cuts, gouges, bulges, cracks;

— corrosion, giving special attention to areas where water can be trapped, to the base of the pressure vessel, to the connection between the pressure vessel and the support structure and around the pressure vessel connections;

— other defects indicating possible abnormal operating conditions, external forces, signs of fire impingement.

5.4.4 Inspection criteria

5.4.4.1 Surface damage

Where damage which results in reduction of the wall thickness is detected, it shall be verified that the wall thickness is not reduced below the minimum thickness in the type approval documents or, where those are not available, the minimum thickness as required by ADR.

Where surface corrosion is present, but has not reduced the minimum thickness, a suitable corrosion protection system shall be applied to the tank. Where the tank has been rejected due to corrosion, it may either be disposed of safely in accordance with EN 13109 or undergo a detailed special assessment in consultation with the inspector in order to determine a suitable method for repair.

5.4.4.2 Abnormal surface conditions

Where abnormal surface conditions are detected, the inspector shall review the design documents and the initial inspection report and/or other previous inspection reports, if any, and decide what further action is required. Limits as per 5.4.4.1 apply regardless of the cause of damage.

5.5 Hydraulic pressure testing

5.5.1 General

Prior to the test, the outside surface of the pressure vessel and its equipment shall be sufficiently dry and clean so that any leakage can be detected on the shell. If the ambient temperature is below 5 °C, a hydraulic pressure test with water is only allowed if precautions are taken to prevent the water from freezing.

The equipment of the pressure vessel may be tested separately.

Sheathing for thermal or other insulation shall be removed only to the extent required for a reliable appraisal of the pressure vessel.

5.5.2 Hydraulic test pressure

The test pressure shall be as shown on the data plate of the pressure vessel.

5.5.3 Hydraulic pressure test liquid

The liquid normally used for hydraulic pressure testing is water.

Care shall be taken with the disposal of the liquid to avoid environmental contamination.

In special cases and with the agreement of the inspector, the hydraulic pressure test may be replaced by a pressure test using another liquid or gas, where such an operation does not present any danger.

5.5.4 Pressurization

The pressure vessel shall be totally filled with the test liquid; taking care that no gas pockets remain before pressure is gradually applied.

The pressure vessel shall be pressurized at constant rate until pressure reaches maximum working pressure. At this pressure the pressure vessel shall be inspected for leaks and permanent deformation. Were no leaks or permanent deformation are detected, the pressure shall slowly be increased up to the designated test pressure. In the event of a leakage or permanent deformation, the test is to be interrupted and the pressure vessel depressurized.

The assessment shall be made according to 5.5.7.

A safety device shall be included in the hydraulic pressure system. The device shall be set so that the pressure in the pressure vessel does not exceed 105 % of the required test pressure.

5.5.5 Test duration

The test pressure shall be held for the time necessary for the inspection to be carried out but not less than 15 min.

5.5.6 Measurement

The test pressure shall be measured by a pressure gauge. Pressure gauges shall be in accordance with EN 837-1:1996 and EN 837-3:1996 (accuracy class 1,6 or better). Pressure gauges shall have an accuracy at least equal to 4 % of the reading. The test pressure of the pressure vessel shall give a reading on the gauge between 50 % and 90 % of full scale deflection.

Alternative methods of pressure measurement (e.g. by transducer) may be used if they achieve equivalent accuracy.

5.5.7 Evaluation of the test

The pressure vessel fails the hydraulic pressure test if there is any visible permanent deformation caused by the test pressure or if a leak is detected on the shell.

In the event of failure the pressure vessel may be repaired with the agreement of the inspector and retested or disposed of safely in accordance with EN 13109.

If the pressure vessel is to be scrapped, as much material as possible shall be recycled.

5.5.8 Alternatives to the periodic hydraulic test

5.5.8.1 General

With the agreement of the inspection body, the periodic hydraulic test may be replaced by an equivalent method based on eddy current testing, magnetic particle testing, ultrasonic examination or a combination of these methods.

Where hot work has been undertaken on the vessel shell or any part of the pressure retaining system a hydraulic test shall be performed. This may be limited to a separate component or section of pipework which has had hot work.

The non-destructive testing (NDT) shall verify the integrity of the parent metal and the construction welding. The method used shall yield at least the same level of safety as that afforded by the hydraulic test.

The NDT does not replace the leakproofness test that is to be undertaken on the complete pressure retaining system.

If the pressure vessel has not undergone post weld heat treatment on completion of construction then the residual stresses resulting from the welding operations could reduce the fatigue life of the welding. This should be taken into account when determining the NDT inspection regime.

5.5.8.2 NDT methods

Non-destructive testing shall be carried out in accordance with Table 2.

The NDT shall be performed in accordance with the relevant standards listed in 5.5.8.3

Defect acceptance levels shall be in accordance with the original construction standard or where the original construction standard is obsolete, in accordance with EN 12493. Pressure vessels with defects falling outside the acceptance levels shall undergo a suitable repair or shall be disposed of safely in accordance with EN 13109. Alternatively, a fitness for purpose assessment shall be made on the defect by special assessment such as finite element analysis and/or fracture mechanics.

Table 2 — Non-destructive testing of the pressure vessel and pressure retaining system

Area of pressure vessel and pressure retaining system	NDT
'Tee' junctions of butt welds in the vessel shell	100 % ultrasonic, magnetic particle or eddy current testing
Vessel longitudinal butt welds	100 % ultrasonic, magnetic particle or eddy current testing
Vessel circumferential butt welds	100 % ultrasonic, magnetic particle or eddy current testing
Vessel shell, areas that cannot be visually inspected from the outside	Ultrasonic thickness survey, from inside, on a 150 mm (maximum) spaced grid
Attachment welds (internal) direct to the vessel shell including branches, bosses and fittings	100 % ultrasonic, magnetic particle or eddy current testing
High stress areas of vessel support attachment doubling plates (over the saddle horns plus 400 mm)	100 % magnetic particle or eddy current testing
External pressure retaining system and pipework	100 % ultrasonic, magnetic particle or eddy current testing

Where the support attachment welds are hidden by insulation and cladding, magnetic particle inspection may be substituted by an ultrasonic test of the internal area of shell adjacent to the attachment welds.

5.5.8.3 NDT process

The NDT techniques referred to above shall be performed in accordance with the following standards by personnel qualified and certified in accordance with EN ISO 9712:

— ultrasonic techniques in accordance with EN ISO 17640;

— magnetic particle techniques in accordance with EN ISO 17638;

— eddy current testing in accordance with EN 1711.

The results of the NDT shall be recorded and retained for the lifetime of the pressure vessel.

5.6 Inspection of the vehicle LPG equipment and accessories

5.6.1 Inspection

The inspection (see Table 1) shall include a:

— visual external examination for corrosion, damage and satisfactory operation (see 5.6.2);

— visual external examination of pressure relief valve(s) (if fitted) for corrosion and damage;

— check of the set pressure of the pressure relief valves, either by checking the test/setting protocol (e.g. by checking of documentation), the marking or by physical testing.

At periodic inspection, pressure relief valves and pressure vessel valves shall be requalified (see prEN 16631) or replaced.

Hoses shall be pressure tested in accordance with national regulations.

5.6.2 Satisfactory operation

The operation shall be considered satisfactory if the following are fulfilled:

— for valves, an external operating mechanism moves through a full cycle;

— for contents, temperature and pressure gauges, these provide credible readings.

5.6.3 Hose end couplings

Thorough and detailed inspections shall be made for each hose end coupling to ensure that they are fit for purpose.

For the maintenance requirements of 31/4” ACME threaded connections, see EN 13175.

5.6.4 Emergency Shut-Down system (ESD)

The ESD system as described in EN 12252 shall be checked to ensure that it shuts down within 15 s of activation.

5.7 Leakproofness test

5.7.1 General

The leakproofness test shall be performed as the final test on the completed assembly of pressure vessel and its equipment.

5.7.2 Leakproofness test pressure

The leakproofness test shall be carried out at low pressures.

If the pressure vessel is gas-free the leakproofness test pressure shall be:

— a minimum of 0,2 bar using air or nitrogen (or any other fluid compatible with the materials of the pressure vessel and/or the item/section to be tested), and

— not less than 20 % of the test pressure.

If the pressure vessel is in gas service the leakproofness test pressure shall be not less than 20 % of the test pressure.

5.7.3 Extent of test

The leakproofness test shall be carried out on the pressure vessel, the accessories and the vehicles LPG equipment.

5.7.4 Evaluation of the test

The leakproofness test shall be considered acceptable if there is no visual indication of a leak after application of a soapy water solution or equivalent detection method.

5.8 Inspection of pressure vessel or structural equipment after repair

A complete visual inspection of the repair shall be performed to identify surface defects.

Depending upon the type of repair carried out, the appropriate inspection/tests shall be selected from the list below:

— radiographic testing in accordance with EN ISO 5579 and EN ISO 17636-2;

— ultrasonic testing in accordance with EN ISO 17640;

— magnetic particle testing in accordance with EN ISO 17638;

— penetrant testing in accordance with EN ISO 3452-1;

— any other suitable non-destructive test method with the agreement of the inspector;

— hydraulic pressure test in accordance with 5.5;

— leakproofness test in accordance with 5.7.

If an exceptional check fulfilling the requirements of a periodic inspection according to Clause 4 has been performed, then the exceptional check may be considered to be a periodic inspection. If an exceptional check fulfilling the requirements of an intermediate inspection according to Clause 4 has been performed, then the exceptional check may be considered to be an intermediate inspection.

5.9 Re-inspection

An LPG road tanker that fails one or more inspection/test requirements shall, once the reason for failure has been corrected, be re-inspected/retested in accordance with those requirements. The re-inspection/retest shall consider the need for additional inspection/testing if the repair can affect the validity of the result of other previous inspections/tests. Depending on the result of the inspections/tests, additional inspections/tests can be necessary.

6 Inspection certificate and marking

6.1 Certification of periodic, intermediate inspection and exceptional check

An inspection certificate shall be issued after the inspection/check is completed and added to the record of each pressure vessel. An example of a certificate is shown in Annex A. Additional requirements or remarks, which can influence the next regular inspection or exceptional checks, shall be stated on the certificate.

6.2 Marking

After the completion of the intermediate and periodic inspection, the data plate shall be marked in accordance with ADR.

NOTE The marking of road tankers (tank vehicles) is regulated by ADR, which takes precedence over any clause in this standard. The European Directive on Transportable Pressure Equipment (TPED) includes additional requirements (π-marking).

Annex A
(informative)

Road tanker inspection/check certificate

Number of test report: _____ Applicant/User _____ Street _____ Postal code _____ Town _____ Country _____	Number of type approval _____ Name of manufacturer _____ Country _____ Manufacturer's serial number _____ Year of manufacture _____ Date and type of last inspection _____ Owner's/operator's tanker identification _____
Inspection of necessary documents ☐ Inspection of the pressure vessel interior ☐ Inspection of the pressure vessel exterior ☐ Hydraulic pressure test ☐ Inspection of service and vehicles LPG equipment (accessories) ☐	Leakproofness test/pressure vessel equipment ☐ Determination of water capacity[2)] ☐ Inspection of structural equipment ☐
Pressure relief [1)] valve set to	Overpressure.. bar/...MPa
Other inspections and tests _____	
Remarks/significant defects:	

Periodic inspection	☐	passed	☐	failed	☐
Intermediate inspection	☐	passed	☐	failed	☐
Exceptional check	☐	passed	☐	failed	☐

Next inspection _____ Periodic inspection ☐ Intermediate inspection ☐ Exceptional check	Location and date of inspection _____ Name, signature and stamp of inspector _____ _____

UN-Number	Name of substance	ADR Classification Code "2F"

[1)] If fitted.

[2)] If changed.

Annex B
(informative)

Environmental Checklist

Environmental Aspect	Stages of the life cycle										All stages
	Acquisition		Production		Use			End-of-Life			
	Raw materials and energy	Pre-manufactured materials and components	Production	Packaging	Use	Maintenance and repair	Use of additional products	Reuse / Material and Energy Recovery	Incineration without energy recovery	Deposition	Transportation
Inputs											
Materials											
Water						5.5					
Energy											
Land											
Outputs											
Emissions to air						5.3					
Discharges to water						5.5.3					
Discharges to soil						5.5.3					
Waste						5.5.1		5.3 5.4.4.1 5.5.7 5.5.8.2			
Noise, vibration, radiation, heat losses						5.8					
Other relevant aspects											
Risk to the environment from accidents or unintended use						5.6.4					
Customer information											
Comments:											

Bibliography

[1] European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), Geneva, 30 September 1957, as amended

[2] EN 13175, *LPG equipment and accessories - Specification and testing for Liquefied Petroleum Gas (LPG) tank valves and fittings*

[3] prEN 16631, *LPG equipment and accessories - Pressure relief valves for LPG pressure vessels - Reconditioning requirements*

[4] EN ISO 14001, *Environmental management systems - Requirements with guidance for use (ISO 14001)*

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BSI Group Headquarters

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