BS EN 13953:2015

BSI Standards Publication

LPG equipment and accessories — Pressure relief valves for transportable refillable cylinders for Liquefied Petroleum Gas (LPG)

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National foreword

This British Standard is the UK implementation of EN 13953:2015. It supersedes BS EN 13953:2003 which is withdrawn.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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LPG equipment and accessories - Pressure relief valves for transportable refillable cylinders for Liquefied Petroleum Gas (LPG)

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Flüssiggas-Geräte und Ausrüstungsteile - Sicherheitsventile für ortsbewegliche, wiederbefüllbare Flaschen für Flüssiggas (LPG)

This European Standard was approved by CEN on 29 November 2014.

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Foreword

This document (EN 13953:2015) 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of an identical text or by endorsement, at the latest by September 2015, and conflicting national standards shall be withdrawn at the latest by September 2015.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 13953:2003+A1:2007.

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

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

The major changes to this revision include:

— change to the nominal set pressure;

— restructure of Clause 7, Testing and Inspection of the design;

— introduction of an endurance test.

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

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.

Introduction

This European Standard calls for the use of substances and procedures that may be injurious to health and/or the environment if adequate precautions are not taken. It refers only to technical suitability. It does not absolve the user from their legal obligations at any stage.

Protection of the environment is a key political issue in Europe and elsewhere around the world. Protection of the environment in this document is understood in a very broad sense. The phrase is used, for example, in relation to the total life-cycle aspects of a product on the environment, including expenditure of energy, and during all phases of its existence, from mining of raw materials, to fabrication, packaging, distribution, use, scrapping, recycling of materials, etc.

It is essential that provisions be restricted to a general guidance. Limit values are specified in national laws.

It is recommended that manufacturers develop an environmental management policy. For guidance see the EN ISO 14000 series.

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.

All pressures are gauge pressures unless otherwise stated.

NOTE This European Standard requires measurement of material properties, dimensions and pressures. All such measurements are subject to a degree of uncertainty due to tolerances in measuring equipment etc. It may be beneficial to refer to the leaflet “measurement uncertainty leaflet” SP INFO 2000 27 [2].

1 Scope

This European Standard specifies the design, testing and marking requirements for spring loaded pressure relief valves (PRV), for use in liquefied petroleum gas (LPG) cylinders.

These PRVs can be either an integral part of a cylinder valve (see EN ISO 14245 [3] and EN ISO 15995 [4]) or a separate device.

This European Standard does not exclude the use of other designs of pressure relief devices that provide a similar level of safety.

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 549, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 751-1, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 1: Anaerobic jointing compounds*

EN 751-2, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 2: Non-hardening jointing compounds*

EN 751–3 *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 3: Unsintered PTFE tapes*

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

EN 10270-3, *Steel wire for mechanical springs — Part 3: Stainless spring steel wire*

EN 12164, *Copper and copper alloys — Rod for free machining purposes*

EN 12420, *Copper and copper alloys — Forgings*

EN 13906-1, *Cylindrical helical springs made from round wire and bar — Calculation and design — Part 1: Compression springs*

EN ISO 11114-1, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials (ISO 11114-1)*

EN ISO 11114-2, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials (ISO 11114-2)*

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
pressure relief valve
PRV
self-closing valve which automatically, without the assistance of any energy other than that of the vapour concerned, discharges vapour at a predetermined pressure, and operates with a pop action

Note 1 to entry: This is known as a “safety valve” in ADR.

3.3
nominal set pressure
predetermined pressure of the pressure relief valve at which the valve is set to start to discharge

3.4
start to discharge pressure
inlet pressure at which the first of a stream of bubbles appears at the outlet of a pressure relief valve through a water seal of not more than 50 mm water column, or other equivalent method

3.5
pop action
rapid opening of the pressure relief valve sealing element so that the pressure relief valve is fully open, resulting from an increase of inlet pressure creating a sudden increase in force and compression of the spring

3.6
overpressure
pressure increase between the nominal set pressure and the flow rating pressure

Note 1 to entry: Usually expressed as a percentage of nominal set pressure.

3.7
reseat pressure
inlet pressure at which the sealing element effects a seal with the valve seat after the valve has been subjected to pop action

3.8
flow rating pressure
inlet pressure at which the discharge capacity is measured

3.9
discharge capacity
capacity at the flow rating pressure of a pressure relief valve expressed in cubic metres per minute of free air at STP

3.10
nominal discharge capacity
minimum discharge capacity at the flow rating pressure expressed in cubic metres per minute (m^3/min) of free air at STP rounded down to one decimal place

3.11
sealing element
non-metallic resilient component which affects a seal by contact with the valve seat

3.12
valve seat
normally raised area of the valve body on to which the sealing element effects a seal

3.13
cylinder valve
primary shutoff device intended for liquid filling and liquid or vapour service fitted to LPG cylinders

Note 1 to entry: The valve can also include additional devices e.g. liquid level indicator, excess flow device, pressure relief valve, sediment tube, non-return valve and eduction tube.

3.14
leak tightness
resistance to leakage to atmosphere across the valve seat or any other pressure containing component when the valve is closed

3.15
Standard Temperature and Pressure
STP
15,6 °C (288,7 K), 1,013 bar absolute (0,1013 MPa absolute)

4 Operating Conditions

4.1 Terms used with PRVs are described graphically in Annex A.

4.2 Valves designed in accordance with this European Standard shall be suitable for:

— a minimum operating temperature of −20 °C. Temperatures below this are acceptable for short periods for example, when discharging;

— a minimum operating temperature of −40 °C for those parts of Europe where valves are subject to more severe temperature conditions. The material and design shall be shown to be satisfactory for operations under these conditions and shall meet the requirements of Annex B. Where the PRV is integral with a cylinder valve suitable for temperature of −40 °C, the PRV shall also be designed and tested for a temperature of −40 °C; and

— a maximum operating temperature of 65 °C.

5 Materials

5.1 General

5.1.1 Materials in contact with LPG shall be physically and chemically compatible with LPG under all normal operating conditions for which the valve is intended and shall meet the requirements for propane and butane in accordance with EN ISO 11114-1 and EN ISO 11114-2.

5.1.2 Materials for valve components shall be selected to give adequate strength in service. Consideration shall be given to all modes of failure including atmospheric corrosion, brass dezincification, stress corrosion, impact or material failure.

5.1.3 Alternative materials to those listed in 5.2 are not precluded, providing they can be shown to be equivalent.

5.1.4 Where PRVs are an integral part of a cylinder valve, the material requirements for the cylinder valve standard shall be complied with.

5.2 Metallic materials

5.2.1 Hot stamped brass shall be non-porous and shall be suitable for machining or other processes. Sand-cast brass shall not be used.

Leaded brass shall be CW614N or CW617N in accordance with EN 12420 and EN 12164.

Cold drawn brass rods up to 45 mm wide in cross-section shall only be used after heat treatment and testing for internal cracking. Cold drawn brass rods greater than 45 mm wide in cross-section shall not be used.

Components produced from stamping brass shall not exhibit cold shuts, also known as folds, or surface defects such as a crack which may lead to leakage or component failure.

5.2.2 Springs shall be manufactured from stainless steel in accordance with EN 10270-3 or equivalent standard.

Components, when made from stainless steel, shall contain not less than 16 % chromium and not less than 7 % nickel.

5.3 Non-metallic components

Non-metallic materials in contact with LPG shall not distort, harden or adhere to the body or seat face to such an extent as to impair the function of the valve.

Non-metallic materials in contact with LPG shall meet the requirements for resistance to gas (pentane test), lubricants, ageing, compression, ozone (where the material is exposed to the atmosphere) in accordance with EN 549.

Non-metallic materials which are exposed to the atmosphere shall be UV resistant as confirmed by the material manufacturer.

5.4 Lubricants, sealants and adhesives

Lubricants, sealants and adhesives used on operating threads and seals, shall be compatible with LPG and not interfere with the operation of the valve.

Sealants shall comply with the requirements of EN 751-1, EN 751-2 or EN 751-3.

6 Design

6.1 General

6.1.1 PRVs shall be designed to operate with a pop action within the overpressure of the valve.

The valve components shall be designed with adequate strength and clearances to ensure correct operation in service.

6.1.2 Design and construction of PRVs shall ensure that the fitting of a PRV to the cylinder under normal conditions and in accordance with the instructions of the manufacturer does not affect its performance. When a PRV is integral with a cylinder valve, it shall be ensured that fitting of the cylinder valve to the cylinder in accordance with the instructions of the manufacturer does not affect the performance of the PRV.

6.1.3 The sealing element carrier shall be manufactured from a metallic material with a minimum melting point of 450 °C. Non-metallic materials can be used if they are able to meet the same requirements without deformation or degradation which would impair the operation of the valve.

6.1.4 The design shall incorporate guiding arrangements for the sealing element to ensure reliable operation and leak tightness.

6.1.5 The sealing element shall be secured to prevent it becoming loose in operation.

6.1.6 Means shall be provided to lock and/or to seal the PRV in order to prevent and/or reveal any tampering with the settings. Adhesive shall not be used.

6.1.7 When PRVs are provided with a means of protection (such as a disc or cap) to prevent the ingress of foreign matter, such protection shall be designed so as not to be easily displaced except by the discharge from the PRV and shall not interfere with the proper operation of the valve.

6.1.8 The nominal discharge capacity of the PRV for the cylinder shall be calculated in accordance with Annex C.

6.1.9 The flow rating pressure shall be 120 % of the nominal set pressure when sizing the PRV in accordance with Annex C.

6.1.10 The nominal set pressure for pressure relief valves shall have a value between 2,1 MPa and 3,5 MPa (21 bar and 35 bar) as specified by the valve manufacturer.

6.1.11 In certain liquid off take applications where the PRV, during correct use, is located below the liquid level, an internal tube of sufficient internal cross-sectional area communicating with the vapour space shall be fitted to the PRV. It shall be secured in place, during the service life of the PRV, and when the PRV is discharging at full capacity.

6.1.12 PRVs designed such that the PRV is capable of retaining water on the discharge side of the PRV seat, shall be provided with a protection cap or with a drain at the lowest point where water collects.

6.2 Threads

The end connections for PRVs intended to be directly fitted into the cylinder, shall either be a taper thread or a parallel thread combined with a sealing and securing method.

NOTE EN ISO 13341 [5] provides guidance for the insertion of valves into gas cylinders.

A PRV intended to be used with a vent extension or a discharge pipe shall be threaded or otherwise constructed to allow for their connection to the PRV body.

6.3 Springs

Springs shall be designed in accordance with EN 13906-1 or shall be designed to prevent design stresses (as specified in EN 13906-1) being exceeded at the flow rating pressure. Stops may be provided to avoid excessive stresses.

Springs shall be guided and arranged to reduce binding, buckling, or other interference with their free movement. Both ends of the spring shall be closed, ground and at 90° to the axis.

7 Type Testing and inspection of the design

7.1 General

7.1.1 All sample PRVs shall be tested in accordance with the requirements of 7.3 to 7.9.

7.1.2 The test sequence and valve sample numbers are identified in Table 1.

7.1.3 The test medium shall be air or nitrogen for all tests unless otherwise stated.

7.1.4 The accuracy class for pressure measuring equipment used during the tests shall not be more than 0,6, see EN 837-1:1996., with the test pressure within the middle third of the instrument range.

7.1.5 The test equipment for use in measuring the discharge capacity shall be accurate to within ± 2 % of the nominal discharge capacity.

7.1.6 When changes are made in the design of a PRV which affect its flow path or discharge capacity e.g. a tube fitted to the PRV inlet, or if the set pressure is to be modified by more than 10 %, new tests shall be carried out.

Table 1 — Valve type test requirements

Test	Test detail	Clause	Condition of test valve/test sequence	Temperature at which the test is performed °C	Valve sample number	Number of cycles per valve
1	Dimensional checks	7.3	As received	Room temperature	1	1
2	Hydraulic pressure proof test	7.4	As received	Room temperature	2	2
3	Leak tightness test before ageing	7.5	As received	Room Temperature	3, 4 and 5	1
4	Start to discharge pressure	7.6	From test no. 3	Room temperature	3, 4 and 5	3
5	Discharge capacity	7.7	From test no. 4	Room temperature	3, 4 and 5	1
6	Leak tightness	7.8	From test no. 5	Room temperature, $65\ ^{+2,5}_{-2,5}$ °C, $-20\ ^{0}_{-5}$ °C	3, 4 and 5	1
7	Endurance Test	7.9	From test no. 6	Room temperature	3, 4 and 5	10
8	Visual Inspection	7.10	From test no. 7	Room Temperature	3, 4 and 5	1

7.2 Test requirements

7.2.1 There shall be no chatter, flutter, sticking or vibration during the tests that interferes with the satisfactory operation of the PRV.

7.2.2 The PRV shall comply with the design type specification submitted, see 7.3.

7.2.3 The PRV shall withstand a hydraulic pressure proof test without visible permanent deformation, rupture or leak, see 7.4.

7.2.4 The PRV shall be subjected to a start to discharge pressure test, see 7.6.

The start to discharge pressure shall be within ± 15 % of the nominal set pressure.

The average of the three measurements of each valve shall be taken as the average start to discharge pressure for that valve.

The average start to discharge pressure for each valve shall be within a 5 % band for the results of three valves.

7.2.5 The PRV shall be subjected to a discharge capacity test, see 7.7. The lowest value of the discharge capacity of the tested PRVs shall be deemed to be the nominal discharge capacity of the PRV.

The results of the discharge capacity test for each PRV shall be within $\frac{+20}{-0}$ % of the nominal discharge capacity of the PRV.

The reseat pressure shall be not less than 70 % of the nominal set pressure.

7.2.6 The PRV shall withstand leak tightness tests, see 7.5 and 7.8. The leakage rate shall not exceed 15 cm^3/h at STP.

7.2.7 The PRV shall withstand a further 10 cyclic discharge capacity tests, see 7.9. The start to discharge pressure shall remain within ± 15 % of the nominal set pressure, and the reseat pressure shall be not less than 70 % of the nominal set pressure.

7.2.8 The PRV shall be visually inspected for damage, deformation, wear and cracks see 7.10. Any failure, deformation, excessive wear or cracks that affect the normal operation of the PRV shall be a cause of rejection.

7.3 Dimensional checks

The sample valve shall initially be subjected to dimensional checks for conformity with the design type specification.

7.4 Hydraulic pressure proof test

The test shall be carried out in the following manner:

a) the body seat of the PRV shall be blanked off so that the pressure is only applied to those parts on the inlet side of the seat;

b) the test medium shall be water or other suitable liquid;

c) the PRV shall be subjected to a hydraulic proof pressure of not less than 45 bar;

d) the pressure shall be applied through a fitting reproducing the cylinder connection;

e) the pressure shall be raised continuously and gradually;

f) the pressure shall be maintained for two minutes after the proof pressure is achieved;

g) e) and f) shall then be repeated with the PRV operating mechanism in the open position, and with the outlet sealed.

The PRV shall meet the requirements of 7.2.3, or the design shall be rejected.

Alternatively, pneumatic testing may be carried out, if a similar level of sensitivity and safety is provided.

7.5 Leak tightness test before ageing

If Test no. 2 is satisfactory, valves nos. 2, 3 and 4 shall be subjected to a leak tightness test at room temperature.

The PRV shall be tested to ensure leak tightness at any pressure below the start to discharge pressure and above 0,1 bar. The inlet of the PRV shall be connected to a pressure fixture and be pressurized to 70 % of the nominal set pressure.

The PRV shall meet the requirements of 7.2.6, or the design shall be rejected.

The valves shall then be subjected to an aging process in advance of the remainder of the tests.

The ageing process shall be carried out by elevating and maintaining the temperature of the valve to 65 °C for a period of 5 days.

7.6 Start to discharge pressure test

Samples of the PRV set at the same nominal set pressure shall be used. Any activation indicator, dust or protection cap shall be removed. Any features (for example an internal tube to the vapour space as required in 6.1.11) of a PRV, which can affect the flow characteristics, shall be included in the samples being tested.

The start to discharge pressure shall be determined in the following manner;

— the start to discharge pressure shall be measured three times for each of the PRVs;

— the pressure shall be increased to approximately 85 % of the nominal set pressure. A leak tightness test shall then be carried out in accordance with 7.8;

— the pressure shall then be further increased slowly at a rate not exceeding 0,15 bar/s until the first bubbles are observed from the outlet of the PRV;

— the pressure at which the first bubbles appear as the start to discharge pressure of the PRV shall be recorded;

— the average of the three measurements of each valve shall be taken as the average start to discharge pressure for that valve.

The PRV shall meet the requirement of 7.2.4, or the design shall be rejected.

7.7 Discharge capacity test

The discharge capacity shall be determined in the following manner:

— the pressure shall gradually be increased until the flow rating pressure is reached;

— this pressure shall be maintained until the discharge capacity has been recorded;

— the pressure shall gradually be decreased at a rate not exceeding 0,15 bar/s until the PRV reseats and the reseat pressure shall be recorded.

The PRV shall meet the requirements of 7.2.5, or the design shall be rejected.

7.8 Leak tightness tests

The PRV shall be leak tightness tested to ensure tightness at any pressure below 85 % of the nominal set pressure and above 0,1 bar. The leak tightness test shall be carried out at different temperatures (room temperature, high and low temperatures) in the sequence as given in Table 1.

For valves which are used under extreme low temperature conditions (temperatures below −20 °C) the low temperature test shall be carried out in accordance with Annex B.

The PRV shall meet the requirements of 7.2.6, or the design shall be rejected.

7.9 Endurance test

The endurance test shall be carried out in the following manner:

— the pressure shall gradually be increased until the start to discharge pressure is reached and the start to discharge pressure shall be recorded;

— the pressure shall gradually be increased until the flow rating pressure is reached;

— the pressure shall gradually be decreased until the PRV reseats and the reseat pressure shall be recorded.

The cycle shall be repeated 10 times for each sample.

The PRV shall meet the requirements of 7.2.4, 7.2.5 and 7.2.7.

7.10 Visual Inspection

The valve shall be dismantled and visually inspected for damage, deformation, wear and cracks.

The PRV shall meet the requirements of 7.2.8.

8 Test records

The following data shall be recorded for each valve design:

— manufacturer’s name;

— valve type number with reference to the design type specification;

— valve sample number; and

— results of tests 7.3, 7.4, 7.5, 7.7, 7.8, 7.9 and 7.10.

9 Production testing

Each PRV shall be subjected to production testing. Annex D gives recommendations for production testing and inspection.

10 Marking

The following minimum information shall be marked on the body of all PRVs, except where the information is already included on cylinder valve with an integral PRV:

a) manufacturer's name or trademark;

b) type number;

c) date code, indicating year of manufacture and month, e.g. YY/MM;

d) nominal set pressure;

e) nominal discharge capacity of air, quoted in cubic metres per minute;

f) "-40 °C", for valves fulfilling the requirements of Annex B.

NOTE The EU Directive 2010/35/EU [6] also has marking requirements.

11 Documentation

The following information shall be supplied with PRVs:

a) test report summarizing all tests carried out and the results obtained;

b) performance characteristics;

c) user/installation instructions including a requirement not to interfere with the setting of the valve;

d) method and torque requirements for sealing taper threads, in order to provide the correct thread engagement;

e) valve identification;

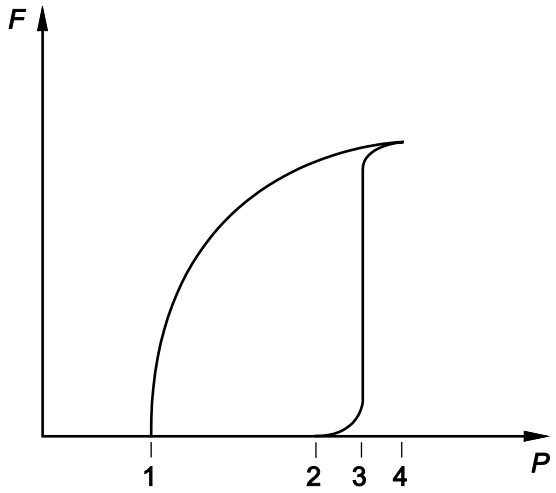
f) manufacturers details and name;

g) maintenance and reconditioning recommendations; and

h) declaration of conformity with this European Standard.

Annex A
(informative)

Terms used with pressure relief valves



Key

1 re-seat pressure

2 start to discharge pressure

3 pop action

4 flow rating pressure

P pressure

F flow

Figure A.1 — Terms used with LPG safety valve

Annex B
(normative)

Special low temperature requirements for valves

B.1 In some parts of Europe where valves are subject to more severe temperature conditions, the design temperature range shall be extended to −40 °C. The material and design shall be shown to be satisfactory for operations under these conditions.

B.2 The valve shall undergo the following procedures:

— the valve is subjected to a temperature of −40°C for 24 h.

— its temperature is then raised to −30 °C.

B.3 The valve shall then be tested in accordance with 7.8.

B.4 The minimum operating temperature “-40 °C ” shall be marked in accordance with the requirements of Clause 10.

Annex C
(normative)

Sizing of PRVs for LPG cylinders

The required nominal discharge capacity of the valve can be calculated in accordance with the formula:

$$Q = 0{,}00278 \times P \times W$$

where:

P is the flow rating pressure in bar absolute,

W is the water capacity of cylinder in litres, (W = 5 for cylinders of 5 l capacity or less)

Q is the required nominal discharge capacity in cubic metres per minute of free air.

Annex D
(informative)

Production testing

D.1 General

The manufacturer should implement a conformity assessment procedure to ensure that the quality and performance of the manufactured PRVs comply with the quality and performance of the design.

D.2 Setting and leak testing of PRVs

Setting and leak testing shall be carried out pneumatically using air, or nitrogen.

Each PRV shall be adjusted so that the start to discharge pressure is at the nominal set pressure.

At any inlet pressure between 0,1 and 0,5 bar, the leakage rate through the valve shall not exceed 15 cm^3 per hour at STP. Also at any inlet pressure between 70 % and 85 % of the nominal set pressure, the leakage rate through the valve shall not exceed 15 cm^3 per hour at STP.

Any subsequent testing of the set pressure shall result in the start to discharge pressure being within ± 15 % of the nominal set pressure.

D.3 Batch samples

Batch samples should be taken in accordance with ISO 2859-1 and the following tests and inspections carried out:

— material suitability;

— dimensional verification; and

— marking.

D.4 Rejection criteria

Valves not meeting the requirements of D.2 should be rejected.

Batches of valves not meeting the requirements of D.3 should follow the rejection criteria of ISO 2859-1.

D.5 Documentation

Results of production testing should be recorded and retained.

Bibliography

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

[2] Measurement uncertainty leaflet (SP INFO 2000 27 uncertainty), Magnus Holmgren et al published by Swedish National Testing and Research Institute

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

[4] EN ISO 15995, *Gas cylinders — Specifications and testing of LPG cylinder valves — Manually operated (ISO 15995)*

[5] EN ISO 13341, *Gas cylinders — Fitting of valves to gas cylinders (ISO 13341)*

[6] Directive 2010/35/EU of the European Parliament and of the Council on transportable pressure equipment, Brussels, 16 June 2010, as amended

[7] ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

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