BS EN 14433:2014

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Tanks for the transport of dangerous goods — Tank equipment for the transport of liquid chemicals and liquefied gases — Foot valves

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National foreword

This British Standard is the UK implementation of EN 14433:2014. It supersedes BS EN 14433:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AUE/18, Tanks for the transport of dangerous goods.

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

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Tanks für die Beförderung gefährlicher Güter - Ausrüstung für Tanks für die Beförderung von flüssigen Chemieprodukten und Flüssiggasen - Bodenventile

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Foreword

This document (EN 14433:2014) has been prepared by Technical Committee CEN/TC 296 “Tanks for transport of dangerous goods”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by April 2015 and conflicting national standards shall be withdrawn at the latest by April 2015.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 14433:2006.

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

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 emphasised that RID/ADR/ADN are being revised regularly at intervals of two years which may lead to temporary non- compliances with the clauses of this standard.

Compared to EN 14433:2006 the following changes have been made:

a) the scope of the standard has been enlarged to include liquefied gases;

b) the references to ADR/RID have been included in the respective clauses of the main part of the standard;

c) the normative references have been updated;

d) change of test conditions (test pressure, hold time).

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1 Scope

This European Standard specifies the requirements for foot valves for use on transportable tanks with a minimum working pressure greater than 50 kPa for the transport of dangerous goods by road and rail.

It is applicable to metallic equipment for use on tanks with gravity and/or pressure bottom loading and discharge for liquid chemicals and liquefied gases. It includes carbon dioxide while excluding refrigerated liquefied gases.

NOTE The standard is also applicable to liquefied gases including LPG, however, for a dedicated LPG standard see EN 13175 [3].

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 12266-1:2012, *Industrial valves - Testing of metallic valves - Part 1: Pressure tests, test procedures and acceptance criteria - Mandatory requirements*

EN 12266-2:2012, *Industrial valves - Testing of metallic valves - Part 2: Tests, test procedures and acceptance criteria - Supplementary requirements*

EN 12516-1, *Industrial valves - Shell design strength - Part 1: Tabulation method for steel valve shells*

EN 12516-2, *Industrial valves - Shell design strength - Part 2: Calculation method for steel valve shells*

EN 12516-3:2002, *Valves - Shell design strength - Part 3: Experimental method*

EN 13445-1, *Unfired pressure vessels - Part 1: General*

EN ISO 11299-1:2013, *Plastics piping systems for renovation of underground gas supply networks - Part 1: General (ISO 11299-1:2011)*

3 Terms and definitions

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

3.1
maximum working pressure
MWP
maximum pressure up to which the valve can be operated, not more than the test pressure divided by 1,3

[SOURCE: ADR/RID chapter 6.8]

3.2
maximum allowable working pressure
MAWP
maximum pressure up to which the valve can be operated, not more than the test pressure divided by 1,3 (liquified gases) respectively 1,5 (liquids)

[SOURCE: ADR/RID chapter 6.7]

3.3
test pressure
the pressure used for the pressure tests

3.4
nominal size
DN
numerical designation of the size of a component which is a convenient round number approximately equal to the manufacturing dimension in millimetres

[SOURCE: EN ISO 11299-1:2013]

4 Function

The footvalve is a primary valve located in the lower part of the tank to allow the controlled loading and discharge of the product and to ensure leaktightness in the closed condition.

5 Design and materials

5.1 General

The footvalve shall be designed for a working pressure of at least 300 kPa. The footvalve shall normally be a non-pressure balanced design. If the valve is a pressure balanced design, a surge pressure of 5 times the MWP shall not jeopardize the tightness of the housing or the function of the valve. The manufacturer shall specify in drawings and other papers, the design and the materials of the footvalve. The valve specification shall include information regarding mating tank flange details.

5.2 Design

5.2.1 The valve shall provide a closure located within the tank shell.

5.2.2 The valve closure shall be positioned so that the pressure in the tank acts to increase the force on the valve seat, and shall be so designed as to prevent self-opening of the valve.

5.2.3 The opening of the valve shall be such as to give a minimum flow path through the valve of a diameter equal to the DN designation of the valve.

5.2.4 The operating mechanism shall be protected from inadvertent operation in transit either by a latching device or by locating within an enclosure.

5.2.5 The internal stop-valve of all filling and all discharge openings of tanks (for tank containers with a capacity greater than 1 m^3) intended for the carriage of liquefied flammable or toxic gases shall be instant-closing and shall close automatically in the event of an unintended movement of the tank or in the event of fire. It shall also be possible to operate the internal stop-valve by remote control.

5.2.6 The operating mechanism of each valve shall have an indicator for the direction of opening and/or closing.

5.2.7 The external valve casing shall have a weakened section (e.g. a shear groove in the external casing or other appropriate means) so positioned that should the valve casing be removed by a severe impact, the sealing capability of the valve shall not be affected. This requires that, in the case of a bottom-operated valve, the operating mechanism of the valve be not directly connected to the valve closure.

5.2.8 Regarding the calculation of flanges and body wall thickness the requirements given in EN 12516-1, EN 12516-2 and EN 12516-3 or EN 13445-1 apply.

5.3 Materials

5.3.1 The manufacturer shall provide, with the equipment, the material specification for those parts that may come into contact with the product.

5.3.2 The material elongation at fracture of the pressure-loaded components of the valve shall be a minimum of 12 %.

5.3.3 The relevant EN reference, where possible, for the valve casing material shall be permanently marked on the valve casing. Should no EN exist then the appropriate national standard designation may be used.

6 Test media

6.1 Hydraulic tests

Hydraulic tests shall be carried out using a fluid in accordance with EN 12266-2:2012, A.1.5.

6.2 Pneumatic tests

Pneumatic tests shall be carried out using a gas in accordance with EN 12266-2:2012, A.1.5.

7 Type tests

7.1 General

Each valve used for testing shall conform to the drawings and dimensions specified and specification provided by the manufacturer. Each design of valve, as verified in Annex A, shall be subjected to a type test. Type testing according to 7.2 to 7.6 shall be carried out under ambient conditions. If the valve is required to operate outside the temperature range –40 °C to +50 °C, the design shall be taken into account either in the type testing or by a validated calculation method. For the calculation of the test pressure, EN 12516-3:2002, 6.3 and 6.4 apply.

The tests shall be carried out with the casing/valve attached to a flange equivalent to that for which its use is intended.

7.2 Valve casing hydraulic pressure test

The valve casing shall be hydraulically tested, using a test medium conforming to 6.1 at a pressure equal to a minimum of 2,25 times the MWP or 400 kPa whichever is the greater. The test pressure shall be maintained for a minimum of 5 min on the valve casing without permanent deformation occurring.

7.3 Valve assembly pressure test

The valve assembly shall be hydraulically or pneumatically tested, using a test medium conforming to 6.1 or 6.2 at a pressure equal to 1,5 times the MWP (MAWP), or 400 kPa, whichever is the greater. The test pressure shall be maintained for a minimum of 10 min on the valve assembly. The leakage shall not exceed Rate A as defined in EN 12266-1:2012, Table A.5. Each assembly pressure test shall be carried out:

a) with the valve in the closed position and the outlet open to test for leakage from the seats;

b) with the valve in the open position and the outlet closed off to test for leakage from gland seals and body joints.

7.4 Closure, casing and valve assembly pneumatic tightness tests

For each design of the valve, as defined in Annex A, the closure, the casing and the valve assembly shall be pneumatically tested, using a test medium conforming to 6.2, at pressures equal to 20 kPa and 1,0 times the MWP (MAWP).

The valve closure, casing and valve assembly shall be totally immersed in a water bath, or, where total immersion of the valve closure, casing and valve assembly is not possible, a suitable leak detection fluid shall be applied. The test pressure shall be maintained for a minimum of 10 min on the valve closure, casing and valve assembly. The leakage shall not exceed Rate A as specified in EN 12266-1:2012, Table A.5. Each pneumatic tightness test shall be carried out:

a) with the valve in the closed position and the outlet open to test for leakage from the valve seats;

b) with the valve in the open position and the outlet closed off to test for leakage from gland seals or body joints.

If the tests defined above do not cover all seals to the environment, these seals of the valve assembly shall also be tested.

7.5 Cyclic test

The valve assembly shall be subjected to a mechanical cycle test to a minimum of 1 000 full cycles (“open” to “closed”) without pressure and 10 full cycles (“open” to “closed”) at MWP (MAWP) or maximum rating coupling pressure at ambient temperature being applied. After completion of the cyclic test, the valve assembly shall be tested in accordance with 7.4 and the leakage shall not exceed Rate A as defined in EN 12266-1:2012, Table A.5.

7.6 Breakaway test

7.6.1 General

The footvalve shall be attached with a suitable gasket to a flange of requirements as defined in 5.1. The flange shall be attached to a test vessel which simulates the tank connection. All bolts intended for tank attaching of the valve shall be tightened. Vertical drop valves that are intended to be mounted to the tank and followed immediately by a tee pipe to the side of the tank should have a tee/elbow fitted to the outlet flange prior to the rigid beam. Following the breakaway of the valve body, the valve shall be hydraulically tested at pressures equal to 20 kPa and 1,0 times the MWP (MAWP). The test pressure shall be maintained for a minimum of 10 min and the leakage shall not exceed Rate B as defined in EN 12266-1:2012, Table A.5.

7.6.2 Test apparatus

The test apparatus consists of the following:

— a rigid beam capable of transmitting the impact load to the valve without permanent deformation, 1 000 mm long, rigidly attached to the foot valve outlet flange;

— a test vessel which is a pressurizable test chamber which simulates the tank and has a MWP (MAWP) at least equal to the valve to be tested;

— a suitable gasket material which is either the specific gasket material to be specified with the valve or which is specified for a range of gasket material with the lowest required seating stresses with compression recovery rate;

— a tee/elbow to change the direction of the outlet pipe simulating the piping connection to the tank.

7.6.3 Test procedure for valves conforming to ADR/RID chapter 6.8

Apply, to the beam 1 000 mm from the centre line of the inlet flange, a sufficient force, perpendicular to the valve outlet pipe and in the same plane as the foot valve tank flange, until the valve body breaks away at the shear device, or the outlet deforms more than 30° (see Figure B.1 a), b) and c)).

7.6.4 Test procedure for valves conforming to ADR/RID chapter 6.7

Apply, load slowly and directly on to the outlet flange or as close as is practicable. The load shall be applied in a vector perpendicular to the ground relative to the perceived fitting of the valve consistent and with the valve being struck from mis-stacking. The load shall be applied until the valve body breaks away at the shear groove, or the outlet takes permanent set and deforms more than 30° (see Figure B.1 d)).

7.6.5 Test procedure for top operated valves

The top operated valve shall be connected to the test vessel in such a manner that the valve poppet is located in the closed position by the connecting rod/tube/wire. The outlet tee/elbow containing the shear device shall be attached to the suitable flange of the test vessel with the extension beam and the test procedure shall follow 7.6.3.

7.6.6 Post impact adjustments

a) Manual reseating of the valves poppet is not permitted;

b) retightened fasteners to stop any leakage from the valve gasket is not permitted;

c) non breakage of shear device is permitted provided that the outlet deflection is greater than 30° and that the leakage rate is less than EN 12266-1:2012 rate B into the valve body after the initial impact and all operating mechanism are attached to the valve.

7.6.7 Test report

The test report shall contain at least the following information:

a) a reference to this European Standard (i.e. EN 14433:2014);

b) gasket material and contact sealing dimensions;

c) bolting material and size.

8 Production tests

8.1 General

Each footvalve produced shall conform to the drawings and other papers in which the design and the materials were specified by the manufacturer. The production testing according to 8.2 to 8.4 shall be carried out under ambient conditions.

8.2 Function test

Each valve shall be opened and closed once.

8.3 Valve casing pressure test

Each valve casing shall be hydraulically or pneumatically tested, using a test medium conforming to 6.1 or 6.2, at a pressure equal to 1,5 times the MWP (MAWP). The casing shall be held in a position in which the valve will be used. The test pressure shall be maintained as given in EN 12266-1 on the valve casing and the leakage shall not exceed Rate A as defined in EN 12266-1:2012, Table A.5.

8.4 Closure, casing and valve assembly pneumatic tests

Each closure, valve casing and valve assembly shall be pneumatically tested using a test medium conforming to 6.2, at pressures equal to 20 kPa and at least 25 % of the test pressure. The closure, casing and valve assembly shall be totally immersed in a water bath, or where total immersion of the valve closure, casing and valve assembly is not possible, a suitable leak detection fluid shall be applied. The test pressure shall be maintained as given in EN 12266-1 on the valve closure, casing and valve assembly and the leakage shall not exceed Rate A as defined in EN 12266-1:2012, Table A.5. Each pneumatic tightness test shall be carried out:

a) with the valve in the closed position and the outlet open to test for leakage from the valve seats;

b) with the valve in the open position and the outlet closed off to test for leakage from gland seals or body joints. For this test, all parts of the valve casing shall be attached to a flange equivalent to that for which its use is intended.

9 Marking

The valve shall be permanently marked with the following information:

a) DN (nominal size) of the valve;

b) manufacturer’s name or symbol;

c) material of the valve casing:

   1) materials shall be used as specified in EN standards, where possible;

d) maximum working pressure (MWP) or maximum allowable working pressure (MAWP);

e) year of manufacture;

f) unique serial number;

g) reference number of this standard (i.e. EN 14433:2014);

h) temperature range (if not within the range –20 °C to +50 °C).

10 Supply requirements

10.1 Order information

Information such as, product characteristics to be carried in the tank, nominal size of the valve, MWP (MAWP) of the valve, connection type and size of the valve, and maximum and minimum operating temperatures shall be provided by the customer at the time of ordering.

10.2 Installation and operation

The manufacturer shall provide with each valve installation, operating and maintenance instructions for correct use of the equipment in accordance with the manufacturer’s recommendations.

Annex A
(normative)

Verification of valve design type

A valve design type shall be verified as follows:

a) it shall have the same construction and MWP but may have a different DN (nominal size);

b) the size in bold shall be tested for each valve design type. Generally, the lowest and the highest size shall be tested and this covers all sizes in between. For example, where the range is DN 50 – DN 150 then sizes shown in bold type shall be type tested:, **50,** 80, 100, 125, **150**;

c) where different seal materials or sealing systems are used in the same valve design type, the tests in 7.4 shall be performed on the valve design type for each combination of seal material group and system, followed by the cyclic test in 7.5;

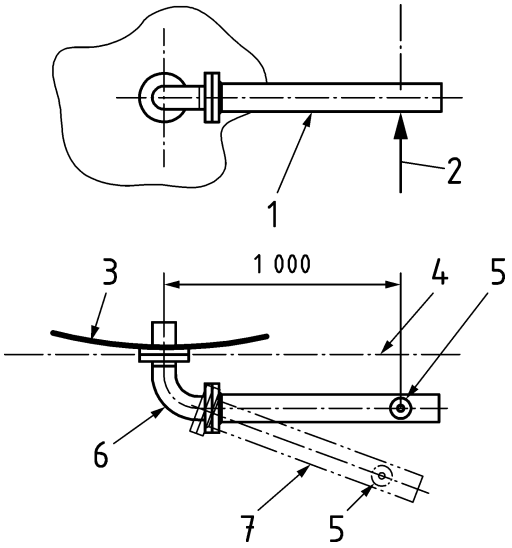
Table A.1 — Sealing group

Sealing material (sealing group)	Samples
Metal-to-metal sealing/metallic sealing	Soft aluminium Soft copper or brass Iron or mild steel Stainless steel
Elastomeric sealing	FPM/FKM EPDM NBR HNBR FFKM (Perfluorelastomer) Silicon Nitrile Butyl PUR
(Thermo-) Plastic sealing	PTFE PA ECTFE FEP
Composite sealing	PTFE/FEP-covered elastomer Fibre-filled elastomeric sealing Spring loaded PTFE-sealing
Fibre sealing	Fibre gaskets Plant fibre sealing

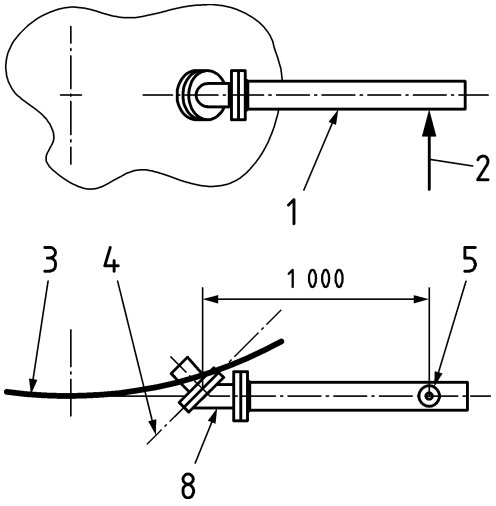
d) where a valve casing is constructed from a material that has a lower strength than the type-tested valve, tests in 7.2 and 7.3 shall be performed; where a valve casing is constructed from a material that has a higher strength than the type-tested valve with a similar ductility, the tests in 7.2 and 7.3 are considered to be fulfilled.

Annex B
(informative)
Examples of breakaway vectors

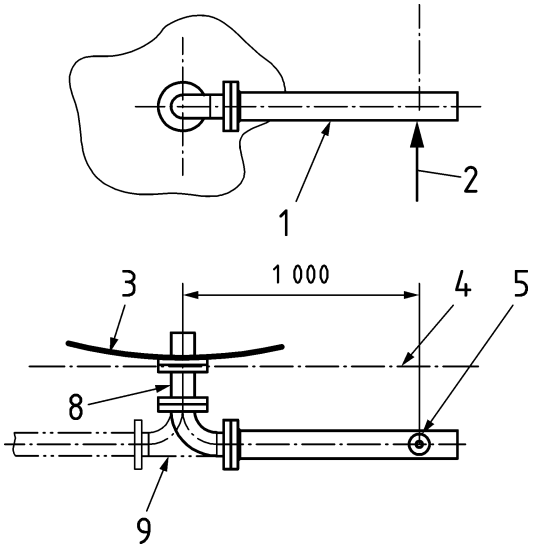
Dimensions in millimetres



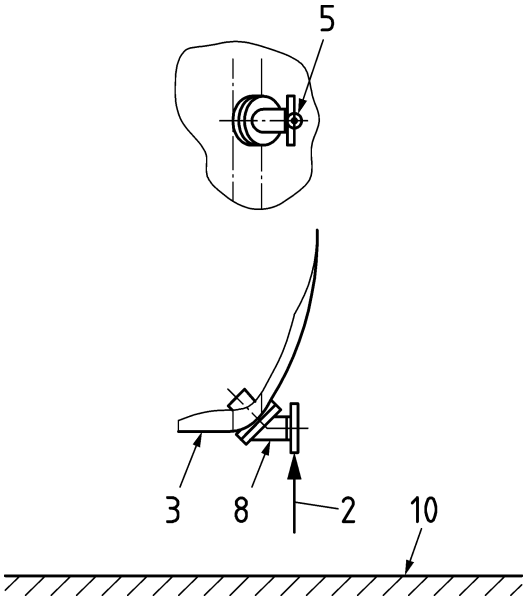
a) ADR/RID chapter 6.8 Angled centre drop valve



b) ADR/RID chapter 6.8 Tank side entry valve



c) ADR/RID chapter 6.8 Tee centre drop valve



d) ADR/RID chapter 6.7 Portable tank test vector

Key

1	ridged beam	6	angled test valve
2	strike vector	7	alternative drop angled outlet
3	tank shell	8	test valve
4	footvalve tank flange plane	9	tee adapter
5	strike point	10	perceived ground orientation

Figure B.1 — Examples of breakaway vectors

Bibliography

[1] Regulation concerning the International Carriage of Dangerous Goods by Rail (RID)

[2] European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)

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

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