EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12266-1

April 2012

ICS 23.060.01

Supersedes EN 12266-1:2003

English Version

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

Robinetterie industrielle - Essais des appareils de robinetterie métalliques - Partie 1: Essais sous pression, procédures d'essai et critères d'acceptation - Prescriptions obligatoires

Industriearmaturen - Prüfung von Armaturen aus Metall - Teil 1: Druckprüfungen, Prüfverfahren und Annahmekriterien - Verbindliche Anforderungen

This European Standard was approved by CEN on 25 February 2012.

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Foreword

This document (EN 12266-1:2012) has been prepared by Technical Committee CEN/TC 69 "Industrial valves", 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of an identical text or by endorsement, at the latest by October 2012, and conflicting national standards shall be withdrawn at the latest by October 2012.

This document supersedes EN 12266-1:2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 97/23/EC (PED).

For relationship with EU Directive 97/23/EC (PED), see informative Annex ZA, which is an integral part of this document.

The main changes compared to the previous edition are:

a) the scope was specified and editorially revised;

b) the normative references were updated;

c) Clause 3 Terms and definitions was revised;

d) Clause 4 Test requirements was changed;

e) A.1.6 Allowable pressure at room temperature was deleted;

f) Table A.2, "Minimum test duration for shell tests" has been updated;

g) Annex ZA was revised;

h) Bibliography was updated.

EN 12266, *Industrial valves — Testing of metallic valves* consists of the following parts:

— *Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements*

— *Part 2: Tests, test procedures and acceptance criteria — Supplementary requirements*

EN 12266-1 was drawn up on the basis of International Standard ISO 5208:1993. EN 12266-2 contains supplementary testing requirements for tests, test procedures and acceptance criteria of valves.

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, 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

The purpose of this European Standard is to establish certain basic requirements for production pressure testing of industrial valves in order to ensure uniform tests and test procedures. Tests and procedures given in this European Standard may also be used, if required, for type tests and acceptance tests.

Special requirements, which are specific to one product or one performance standard only, are not included in this European Standard. Details should be included in the appropriate standard.

1 Scope

This European Standard specifies requirements for tests, test procedures and acceptance criteria for production testing of industrial valves made of metallic materials.

The specified tests may also be used as type tests or acceptance tests.

Safety devices are not covered by EN 12266-1.

When specified as a normative reference in a valve product or performance standard, this European Standard is to be considered in conjunction with given specific requirements of the valve product or performance standard. Where requirements in a product or performance standard differ from those given in this European Standard, the requirements of the product or performance standard apply.

NOTE For testing of industrial valves of thermoplastic materials, ISO 9393-1 and ISO 9393-2 apply.

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 736-1:1995, *Valves — Terminology — Part 1: Definition of types of valves*

EN 736-2:1997, *Valves — Terminology — Part 2: Definition of components of valves*

EN 736-3:2008, *Valves — Terminology — Part 3: Definition of terms*

EN 1349, *Industrial process control valves*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 736-1:1995, EN 736-2:1997, EN 736-3:2008 and the following apply.

3.1
shell test
test at a pressure in excess of the **cold working pressure** (3.7) rating of a valve for the purpose of validating the soundness and strength of the valve pressure containing and retaining structures

Note 1 to entry: These structures include valve-actuating mechanisms that have a direct connection to the valve internals subject to fluid test pressure within the valve proper.

3.2
test pressure
internal pressure (gauge), expressed in bar [1)] to which the valve under testing is subjected

Note 1 to entry: Unless otherwise noted, gauge pressure is used throughout this European Standard.

3.3
test fluid
pressurized liquid or gas used to test a valve

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[1] 1 bar = 10^5 Pa.

3.4
test fluid temperature
temperature of the test fluid, ≥ 5 °C and ≤ 40 °C

3.5
DN, NPS
alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters "DN or NPS" followed or preceded by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connections

Note 1 to entry: The number following "DN or NPS" does not represent a measurable value and should not be used for calculation purposes except where specified in a product standard.

3.6
PN or Class
alphanumeric designation for pressure-temperature rating that is common for components used in a piping system, used for reference purposes, comprising the letters "PN or Class" followed by a dimensionless number indirectly related to the pressure retaining capability as a function of temperature of the component

3.7
cold working pressure
CWP
maximum fluid pressure assigned to a valve for operation at a fluid temperature of – 20 °C to 38 °C

Note 1 to entry: Valve pressure-temperature ratings are specified in product standards by reference to PN or Class designations.

3.8
double block-and-bleed valve
valve with two separate closure seating surfaces that, when in the closed position, block the flow from both ends when the cavity between the two seating surfaces is vented through a bleed connection between the body cavity and the outside environment

4 Test requirements

Test procedures and acceptance criteria shall be as given in Table 1 and Annex A.

a) Shell strength test P10 is mandatory for every valve except when a statistical sampling is permitted.

b) Shell tightness test P11 is mandatory for every valve except when a statistical sampling is accepted.

c) Seat tightness test P12 is mandatory for every isolating and check valve except when a statistical sampling is accepted.

The seat tightness test for control valves shall be in accordance with EN 1349.

Table 1 — Requirements for tests, test procedures and acceptance criteria

Test		Purpose	Test procedure and acceptance criteria
Title	Test reference		
Shell strength [a]	P10	To confirm the pressure containing capability of the shell against internal pressure	see EN 12266-1:2012, A.2
Shell tightness [a]	P11	To confirm the leak tightness of the shell including the operating mechanism sealing against internal pressure	see EN 12266-1:2012, A.3
Seat tightness for valves [b]	P12	To confirm the capability of the seat(s) to comply with the specified leakage rate: — at the time of manufacture; — in the direction(s) for which the valve is designed.	see EN 12266-1:2012, A.4
Obturator strength [c]	P20	To check the pressure containing capability of the obturator	see EN 12266-2:2012, A.2

[a] The shell strength and shell tightness tests may be carried out at the same time.

[b] See Table A.3 for the type of valve.

[c] To check the pressure containing capability of the obturator, if valve is used as the single means of insulation between the content of an item of pressure equipment and the downstream equipment not designed to withstand the upstream pressure.

5 Designation

Tests in accordance with this European Standard shall be designated by the following elements:

— title of test and test reference;

— EN 12266-1.

EXAMPLE Shell strength, Test P10 — EN 12266-1

Annex A
(normative)

Test procedures and acceptance criteria

A.1 General requirements

A.1.1 Purpose

These general requirements shall be applied to all the test procedures detailed in this annex.

Safety aspects of valve testing are not covered in this European Standard.

NOTE Users of this European Standard should analyse the hazard resulting from the pressure and take proper safety precautions.

A.1.2 Test equipment

The test equipment shall be of such a design that it does not subject the valve to externally applied loads which may affect the results of the test.

NOTE The test equipment can apply external loads sufficient to react to the forces resulting from the test pressure.

When using test equipment and procedures different to that detailed in this European Standard, the manufacturer shall be able to demonstrate the equivalence of such test procedures and acceptance criteria with the requirements of this European Standard.

A.1.3 Measuring equipment

The measuring equipment shall be capable of measuring fluid pressure with an accuracy of ± 5 % of the required test pressure.

A.1.4 Painted, coated or lined valves

Before the shell strength test, reference P10, and the shell tightness test, reference P11, valves shall not be painted externally or otherwise coated with materials capable of sealing against leakage from external surfaces of the shell.

Valves with liners, internal linings or coatings forming a design feature of the valve may be tested with the liner, after lining or coating.

Attention shall be given that the liners, internal linings or coatings are not damaged by the test procedure.

NOTE If tests in the presence of a representative of the purchaser are specified, painted or coated valves from stock may be retested without removal of painting or coating.

A.1.5 Test fluid

The test fluid to be used shall be:

— either a liquid (water which may contain a corrosion inhibitor, or any other suitable liquid having a viscosity not greater than water);

— a gas (air or other suitable gas).

Relevant detailed test procedures are specified in A.2.2.1, A.3.2.1 and A.4.2.1.

The test fluid temperature shall be between 5 °C and 40 °C.

A.1.6 Equivalent DN numbers

For the purpose of calculating seat leakage rates and test duration times it is necessary to establish the equivalent DN number for those valves which are designated other than by DN.

The equivalent DN numbers of valves having flanged ends, threaded ends, welded ends, capillary or compression ends shall be as given in Table A.1.

Table A.1 — Equivalent DN numbers for different types of body ends

Equivalent DN numbers	Flanged, threaded or welding ends NPS	Capillary or compression ends for copper tube mm	Compression ends for plastic tube mm
8	¼	8	—
10	—	10; 12	10; 12
15	½	14; 14,7; 15; 16; 18	14,7; 15; 16; 18
20	¾	21; 22	20; 21; 22
25	1	25; 27,4; 28	25; 27,4; 28
32	1 ¼	34; 35; 38	32; 34
40	1 ½	40; 40,5; 42	40; 40,5
50	2	53,6; 54	50; 53,6
65	2 ½	64; 66,7; 70	63
80	3	76,1; 80; 88,9	75; 90
100	4	108	110
125	5	—	—
150	6	—	—
200	8	—	—
250	10	—	—
300	12	—	—
350	14	—	—
400	16	—	—
450	18	—	—
500	20	—	—
600	24	—	—
650	26	—	—
700	28	—	—
750	30	—	—
800	32	—	—
900	36	—	—
1 000	40	—	—

A.2 Shell strength, test reference, P10

A.2.1 Purpose

The test shall confirm the pressure containing capability of the shell against internal pressure.

A.2.2 Test method

A.2.2.1 Test procedure

The test fluid shall be a liquid. The choice of gas as a test medium shall be agreed between the purchaser and the manufacturer.

WARNING — When the test medium is a gas, additional safety measures may be applied.

The test procedure is the following:

a) the obturator of isolating and control valves shall be in a partially open position;

b) the end connections of the shell shall be blanked off and all cavities shall be filled with the test fluid;

c) the pressure shall be applied as specified in A.2.2.2 to the test fluid;

d) the test pressure shall be maintained for the test duration as specified in A.2.2.3.

The shell shall be examined for leak tightness as follows:

— if the test fluid is a liquid, the complete external surface of the shell shall be checked visually for leakage;

— if the test fluid is a gas, the valve shall be immersed in water with the upper surface of the valve not more than 50 mm below the surface of the water. A check shall be made for bubbles breaking the surface of the water. Alternatively, the valve shall be coated with a leak detection fluid and a check shall be made for the detection of bubbles. The shell strength test may be applied separately to the individual shell components. The assembled shell shall be subjected to the shell tightness test subsequently to determine that there is no leakage at the contact surfaces of the components.

Internal components which have no impact on the shell strength and which could be damaging should be removed.

A.2.2.2 Test pressure

The test pressure shall be at least 1,5 times higher than the allowable pressure at room temperature PS_{RT} for PN and Class designated valves.

$$P_{Test} = 1{,}5 \times PS_{RT}$$

For valves where the allowable pressure PS_t is indicated only for an elevated temperature t, the higher value shall be applied as test pressure.

$$P_{Test} = 1{,}5 \times PS_t$$

or

$$P_{Test} = 1{,}25 \times PS_t \times \frac{f_{d\,RT}}{f_{d/t}}$$

where

$f_{d\,RT}$ is the maximum allowable stress at room temperature in MPa;

P_{Test} is the test pressure;

PS_{RT} is the allowable pressure at room temperature;

$f_{d,t}$ is the maximum allowable stress at temperature in MPa;

If the valve is designed for piping operating the creep range it is not decisive for pressure test, the highest obtainable time-independent characteristics shall be used for test pressure calculation.

PS_t is the maximum allowable pressure at temperature t;

t is the design temperature;

RT is the room temperature.

NOTE The term maximum allowable pressure, PS, defined in EU Directive 97/23/EC (PED) is equivalent to the term allowable pressure, p_s, defined in EN 764-1.

A.2.2.3 Test duration

The test pressure shall be maintained for a test duration not less than the periods specified in Table A.2.

Table A.2 — Minimum test duration for shell tests

Nominal size	Minimum test duration	
	Production test and acceptance test Liquid or gas	Type test Liquid or gas
up to DN 50	15 s	10 min
from DN 65 to DN 150	60 s	10 min
DN 200 to DN 300	120 s	10 min
DN 350 and above	300 s	10 min

Every valve shall be proof tested unless it is in PED Category I where a statistical proof test is permitted. Where production cycle times do not permit the test duration stated in Table A.2, each valve shall be tested for a duration which relates to the production cycle time, provided that a statistically valid series of tests shall be applied for the full times specified in Table A.2.

A.2.3 Acceptance criteria

The acceptance criteria shall be as follows:

a) if the test fluid is a liquid, visually detectable leakage from any external surface of the shell is not permitted;

b) if the test fluid is a gas:

   1) no bubbles from any external surface of the shell and breaking the surface of the water are permitted;

   2) no continuous formation of bubbles is permitted when the valve is coated with a leak detection fluid.

Unless otherwise specified in the appropriate product standard, leakage from the operating mechanism sealing is permitted at the shell test pressure, provided that there is no visually detectable leakage when the test pressure is 1,1 times the maximum allowable pressure at room temperature.

A.3 Shell tightness, test reference, P11

A.3.1 Purpose

The test shall confirm the leak-tightness of the shell, including the operating mechanism sealing against internal pressure.

A.3.2 Test method

A.3.2.1 Test procedure

The test fluid shall be either a gas or a liquid. The choice of the test fluid is the responsibility of the manufacturer.

NOTE When the test medium is a gas, additional safety measures may be applied.

The test procedure is the following:

a) the obturator of isolating and control valves shall be in a partially open position;

b) the end connections of the shell shall be blanked off and all cavities shall be filled with the test fluid;

c) pressure specified in A.3.2.2, or at the maximum design pressure of tightness components, should be applied to the testing fluid;

d) the test pressure shall be maintained for the test duration time as specified in A.3.2.3.

The shell shall be examined for leak-tightness as follows:

— if the test fluid is a liquid, the complete external surface of the shell shall be checked visually for leakage;

— if the test fluid is a gas, the valve shall be immersed in water with the upper surface of the valve not more than 50 mm below the surface of the water. A check shall be made for bubbles breaking the surface of the water.

Alternatively the valve shall be coated with a leak detection fluid and a check shall be made for the detection of bubbles.

A.3.2.2 Test pressure

The test pressure shall be according to A.2.2.2.

If the test fluid is a gas, the test pressure shall be the lower of the test pressures according to A.2.2.2 or (6 ± 1) bar.

A.3.2.3 Test duration

The test pressure shall be maintained for a test duration not less than the periods specified in Table A.2.

When the shell is tested in a production line and the time of one production cycle is shorter than the production test time specified in Table A.2, the shell shall be tested for the time of the production cycle. In this case, statistical process control tests shall be carried out confirming that all valves are capable of meeting the requirements of A.3.3.

A.3.3 Acceptance criteria

The acceptance criteria shall be as follows:

a) if the test fluid is a liquid, visually detectable leakage is not permitted;

b) if the test fluid is a gas:

   1) no bubbles are permitted to break the surface of the water when the valve is immersed in water;

   2) no continuous formation of bubbles is permitted when the valve is coated with a leak detection fluid.

Unless otherwise specified in the appropriate product standard, when the test fluid is a liquid, leakage from the operating mechanism sealing is permitted provided that there is no visually detectable leakage when the test pressure is 1,1 times the maximum allowable pressure.

A.4 Seat tightness, test reference P12

A.4.1 Purpose

The test shall confirm the capability of the seat(s) to conform to the specified leakage rate:

a) at the time of manufacture;

b) in the direction(s) for which the valve is designed.

A.4.2 Test method

A.4.2.1 Test procedure

The test fluid shall be a liquid or gas. The choice of the test fluid is the responsibility of the manufacturer. If the test fluid is a liquid, avoid entrapped gas.

The test procedures to be used for the different types of valves shall be taken from Table A.3.

Table A.3 — Seat tightness test method

Type of valve	Test procedure
Gate valve Ball valve Plug valve	1. Fill the valve cavity including if appropriate, the bonnet cavity with the test fluid. 2. Force of closing shall be in accordance to standards dealing with products and fitness for purpose. 3. Move the obturator to the closed position. 4. Apply the test pressure specified in A.4.2.2 and maintain the test pressure for the test duration specified in A.4.2.3. 5. Determine the leakage rate. 6. Repeat 3 and 4 inclusive for the other side of the valve. See NOTES 1, 2, 3, 4 and 5.
Globe valve	1. Fill the upstream valve cavity with the test fluid. 2. Move the obturator to the closed position. 3. Apply the test pressure specified in A.4.2.2 in the direction to unseat the obturator, and maintain the test pressure for the test duration specified in A.4.2.3. 4. Determine the leakage rate.
Diaphragm valve	1. Fill the valve cavity with the test fluid. 2. Move the obturator to the closed position. 3. Apply the test pressure specified in A.4.2.2 in the flow direction marked on the body, and maintain the test pressure for the test duration specified in A.4.2.3. 4. Determine the leakage rate. See NOTE 6.
Butterfly valve	1. Fill the valve cavity with the test fluid. 2. Move the obturator to the closed position. 3. Apply the test pressure specified in A.4.2.2 to the disc in the marked direction or in the direction producing the most adverse sealing condition, and maintain the test pressure for the test duration specified in A.4.2.3. Test double disc butterfly valves either in both directions with the body vent plug removed, or test by introducing the test pressure between the discs via a shell tapping and measuring leakage either side of the disc. 4. Determine the leakage rate. See NOTE 6.
Check valve	1. Fill the downstream valve cavity including, if appropriate, the cover cavity with the test fluid. 2. Apply the test pressure specified in A.4.2.2 in the direction tending to close the obturator, and maintain the test pressure for the test duration specified in A.4.2.3. 3. Determine the leakage rate.

NOTE 1 The procedure described may not ensure pressurization of the integrate space of double-seated valves and may not therefore permit verification of the leakage rate of the downstream seat. When such pressurization is a requirement of the product or performance standard, or is required by the purchaser, it may be necessary to carry out step 3 before step 2.

NOTE 2 Valves which incorporate "double block and bleed" design features shall have the bleed plug removed prior to the test in order to prove the "double block and bleed" capability.

NOTE 3 Valves with double sealing (such as two-piece obturator or double-seated valves) may be tested by applying the test pressure between the seats and checking each side of the closed valve.

NOTE 4 Soft seated ball valves previously subjected to a liquid seat test pressure may have a reduced performance capability in some subsequent services at low differential pressures. If a liquid seat test pressure is specified and is carried out before a low pressure gas seat test, it may be necessary to allow time for the seat material to recover.

NOTE 5 With plug valves relying on a sealing compound to effect a seal, it is permitted to charge with sealing compound prior to testing.

NOTE 6 Valves with symmetrical seating may be tested in either direction.

A.4.2.2 Test pressure

The test pressure shall be a minimum of 1,1 times the maximum allowable differential pressure, except that if the test fluid is a gas, the test pressure may be the lower of 1,1 times the maximum allowable differential pressure or (6 ± 1) bar.

A.4.2.3 Test duration

The test pressure shall be maintained for a duration not less than the periods specified in Table A.4.

Table A.4 — Minimum test duration for seat tightness tests

Nominal size	Minimum test duration	
	Production test and acceptance test	Type test
	Metal seated and soft seated valves	All valves
	Liquid or gas	Liquid or gas
up to DN 50	15 s	10 min
DN 65 to DN 150	60 s	10 min
DN 200 to DN 300	120 s	10 min
DN 350 and above	120 s	10 min

When the seat tightness is tested in a production line and the time of one production cycle is shorter than the production test time specified in Table A.4, the seat tightness shall be tested for the time of the production cycle. In this case, statistical process control tests shall be carried out confirming that all valves are capable of meeting the requirements of A.4.3.

A.4.3 Acceptance criteria

The choice of the rate A to G is specified in the relevant valve product standards.

The leakage rates measured during the specified test duration shall not exceed the rate specified in the corresponding product or performance standards. The acceptance criteria takes into account the uncertainties measurement. Leakage rates are given in Table A.5.

Table A.5 — Maximum allowable seat leakage for each leakage rate

Unit: mm^3/s

Test fluid	Rate A	Rate B	Rate C	Rate D	Rate E	Rate F	Rate G
Liquid	No visually detectable leakage for the duration of the test	0,01 × DN	0,03 × DN	0,1 × DN	0,3 × DN	1,0 × DN	2,0 × DN
Gas		0,3 × DN	3,0 × DN	30 × DN	300 × DN	3 000 × DN	6 000 × DN

NOTE 1 The leakage rates only apply when discharging to room temperature.

NOTE 2 Table A.1 shall be used to establish the equivalent DN number for those valves which are designated other than by DN.

NOTE 3 "No visually detectable leakage" means no visible weeping or formation of drops or bubbles. If leakage rate measurements are carried out by automatics means, this should be qualified by the manufacturer's quality system.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC (PED)

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC (PED).

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 97/23/EC (PED)

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 97/23/EC	Qualifying remarks/Notes
4 a)	3.2.2	Proof test
A.2.2.2	7.4	Hydrostatic test pressure

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

EN 764-1, *Pressure equipment — Part 1: Terminology — Pressure, temperature, volume, nominal size*

ISO 5208, *Industrial valves — Pressure testing of metallic valves*

ISO 9393-1, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 1: General*

ISO 9393-2, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 2: Test conditions and basic requirements*