

# Industrial valves — Testing of valves —

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

The European Standard EN 12266-1:2003 has the status of a  
British Standard

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# National foreword

This British Standard is the official English language version of EN 12266-1:2003. Together with BS EN 12266-2:2002, it supersedes BS 6755-1:1986 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PSE/7, Valves, to Subcommittee PSE/7/1, Valves — Basic standards, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 15 and a back cover.

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English version

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

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

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

This European Standard was approved by CEN on 27 December 2002.

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## Foreword

This document (EN 12266-1:2003) 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of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003..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(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

EN 12266 consists of two parts, which can be used separately under the general title, *Industrial valves — Testing of valves*:

- *Part 1 : Pressure tests, test procedures and acceptance criteria — Mandatory requirements*
- *Part 2 : Tests, test procedures and acceptance criteria — Supplementary requirements*

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

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

Annex A forms a normative part of this part of EN 12266.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

The purpose of this part of EN 12266 is to establish certain basic requirements for the production pressure testing of industrial valves in order to ensure uniform tests and test procedures are adopted. The tests and procedures detailed may also be used, when required, for type tests and acceptance tests.

## 1 Scope

This standard specifies mandatory requirements for tests, test procedures and acceptance criteria for production testing of industrial valves.

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

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

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

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

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

## 3 Terms and definitions

For the purposes of this European Standard, EN 736-1, EN 736-2 and EN 736-3 and the following term and definition apply.

### 3.1

#### **series-produced**

design of valve which is repetitively manufactured

## 4 Test requirements

**4.1** Every valve shall be subject to the shell strength test, reference P10, listed in Table 1, except that this test may be carried out on a statistical sampling basis provided :

- a) the valve is series-produced and ;
- b) the nominal size of the valve is less than or equal to DN 100 (see A.1.7 for nominal sizes which do not have a DN designation) and ;
- c) for valves of a nominal size greater than DN 25, the allowable pressure designation shall not exceed the values in Table 2 and ;
- d) the body, bonnet or cover materials are not manufactured from cast steel or cast nickel alloy.

**4.2** Every valve shall be subject to the shell tightness test, reference P11, listed in Table 1.

**4.3** Every isolating and check valve shall be subject to the seat tightness test, reference P12, listed in Table 1.

**4.4** Test procedures and acceptance criteria shall be as given in annex A.

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

Test		Purpose	Test procedure and acceptance criteria
Title	Test reference		
Shell strength <sup>a</sup>	P10	To confirm the pressure containing capability of the shell against internal pressure	see A.2
Shell tightness <sup>a</sup>	P11	To confirm the leak tightness of the shell including the operating mechanism sealing against internal pressure	see A.3
Seat tightness	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 A.4
<sup>a</sup> The shell strength and shell tightness tests may be carried out at the same time when the test fluid used for the shell tightness test is a liquid.			

Table 2 — Allowable pressure designation

DN	PN
≤ DN 25	All
DN 32, DN 40	≤ PN 25
DN 50	≤ PN 16 or Class 150
DN 65, DN 80, DN 100	≤ PN 10

## 5 Designation

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

- title of test, 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 standard. The users of this 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 standard, the manufacturer shall be able to demonstrate the equivalence of such test procedures and acceptance criteria with the requirements of this standard.

##### A.1.3 Measuring equipment

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

##### A.1.4 Painted, coated or lined valves

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

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

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, as specified in the relevant test procedures detailed in A.2.2.1, A.3.2.1 and A.4.2.1, shall be :

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

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

### A.1.6 Allowable pressure at room temperature

The test pressure shall be calculated based on the allowable pressure at room temperature  $p_{s/RT}$ . For valves for which the allowable pressure  $p_s$  is given only for an elevated temperature  $t$ , the allowable pressure at room temperature,  $p_{s/RT}$ , to be used to determine the test pressure shall be calculated from the following equation :

$$p_{s/RT} = p_{s/t} \times \frac{R_{p0,2min/RT}}{R_{p0,2min/t}}$$

where :

$R_{p0,2 min/RT}$  is the 0,2 % proof strength at room temperature according to the relevant material standard ;

$R_{p0,2 min/t}$  is the 0,2 % proof strength at temperature  $t$  according to the relevant material standard ;

$p_{s/t}$  is the allowable pressure at temperature  $t$ .

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 736-3.

### A.1.7 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, weld 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	Compression ends for plastic tube
		mm	mm
8	$\frac{1}{4}$	8	—
10	—	10; 12	10; 12
15	$\frac{1}{2}$	14; 14,7; 15; 16; 18	14,7; 15; 16; 18
20	$\frac{3}{4}$	21; 22	20; 21; 22
25	1	25; 27,4; 28	25; 27,4; 28
32	1 $\frac{1}{4}$	34; 35; 38	32; 34
40	1 $\frac{1}{2}$	40; 40,5; 42	40; 40,5
50	2	53,6; 54	50; 53,6
65	2 $\frac{1}{2}$	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	42	—	—

## A.2 Shell strength, Test 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 obturator of isolating and control valves shall be in a partially open position.

The end connections of the shell shall be blanked off and all cavities filled with the test fluid.

The pressure specified in A.2.2.2 shall be applied to the test fluid.

The test pressure shall be maintained for the test duration specified in A.2.2.3.

The shell shall be examined for leak tightness.

The shell strength test may be applied separately to the individual shell components provided that subsequently the assembled shell be subjected to the shell tightness test, to determine that there is no leakage at the contact surfaces of the components.

**A.2.2.2 Test pressure**

The test pressure (see A.1.6) shall be a minimum of 1,5 times the allowable pressure at room temperature.

**A.2.2.3 Test duration**

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

**Table A.2 — Minimum test duration for shell tests**

Nominal size	Minimum test duration	
	Production test and acceptance test s	Type test min
up to DN 50	15	10
from DN 65 to DN 200	60	10
DN 250 and above	180	10

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 that case statistical process control tests shall be carried out confirming that all valves are capable of meeting the requirements of A.2.3.

**A.2.3 Acceptance criteria**

Visually detectable leakage from any external surface of the shell is not permitted.

Unless otherwise specified in the appropriate valve 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 allowable pressure at room temperature.

**A.3 Shell tightness, Test 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.

The obturator of isolating and control valves shall be in a partially open position.

The end connections of the shell shall be blanked off and all cavities filled with the test fluid.

The pressure specified in A.3.2.2 shall be applied to the test fluid.

The test pressure shall be maintained for the test duration time 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 continuous formation of bubbles.

#### **A.3.2.2 Test pressure**

The test pressure (see A.1.6) shall be as follows :

- if the test fluid is a liquid, the test pressure shall be a minimum of 1,5 times the allowable pressure at room temperature ;
- if the test fluid is a gas, the test pressure shall be the lower of 1,5 times the allowable pressure at room temperature or  $(6 \pm 1)$  bar.

#### **A.3.2.3 Test duration**

The test pressure shall be maintained for a test duration not less than 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 that 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 :

- if the test fluid is a liquid, visually detectable leakage from any external surface of the shell is not permitted ;
- if the test fluid is a gas :
  - no bubbles are permitted breaking the surface of the water, when the valve is immersed in water ;
  - 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 allowable pressure at room temperature.

### **A.4 Seat tightness, Test P12**

#### **A.4.1 Purpose**

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

- at the time of manufacture ; and
- 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.

The test procedure to be used for the different types of valve 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	<ol style="list-style-type: none"> <li>1. Fill the valve cavity including if appropriate, the bonnet cavity with the test fluid.</li> <li>2. Move the obturator to the closed position.</li> <li>3. 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.</li> <li>4. Determine the leakage rate.</li> <li>5. Repeat 3 and 4 inclusive for the other side of the valve.</li> </ol> <p>See NOTES 1, 2, 3, 4 and 5.</p>
Globe valve	<ol style="list-style-type: none"> <li>1. Fill the upstream valve cavity with the test fluid.</li> <li>2. Move the obturator to the closed position.</li> <li>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.</li> <li>4. Determine the leakage rate.</li> </ol>
Diaphragm valve	<ol style="list-style-type: none"> <li>1. Fill the valve cavity with the test fluid.</li> <li>2. Move the obturator to the closed position.</li> <li>3. Apply the test pressure specified in A.4.2.2 in the direction producing the most adverse sealing condition, and maintain the test pressure for the test duration specified in A.4.2.3.</li> <li>4. Determine the leakage rate.</li> </ol> <p>See NOTE 6.</p>
Butterfly valve	<ol style="list-style-type: none"> <li>1. Fill the valve cavity with the test fluid.</li> <li>2. Move the obturator to the closed position.</li> <li>3. Apply the test pressure specified in A.4.2.2 to the disc 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.</li> <li>4. Determine the leakage rate.</li> </ol> <p>See NOTE 6.</p>
Check valve	<ol style="list-style-type: none"> <li>1. Fill the downstream valve cavity including, if appropriate, the cover cavity with the test fluid.</li> <li>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.</li> <li>3. Determine the leakage rate.</li> </ol>
<p>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.</p> <p>NOTE 2 Valves which incorporate "double block and bleed" design feature have the bleed plug removed prior to the test in order to prove the "double block and bleed" capability.</p> <p>NOTE 3 Valves with independent double seating (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.</p> <p>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.</p> <p>NOTE 5 With plug valves relying on a sealing compound to effect a seal, it is possible to charge with sealing compound prior to testing.</p> <p>NOTE 6 Valves with symmetrical seating may be tested in either direction.</p>	

#### A.4.2.2 Test pressure

The test pressure (see A.1.6) shall be a minimum of 1,1 times the allowable differential pressure at room temperature, except that if the test fluid is a gas, the test pressure may be the lower of 1,1 times the allowable differential pressure at room temperature or  $(6 \pm 1)$  bar for valves :

— sizes up to DN 80 for all pressure ratings ;

— sizes above DN 80 and up to DN 200 for pressure ratings up to PN 40 and up to Class 300.

#### A.4.2.3 Test duration

The test pressure shall be maintained for a duration not less than 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 valves		Soft seated valves	All valves
	Liquid	Gas	Liquid or gas	Liquid or gas
up to DN 50	15 s	15 s	15 s	10 min
DN 65 to DN 200	30 s	15 s	15 s	10 min
DN 250 to DN 450	60 s	30 s	30 s	10 min
DN 500 and above	120 s	30 s	60 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 that 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 leakage rates measured during the specified test duration shall not exceed the rate specified in the corresponding product or performance standards. Leakage rates are given in Table A.5.

**Table A.5 — Maximum allowable seat leakage for each leakage rate in cubic millimetres per second**

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	$0,01 \times \text{DN}$	$0,03 \times \text{DN}$	$0,1 \times \text{DN}$	$0,3 \times \text{DN}$	$1,0 \times \text{DN}$	$2,0 \times \text{DN}$
Gas		$0,3 \times \text{DN}$	$3,0 \times \text{DN}$	$30 \times \text{DN}$	$300 \times \text{DN}$	$3\,000 \times \text{DN}$	$6\,000 \times \text{DN}$

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

NOTE 2 "No visually detectable leakage" means no visible weeping or formation of drops or bubbles and is a lower leakage rate than Rate B.

## Annex ZA (informative)

### Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

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 EU Directive 97/23/EC (PED).

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

Compliance with the clauses of this standard given in Table ZA.1 provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

**Table ZA.1 — Clauses of this European Standard addressing essential requirements of EU Directive 97/23/EC**

Clauses/subclauses of this European Standard	Nature of requirement	Annex I of PED
		Essential safety requirements
The whole standard	Proof test	3.2.2
The whole standard	Hydrostatic test pressure	7.4

## Bibliography

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

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