BRITISH STANDARD

BS EN
13828:2003

Building valves — Manually operated copper alloy and stainless steel ball valves for potable water supply in buildings — Tests and requirements

The European Standard EN 13828:2003 has the status of a British Standard

ICS 23.060.10

National foreword

This British Standard is the official English language version of EN 13828:2003.

The UK participation in its preparation was entrusted by Technical Committee B/504,Water supply, to Subcommittee B/504/7, Control and safety devices, 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.

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

Cross-references

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Robinetterie de bâtiment - Robinets d'arrêt à tournant sphérique en alliage de cuivre et en acier inoxydable pour la distribution d'eau potable dans les bâtiments - Essais et caractéristiques

Gebäudearmaturen - Handbetätigte Kugelhähne aus Kupferlegierungen und nicht rostenden Stählen für Trinkwasseranlagen in Gebäuden - Prüfungen und Anforderungen

This European Standard was approved by CEN on 1 August 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 13828:2003) has been prepared by Technical Committee CEN/TC 164 “Water supply”, 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 March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

The requirements with regard to the drinking water quality are specified in national regulations.

This document includes a Bibliography.

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

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard:

1) this standard provides no information as to whether the product may be used without restriction in any of the member states of the EU or EFTA;

2) it should be noted that, while awaiting the adoption of the verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

1 Scope

This European standard applies primarily to copper alloy ball valves, dimensions DN 8 to DN 100, for potable water supply in buildings up to PN 10 and a distribution temperature of 65 °C. Occasional excursions up to 90 °C are permitted for a period of 1 h maximum.

This standard applies also to ball valves in combination with other components in the same body.

This standard specifies:

— the requirements of the materials and the design of ball valves;

— the mechanical, hydraulic and acoustic requirements of ball valves;

— the test methods to verify the requirements of ball valves;

— the marking requirements of ball valves.

Ball valves in combination with other valves should fulfil the same requirements.

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 ISO 3822-1, *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 1: Method of measurement (ISO 3822-1:1999).*

EN ISO 3822-3, *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 3: Mounting and operating conditions for in-line valves and appliances (ISO 3822-3:1997).*

EN ISO 6509, *Corrosion of metals and alloys — Determination of dezincification resistance of brass (ISO 6509:1981).*

EN ISO 6708, *Pipework components — Definition and selection of DN (nominal size) (ISO 6708:1995).*

ISO 65, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1.*

3 Terms and definitions

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

3.1
ball valves
valves in which a manually operated ball rotates about an axis at right angle to the direction of flow and in the open position, the flow passes through the ball in a straight or angled line and with a normal operating position of either fully open or fully closed. Ball valves will be opened or closed by a single turn through 90°

They ensure the complete prevention of flow in a water pipe.

The following types are covered:

— straight pattern ball valves (see Figure 1);

— angle pattern ball valves (see Figure 2).

3.2
nominal size (DN)
nominal sizes of ball valves, corresponding to EN ISO 6708

3.3
end connections
typical end connections defined in 5.2 (see Table 3)

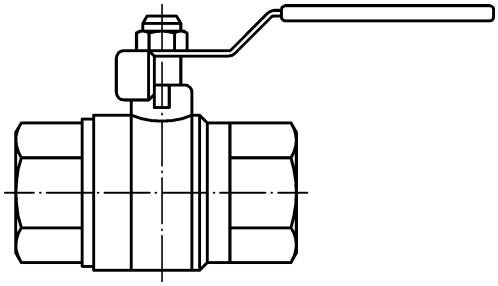


Figure 1 — Example Straight pattern (S)

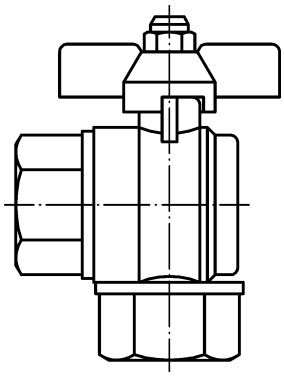


Figure 2 — Example: Angle pattern (A)

4 Designation

The designation of a ball valve comprises:

— its type and material;

— its nominal size (DN);

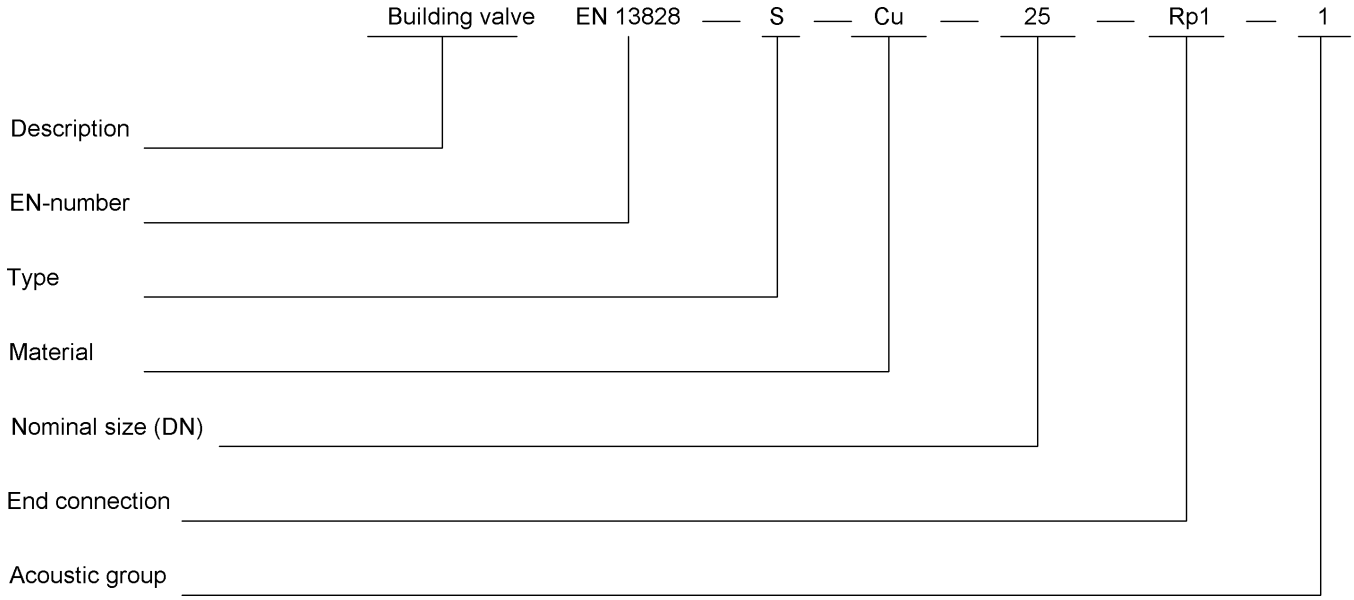
— its bore, whether full or reduced;

— its end connections;

— its acoustic group;

— number of this standard, i.e. EN 13828.

EXAMPLE Straight pattern ball valve (S) of copper alloy, DN 25, with threads Rp 1 on both sides, acoustic group 1, according to EN 13828.



5 Design requirements

5.1 Materials

The selection of materials is the responsibility of the manufacturer, provided the complete valve satisfies the requirements of this standard. The materials and coatings used shall not contaminate or change the drinking water, when in normal or accidental contact up to a temperature of 90 °C.

The manufacturer shall state in his technical and sales literature which materials and coatings are used. The materials, in particular copper alloys, for which recommendations or international standards exist, shall comply with them. These references shall be stated.

5.1.1 Body and ball materials

5.1.1.1 Copper alloys

Examples of suitable copper alloys are given in Table 1.

Table 1 — Examples of copper alloys

Material designation		EN standard
Symbol	Number	
CuSn10-C	CC480K	EN 1982
CuSn5Zn5Pb5-C	CC491K	EN 1982
CuSn3Zn8Pb5-C	CC490K	EN 1982
CuZn39Pb3	CW614N	EN 12420, EN 12164, EN 12165
CuZn40Pb2	CW617N	EN 12420

5.1.1.2 Dezincification resistant copper alloy

Copper-zinc alloys containing more than 10 % zinc are subject to dezincification when submitted to water capable of dezincification. In the countries where the use of products made of dezincification resistant materials is required,

the products have to guarantee a dezincification depth less than 200 µm in any direction, they have to be tested in accordance with EN ISO 6509 and have to be marked in compliance with the indication in clause 8.

5.1.1.3 Stainless steels

Examples of suitable stainless steels (more than 16 % chromium) are given in Table 2.

Table 2 — Examples of stainless steels

Material designation		EN standard
Symbol	Number	
X6CrNiMoTi17-12-2	1.4571	EN 10213-4
X5CrNiMo17-12-2	1.4401	EN 10213-4
X2CrNiMo17-12-2	1.4404	EN 10272
GX5CrNiMoNb19-11-2	1.4581	EN 10272
GX5CrNiMo19-11-2	1.4408	EN 10272

5.1.1.4 Body and ball materials

The ball shall be of solid material with cylindrical bore (e.g. copper-zinc alloy — chromium plated, plastic coated, special steel according to the "EU-Directive on the quality of water intended for human consumption").

5.2 End connections

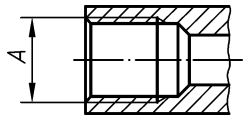
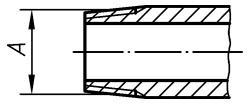
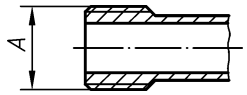
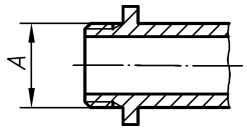
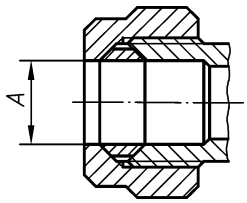
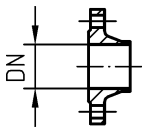
Examples of end connections are defined in Table 3. Compression ends for use with plastic pipes are described in EN 1254-3.

Valves with threaded connections shall have flats on the body which when used for fitting shall accommodate commercially available tools.

Other end connections are permitted provided they comply with an international standard.

For different connection threads the nominal size (DN) is dependent on the smallest connection thread.

Table 3 — Examples of end connections and nominal sizes (DN)

Type	a	DN 8	DN 10	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100
a) Internal thread to ISO 7-1 	A	Rp ¼	Rp ⅜	Rp ½	Rp ¾	Rp 1	Rp 1¼	Rp 1½	Rp 2	Rp 2½	Rp 3	Rp 4
b) external thread to ISO 7-1 	A	R ¼	R ⅜	R ½	R ¾	R 1	R 1¼	R 1½	R 2	R 2½	R 3	R 4
c) flat faced external thread ISO 228-1 	A	G ⅜ B	G ½ B	G ¾ B	G 1 B	G 1¼ B	G 1½ B	G 1½ B G 1¾ B	G 2 B G 2⅜ B	G 3 B	G 3½ B	—
d) external thread with shoulder to ISO 228-1 	A	G ¼ B	G ⅜ B	G ½ B	G ¾ B	G 1 B	G 1¼ B	G 1½ B G 1¾ B	G 2 B G 2⅜ B	G 2½ B	G 3 B	G 4 B
e) compression end for copper pipe to EN 1254-2 	A	10	12	15/18	22	28	35	42	54	76,1	88,9	108
f) flanged connection to ISO 7005-3 	DN	—	—	15	20	25	32	40	50	65	80	100

a Reference dimensions.

5.3 Operation

Ball valves shall close in a clockwise direction. The rotation of the ball from open to close position shall be 90°. The operating devices shall be designed to be easily operated by hand.

5.3.1 Operating devices

The ball valve is operated by applying a manual or mechanical force to the operating device, which can be, for example:

— lever handle;

— "T" type handle;

— gear handle;

— screw driver or key.

If the operating device is detachable, then the end of the operating stem shall be marked, so the open and closed position are indicated.

Ball valves with a nominal diameter bigger than DN 25 shall be furnished with a gear handle if required by national regulations. The operating device shall complete a turn of at least 270° to close the ball valve from a completely open position.

5.4 Stops

On valves the end positions "open" and "close" shall be identified and limited by fixed, non adjustable stops. A manual operating device shall be designed so that it is:

— perpendicular to the direction of the flow for the "close" position;

— parallel to the direction of the flow for the "open" position.

When the actuating mechanism is a gear handle or handwheel the open and closed positions shall be clearly indicated on the actuating mechanism.

5.5 Ball bore

Tolerances for the minimum bore diameter for full bore valve and reduced bore valve shall be maximum ± 1 %.

5.5.1 Full bore

A valve is designated as full bore when the diameter of the bore of the ball of all parts of the valve is as given in Table 4.

Table 4 — Full bore valves

DN	8	10	15	20	25	32	40	50	65	80	100
Minimum bore diameter (mm)	8	10	15	20	25	32	40	50	65	80	100

5.5.2 Reduced bore

A valve is designated as reduced bore when the diameter of the bore of the ball is as given in Table 5.

Table 5 — Reduced bore valves

DN	8	10	15	20	25	32	40	50	65	80	100
Minimum bore diameter (mm)	6	8	10	15	20	25	32	40	50	65	80

6 Performance requirements

6.1 Operating torque

The measured operating torque shall not exceed the values given in Table 7.

The torque required for the preliminary cycle shall not be greater than 1,5 times for valves up to DN 15 and 2,5 times for DN 20 up to DN 100 of the values given in Table 7.

6.2 Stop resistance

The valve shall be tested in accordance with 7.3. There shall be no visual deformation, cracking or failure.

6.3 Leak-tightness

The valve shall be leak-tight.

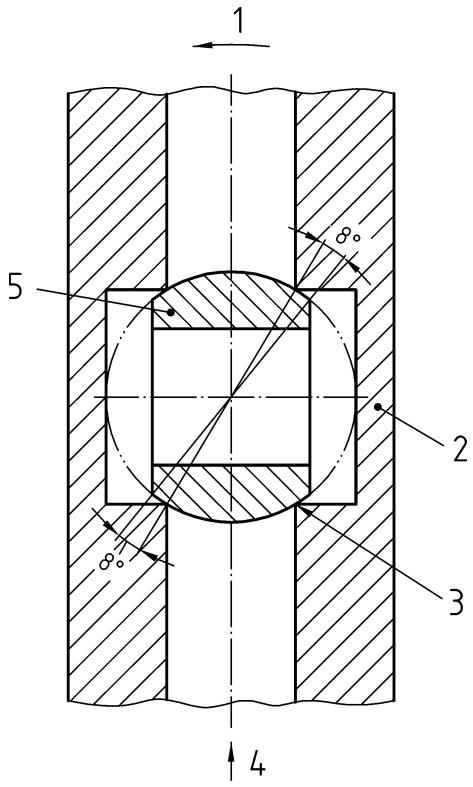
The valve shall be considered leak-tight if it meets the tests detailed in 7.4.

6.4 Angular seal

With the valve in the fully closed position, the angular distance between the port in the closure member and both the inlet port and outlet port in the valve body, shall be at least values according to Table 6 when measured according to 7.7 (see Figure 3).

Table 6 — Angular seal

DN	Angle
8-50	α = minimum 6°
65-100	α = minimum 5°



Key

1 Opening direction
2 Valve body
3 Seat
4 Flow
5 Closure member

Figure 3 — Angular seal

7 Test methods

The tests described are type tests (laboratory tests) and not quality control tests carried out during manufacture.

Tests 7.1 to 7.6 shall be carried out in the sequence of this standard on the same ball valve.

All tests shall be carried out with cold water of (20 ± 5) °C.

7.1 Operating torque test

Before starting the test, one preliminary cycle shall be carried out. The valve shall then be left for 24 h at ambient temperature.

The operating torque of the valve is measured continuously from the fully open position to the fully closed position and then back to the fully open position while it is subjected to the static PN 10. During the test the speed of the rotation shall be 5 ± 1 cycles per minute.

Table 7 — Operating torque

DN	8	10	15	20	25	32	40	50	65	80	100
Torque (Nm)	4	5	6	8	10	15	20	28	35	45	65

7.2 Torque and bending test

7.2.1 General

Hold the ball valve in a rigid fixture as shown in Figure 4.

a) All tests shall be carried out with connections to the valves (whatever their end fitting configurations) which are capable of withstanding the required torque values and bending moments (according to Table 8 and Table 9);

b) if the inlet and outlet connection are not on a common axis, the torque tests shall be repeated with the connections reversed;

c) ensure that the bending and torsional moments can be attained with an accuracy of 5,0 % of the specified values;

d) if the valve has different inlet and outlet connection, the larger connection shall be used for pipe 1 (see Figure 4 and Figure 5);

e) the pipes for the testing of connections shall conform to ISO 65, medium series, and have a length of 1 m;

f) for valves with end fittings which are especially designed for use only with flexible connections, only tests on torque MT_1, and bending moment MF_1, are carried out.

7.2.2 Sequence of torsion and bending moment tests for valves

7.2.2.1 Torque

(See Figure 4).

This test is only applicable to ball valves with internal threads on both sides. The torque shall be applied in both directions.

Table 8 — Applied torque

DN	8	10	15	20	25	32	40	50	65	80	100
Torque MT_1 (Nm)[a]	20	35	75	100	125	160	200	250	300	370	465
Torque MT_2 (Nm)[a]	16	28	40	68	100	128	160	200	250	290	370
a $^{+10}_{0}$ % tolerance.											

The stress MT_1 represents the installation stress.

The stress MT_2 represents the stress to which the valve may be submitted during service.

The valve shall be under nominal pressure for these tests.

7.2.2.1.1 Torque MT_1

a) Screw pipe 1 with a torque, not exceeding the required torque indicated in Table 8, into the valve. Clamp pipe 1 at a distance equal to or greater than 2 DN from the valve;

b) screw pipe 2 with a torque, not exceeding the required torque indicated in Table 8, into the valve. Ensure that the joint is leak-tight;

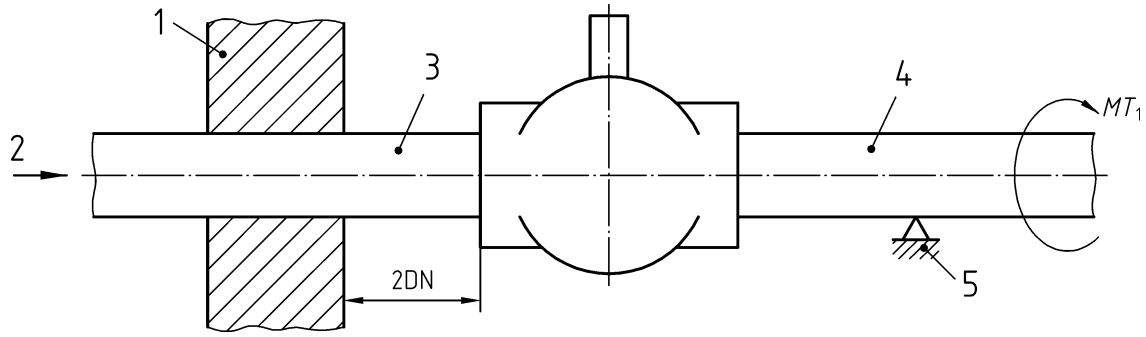
c) support pipe 2 such that no bending moment is applied to the valve;

d) apply the required torque (MT_1) to pipe 2 for 10 s (see Table 8);

e) the torque shall be applied progressively and smoothly without undue delay. The torque given in Table 8 shall not be exceeded;

f) with the stress removed, check the valve for external and internal leak-tightness (see 7.4.1) and visually for any deformation;

g) check the operating torque as in 6.1.



Key

1 Pipe clamp
2 Test pressure
3 Pipe 1
4 Pipe 2
5 Pipe support

Figure 4 — Arrangement for torsion test

7.2.2.1.2 Torque MT_2

a) Apply MT_2 (see Table 8) for 900 s to the same valve as for the torsion test MT_1.

b) during this time the internal and external leak-tightness and operating torque are measured.

7.2.2.2 Bending

(See Figure 5).

Table 9 — Bending moments

DN	8	10	15	20	25	32	40	50	65	80	100
MF_1 (Nm)[a]	30	70	105	225	340	475	610	1100	1550	1900	2500
MF_2 (Nm)[a]	15	35	53	113	170	238	305	550	775	950	1250
a $^{+10}_{0}$ %.											

The stress MF_1 represents the installation stress.

The stress MF_2 represents the stress to which the valve may be submitted during service.

7.2.2.2.1 Bending moment MF_1 at the axis of the closure member

a) Use the same valve and the same arrangement as for the torque test;

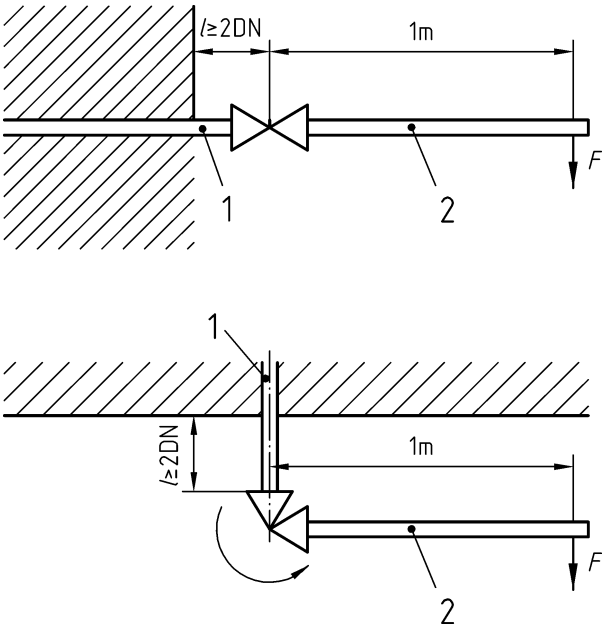
b) apply force F, for 10 s at 1 m from the axis of the closure member so that the bending moment MF_1 is produced;

c) with the stress removed, measure the external and internal leak-tightness according to 6.3 and the operating torque according to 6.1.

7.2.2.2.2 Bending moment MF_2 at the axis of the closure member

a) Apply MF_2 (see Table 9) for 900 s to the same valve as for the bending moment test MF_1;

b) during this time the internal and external leak-tightness and operating torque are measured.



Key

1 Pipe 1
2 Pipe 2

Figure 5 — Arrangement for bending moment test

7.3 Stops and spindle — Mechanical resistance test

The force required to overcome the stops shall be at least 2,5 times the measured operating torque of the valve under test and shall not exceed the values given in Table 7.

Apply this force for 60 s to the on/off operation device.

After the torque is removed, check the valve visually for any deformation, cracking or failure of the mechanism.

7.4 Hydraulic tests

7.4.1 Leak-tightness test

7.4.1.1 Principle

This test shall verify the leak-tightness of the ball (internal tightness) and the ball valve assembly (external tightness) under cold water pressure.

7.4.1.2 Test

Install the ball valve in a test rig capable of maintaining the static pressures indicated in Table 10.

For test 1, close the ball using a torque which is not greater than the values in Table 7.

Subject the ball valve to the pressures indicated in Table 10 for $\left(60^{+5}_{0} \right)$ s.

7.4.1.3 Requirement

The ball valve shall be leaktight at the pressures indicated in Table 10.

Table 10 — Requirements for leak-tightness

Test	Tightness of	Ball	Outlet	Pressure	Duration
1	Ball[a]	closed	open	(1,6 ± 0,1) MPa (16 ± 1) bar	$\left(60^{+5}_{0}\right)$ s
2	Assembled ball valve[b]	partly open	partly closed	(1,6 ± 0,1) MPa {(16 ± 1) bar} 0,02 MPa (0,2 bar)[a]	$\left(60^{+5}_{0}\right)$ s

[a] If the flow direction is not designated, the test shall be carried out from both sides.

[b] Additional test if the tightness of the spindle is made by non adjustable seals (e.g. O-ring, etc.).

7.4.2 Hydraulic strength

7.4.2.1 Principle

This test shall verify that the ball valve withstands a cold water hydraulic pressure.

7.4.2.2 Test

Install the valve in a test rig, capable of maintaining the static pressures indicated in Table 11.

Subject the ball valve, with the ball open and the outlet closed to a pressure of (2,5 + 0,1) MPa {(25 + 1) bar} for $\left(10^{+1}_{0}\right)$ min.

Leaking at spindle sealing and end connection is allowed.

7.4.2.3 Requirement

The ball valve shall show no permanent deformation, rupture or breakage at the pressure indicated in Table 11.

Table 11 — Requirements for hydraulic strength

Ball	Outlet	Pressure	Duration
Open	closed	(2,5 + 0,1) MPa {(25 + 1) bar}	$\left(10^{+1}_{0}\right)$ min

7.5 Acoustic tests and requirements

This test applies only to ball valves DN 8 to DN 32 inclusive.

7.5.1 Principle

This test shall classify ball valves by acoustic groups (I, II or not classified).

7.5.2 Test

The mounting and operating conditions shall comply with the specifications laid down in EN ISO 3822-3.

The test shall be carried out as described in EN ISO 3822-1 and EN ISO 3822-3.

The sound pressure level L_{ap} in dB (A) shall be determined at a flow pressure of 0,3 MPa (3 bar) and the flow rate indicated in Table 12.

Table 12 — Requirements for flow rates at 3 bar

DN	8	10	15	20	25	32
V **(l/s)**	0,1	0,2	0,5	0,8	1,3	2,0

7.5.3 Requirements

The requirements are indicated in Table 13.

Table 13 — Acoustic groups

Acoustic group	L_{ap} **(dB) (A) at 0,3 MPa (3 bar)**
I	$L_{ap} \leq 20$
II	$20 < L_{ap} \leq 30$
Not classified	$L_{ap} > 30$

7.6 Endurance test

7.6.1 Principle

The manual actuator of the valve shall withstand a series of operating cycles as specified in Table 14.

7.6.2 Test installation

An automatic test rig that ensures that the closing torque remains constant and is not effected by the influence of the moment of inertia of the equipment during test.

Equipment related forces that act horizontally or vertically onto the headwork and might result in abnormal wear ought to be eliminated. A frictionless connection to the operating spindle shall be ensured.

7.6.3 Test

7.6.3.1 Conditions

Apply a closing torque according to Table 7. With the ball valve in the closed position adjust the static pressure to between 0,2 MPa and 0,4 MPa (2 bar and 4 bar). With the ball valve in the open position adjust the flow rate to between 0,066 l/s and 0,1 l/s (4 l/min and 6 l/min) by a regulation valve downstream of the valve under test.

7.6.3.2 Procedure

1) Open the valve completely and mount the valve to the test rig;

2) close the valve with a speed of the ball 5 rev./min. and stop the movement without submitting the stops to a torque exceeding the appropriate value given in Table 7;

3) hold the valve 5 s in closed position;

4) open the valve with a speed and torque as given in point 2;

5) hold the valve 5 s in open position;

6) repeat the procedure given in points 1 to 5 for 50 % of the number of cycles given in Table 14;

7) store the valve for one week at ambient temperature in open position;

8) mount the valve in closed position to the test rig and apply water of 65 °C;

9) repeat the procedure given in points 1 to 5 for 50 % of the number of cycles given in Table 14 at a water temperature of 65 °C;

10) store the valve for one week at ambient temperature in closed position;

11) the valve shall comply with 7.6.3.3.

Table 14 — Endurance test cycles

DN	8	10	15	20	25	32	40	50	65	80	100
Cycles	5 000			2 500		1 000			500		

The test is applied to ball valves as delivered.

7.6.3.3 Acceptance criteria

1) If leakage or malfunction occurs test shall be stopped;

2) 1 week after concluding the tests, stored in open position at ambient temperature, the valve shall comply with the leak tightness test (7.4.1) and operating torque test (7.1).

7.7 Angular seal

Mount the complete valve on a test rig which is capable of measuring the angle of rotation of the actuator (e.g. a 360° graduated scale and pointer mounted on the handle or control lever).

Connect the inlet of the valve to a compressed air supply of 6 bar pressure through a bubble indicator (or similar flow measuring device). The air flow through the valve is limited to a value between 1 l/h and 5 l/h by means of a flow restrictor connected to the outlet of the valve.

Slowly open the valve until the flow measuring device indicates flow, then slowly close the valve until the flow measuring device indicates no flow. Measure the angle between the closed position and the "no flow" position. The measured values shall be in accordance with 6.4.

For sizes DN 65, 80, 100 the test is carried out at 6 bar pressure with water instead of air.

8 Marking

Ball valves shall be marked in a durable way with the following:

— manufacturer's name or mark;

— nominal size (DN ...) for full bore;

— nominal size (DN ... R) for reduced bore (for instance DN 15 R);

— arrow indicating normal direction of flow if it is necessary;

— date of manufacture (at least the year), maybe in code;

— DR for dezincification resistant alloy;

— acoustic group, if classified, group I or II;

— PN 10.

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[3] EN 1254-1, *Copper and copper alloys — Plumbing fittings — Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes.*

[4] EN 1254-2, *Copper and copper alloys — Plumbing fittings — Part 2: Fittings with compression ends for use with copper tubes.*

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