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**Industrial valves — Ball valves  
of thermoplastics materials**

*Robinetterie industrielle — Robinets à tournant sphérique en matériaux  
thermoplastiques*



Reference number  
ISO 16135:2006(E)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16135 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 69, *Industrial valves*, in collaboration with ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 7, *Valves and auxiliary equipment of plastics materials*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

# Industrial valves — Ball valves of thermoplastics materials

## 1 Scope

This International Standard specifies requirements for the design, functional characteristics and manufacture of ball valves made of thermoplastics materials intended for isolating service, for control service, and to divert/mix fluids, their connection to the pipe system, the body materials and their pressure/temperature rating between  $-40\text{ }^{\circ}\text{C}$  and  $+120\text{ }^{\circ}\text{C}$ , for a lifetime of 25 years, and also specifies their tests.

This International Standard is applicable to hand- or power-operated valves to be installed in industrial pipe systems, irrespective of the field of application and the fluids to be conveyed.

NOTE 1 Industrial pipe systems also include systems for water supply for general purposes, drainage and sewerage.

NOTE 2 Special requirements can apply to pipe systems for water for human consumption.

This International Standard is concerned with the range of DN

DN 8, DN 10, DN 15, DN 20, DN 25, DN 32, DN 40, DN 50, DN 65, DN 80, DN 100, DN 125 and DN 150

and the range of PN and Class

PN 6, PN 10, PN 16, PN 25, Class 150 and Class 300.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 228-1:2000, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs*

ISO 5211:2001, *Industrial valves — Part-turn actuator attachments*

ISO 8233:1998, *Thermoplastics valves — Torque — Test method*

ISO 8659:1989, *Thermoplastic valves — Fatigue strength — Test method*

ISO 9393-2:2005, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 2: Test conditions and basic requirements*

ISO/TR 10358:1993, *Plastics pipes and fittings — Combined chemical-resistance classification table*

ISO 10931:2005, *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) — Specifications for components and the system*

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ISO 12092:2000, *Fittings, valves and other piping system components, made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) acrylonitrile-butadiene-styrene (ABS) and acrylonitrile-styrene-acrylester (ASA) for pipes under pressure — Resistance to internal pressure — Test method*

ISO 12162:1995, *Thermoplastics materials for pipes and fittings for pressure applications — Classification and designation — Overall service (design) coefficient*

ISO 15493:2003, *Plastics piping systems for industrial applications — Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C) — Specifications for components and the system — Metric series*

ISO 15494:2004, *Plastics piping systems for industrial applications — Polybutene (PB), polyethylene (PE) and polypropylene (PP) — Specifications for components and the system — Metric series*

EN 558-1:1995, *Industrial valves — Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems — Part 1: PN-designated valves*

EN 558-2:1995, *Industrial valves — Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems — Part 2: Class-designated valves*

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 736-3:1999, *Valves — Terminology — Part 3: Definition of terms*

EN 1092-1:2001, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1267:1997, *Valves — Test of flow resistance using water as test fluid*

EN 1759-1:2004, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS ½ to 24*

EN 12107:1997, *Plastics piping systems — Injection-moulded thermoplastics fittings, valves and ancillary equipment — Determination of the long-term hydrostatic strength of thermoplastics materials for injection moulding of piping components*

EN 12266-1:2003, *Industrial valves — Testing of valves — Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements*

EN 12570:2000, *Industrial valves — Method for sizing the operating element*

### 3 Terms and definitions

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

NOTE Other terms and definitions relative to thermoplastics materials are given in ISO 15493, ISO 15494 and ISO 10931.

#### 3.1 nominal size

**DN**  
alphanumeric designation of size for components of a pipework system, which is used for reference purposes, comprising the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

[ISO 6708:1995, definition 2.1]

### 3.2 nominal pressure PN

numerical designation relating to pressure that is a convenient round number for reference purposes

NOTE 1 It is intended that all equipment of the same nominal size (DN) designated by the same PN number have the same mating dimensions appropriate to the type of end connections.

NOTE 2 The permissible working pressure depends upon materials, design and working temperature and is to be selected from the pressure/temperature rating tables in corresponding standards.

[ISO 7268:1983, Clause 2]

### 3.3 Class

alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system, which comprises the word "Class" followed by a dimensionless whole number

NOTE The number following the word "Class" does not represent a measurable value and is not intended to be used for calculation purposes except where specified in the relevant standard.

### 3.4 allowable maximum operating pressure PMA

maximum pressure occurring from time to time, including surge, that a component is capable of withstanding in service

[EN 805:2000, definition 3.1.1]

NOTE EU Directive 97/23/EC (PED) designates PS (maximum allowable pressure) irrespective of temperature. The values of PMA and PS are identical at 20 °C.

### 3.5 trim

inside parts of the valve in contact with the fluid

NOTE Adapted from EN 736-2:1997, definition 3.2.

### 3.6 rating factor

$f_r$

rating factor used in the relationship between PMA and PN or Class and used to calculate the maximum allowable pressure PMA at temperatures other than 20 °C

### 3.7 manual forces

$F$  and  $F_s$

operating manual force ( $F$ ) and maximum manual force ( $F_s$ ) which one person is capable of applying to the manual operating element of a valve

NOTE Adapted from EN 12570:2000.

## 4 Requirements

### 4.1 Design

#### 4.1.1 Valve function

Two-way ball valves in accordance with this International Standard shall be suitable for isolating service and may be designed to be used for control service.

Multi-way ball valves in accordance with this International Standard shall be suitable to divert/mix the flow. They may also be suitable for isolating one or more ways.

#### 4.1.2 Design characteristics

**4.1.2.1** The valve type shall be of one-way or multi-way design. Annex B gives possible guidance on type alternatives for multi-way ball valves.

**4.1.2.2** Valves shall have the following design characteristics.

a) For two-way ball valves only: a design of valve obturation suitable for flow in both directions.

If the sealing capability is in one direction only, this shall be marked by an arrow on the outside of the valve body as specified in Table 2, item 10.

b) A ball that shall be turned by a shaft and that shall be fixed by friction in the end position and in all intermediate positions, so that the hydraulic forces of the flow cannot turn the ball from the actual position.

c) In accordance with EN 736-3, the ball bore shall be

- either full bore, i.e. not less than 90 % of DN expressed in millimetres (mm), or
- reduced bore, in which case the manufacturer shall specify the ball bore reduction (see Table 2, item 9).

d) A shaft that

- shall be fixed in the body and blow-out proof according to EN 736-3,
- shall have a shaft sealing system by self-sealing elements,
- shall indicate by design or marking at the visible end the orientation of the ball bore (two-way ball valves only), and
- shall be connected to the ball in such design that the position indication or the marking (as described above) cannot be changed, even after disassembling and re-assembling.

**4.1.2.3** Valves may have a soft seat method of obturation with sealing element(s) in the valve body.

#### 4.1.3 Types of valve end connection

The types of valve end connection can be chosen from the following alternatives:

- butt fusion ends;
- spigot ends for cementing or for welding;
- socket ends for electro-fusion;



- socket ends for heated tool welding;
- socket ends for cementing;
- socket ends for/with elastomeric seal rings;
- flanged ends;
- wafer type ends;
- threaded ends;
- union ends.

Other types of end connection are possible.

All valve ends shall be an integral part of, or threaded onto, the valve body. Different types of end connection on one body are possible.

## 4.2 Materials

### 4.2.1 Materials for the shell

The valve body and bonnet/cover materials may be selected from ISO 15493 or ISO 15494 or ISO 10931, and shall be in accordance with the requirements of the relevant International Standard:

- ABS;
- PE;
- PP;
- PVC-C;
- PVC-U;
- PVDF.

If other materials for body and bonnet/cover are used, the manufacturer shall ensure that these materials fulfil adequate requirements (such as those contained in the above International Standards for the above materials).

The bolting material between body and bonnet/cover shall be selected according to ISO 898-1.

### 4.2.2 Materials for other valve components

The choice of the materials for the obturator and all other trim components shall be the responsibility of the manufacturer. The design of these components shall ensure the mechanical integrity of the valve and shall be tested as specified in 5.2. A component failing any test according to 5.2 is not in conformity with the requirements of this International Standard.

### 4.3 Pressure/temperature rating

The valve body shall be designed in accordance with the MRS values as defined in ISO 12162, for the material specified in 4.2.1, and rated for PN 6, PN 10, PN 16, PN 25, Class 150 or Class 300.

The PMA, in relation to the working temperature of the complete valve, depends not only on the pressure/temperature (*p/t*) rating of the valve body material, but also on the valve design, and can be different from the *p/t* rating of the shell material. The PMA for thermoplastics valves shall be determined using a rating factor  $f_r$  as follows:

$$\text{PMA} = f_r \times \text{PN} \text{ [in bar } ^1\text{]} \text{ or } \text{PMA} = f_r \times \text{Class} \text{ [in psi } ^2\text{]}$$

The minimum values for the rating factor  $f_r$  for valves shall be as specified in Table 1 and are valid for

- the relevant body material,
- a lifetime of 25 years,
- fluids without any effect on the physical and chemical characteristics of the valve parts in contact with the fluid.

NOTE For applications with lifetimes other than 25 years and/or with fluids with any effect on the physical and/or chemical characteristics of the valve material of the valve body, the rating factor  $f_r$  is usually established by the manufacturer.

Table 1 gives the minimum rating factors and the allowable temperature range for the valve body materials.

If the choice of materials of the trim parts (e.g. obturator, seals) limits the maximum allowable pressure and/or the maximum allowable temperature of the complete valve to less than the values given in Table 1, then this limitation shall be marked as specified in item 8 of Table 2.

The *p/t* rating factor  $f_r$  for each valve type and each body material shall be declared by the manufacturer.

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1) 1 bar = 0,1 MPa = 10<sup>5</sup> Pa; 1 MPa = 1 N/mm<sup>2</sup>.

2) Pounds per square inch.

Table 1 — Minimum values for rating factor  $f_r$  for a lifetime up to 25 years

Temperature °C	Minimum rating factor $f_r$ for body material					
	ABS	PE	PP	PVC-C	PVC-U	PVDF
– 40	1,0	1,0	—	—	—	a
– 30	1,0	1,0	—	—	—	a
– 20	1,0	1,0	—	—	—	1,0
– 10	1,0	1,0	—	—	—	1,0
0	1,0	1,0	—	—	—	1,0
+ 5	1,0	1,0	1,0	—	—	1,0
10	1,0	1,0	1,0	1,0	1,0	1,0
20	1,0	1,0	1,0	1,0	1,0	1,0
25	1,0	1,0	1,0	1,0	1,0	1,0
30	0,8	0,76	0,85	0,85	0,80	0,9
40	0,6	0,53	0,70	0,65	0,60	0,8
50	0,4	0,35	0,55	0,50	0,35	0,71
60	0,2	0,24	0,40	0,35	0,15	0,63
70	—	—	0,27	0,25	—	0,54
80	—	—	0,15	0,15	—	0,47
90	—	—	0,08	a	—	0,36
100	—	—	a	—	—	0,25
110	—	—	—	—	—	0,17
120	—	—	—	—	—	0,12
130	—	—	—	—	—	a
140	—	—	—	—	—	a

NOTE These values do not coincide with the relevant factors for pipes and fittings.

<sup>a</sup> A rating factor for this temperature may be declared by the manufacturer.

## 4.4 Dimensions

### 4.4.1 Face-to-face dimensions

The face-to-face dimensions of valves for use in flanged pipe systems shall be selected from

- EN 558-1 for PN designated flanges,
- EN 558-2 for Class designated flanges.

For all other types of end connection, the face-to-face dimensions shall be the responsibility of the manufacturer.

### 4.4.2 Joint dimensions of the valve end connections

The joint dimensions for flanged valve end connections shall be in accordance with

- EN 1092-1 for PN designated flanges,
- EN 1759-1 for Class designated flanges.

The joint dimensions of valves to be connected by threaded ends shall be in accordance with ISO 7-1 or ISO 228-1.

The joint dimensions for other end connections shall be, as applicable, in accordance with ISO 15493 and ISO 15494 and ISO 10931. If end connections not defined in the above standards but specified in 4.1.3 are selected, the manufacturer shall declare the joint dimensions.

## 4.5 Operation

All operating devices shall

- indicate the orientation of the ball bore by an indicating device on the actuator or by the position of the lever.

Hand-operated two-way ball valves shall have the following characteristics:

- closed by turning the lever or hand-wheel clockwise when viewed from above;
- it shall not be possible to change the specified lever position relative to the shaft;
- a stroke limited by mechanical stops at the end positions “OPEN” and “CLOSED”;

Gear- and power-operated valves shall have

- stop devices at the end positions “OPEN” and “CLOSED” (two-way ball valves only), and
- actuator attachments in accordance with the requirements of ISO 5211.

Valve actuators of a compact design, which are integrated in the valve, may be excepted from this requirement.

## 4.6 Functional characteristics

### 4.6.1 Design strength

For each valve body material, the shell design strength shall conform to ISO 9393-2:2005:

- Clause 5 for the shell test;
- Clause 6 for the long-term behaviour test of the complete valve.

### 4.6.2 Flow characteristics

The manufacturer shall specify the  $k_v$  values, according to EN 1267, for the fully open position.

If the valve can be used for control service, the manufacturer shall declare the  $k_v$  values (see EN 1267) for intermediate positions.

### 4.6.3 Seat and shell leaktightness

The seat and shell leaktightness shall be in accordance with the requirements of ISO 9393-2:2005, Clause 7.

The requirement for seat leaktightness is mandatory for two-way ball valves only.

#### 4.6.4 Operating torque

The manufacturer shall declare the maximum operating torque value allowed to fully open or fully close a valve at a differential pressure equal to the PN, in bar (or equal to the Class, in psi).

#### 4.6.5 Permissible manual forces

The lever and hand-wheel rim forces to open and fully close the valve shall not exceed the values given for the force  $F$  in EN 12570:2000, Table 1.

The elevated forces  $F_s$  in EN 12570:2000, Table 1 may not be necessary.

All functional parts shall be serviceable after the application of the force  $F$ .

#### 4.6.6 Durability

After the endurance test carried out in accordance with 5.2.6, the following requirements shall apply:

- the shell tightness shall be in accordance with the requirements of ISO 9393-2;
- all functional parts shall be serviceable after endurance testing;
- a seat leakage rate (if any) shall be checked according to EN 12266-1 and the result shall be recorded.

### 4.7 Manufacture

#### 4.7.1 Control of the manufacture of body and bonnet/cover

The valve manufacturer shall ensure that

- for body and bonnet/cover the incoming raw material is in accordance with 4.2.1,
- the material properties of the incoming raw material are in accordance with a written specification,
- the body marking in accordance with item 3 of Table 2 conforms to the raw material supplied,
- the body is marked with a code for the year of production, and
- the body is marked with a code or the name of the manufacturer.

#### 4.7.2 Permanent jointing

The welding process or the cementing by solvent process for permanently jointed parts of the valve body shall be carried out using procedures supervised by competent personnel in accordance with written instructions.

### 4.8 Other requirements

#### 4.8.1 Wear

Where the valve functionality can be affected by erosion or abrasion, the design of the valve shall permit serviceability of the affected parts or else the manufacturer's operating instruction shall give recommendations for the replacement of the complete valve.

#### 4.8.2 Corrosion resistance or other chemical attack

Where fluids other than water are to be conveyed, the effect of the fluid on the trim materials can be established by reference to ISO/TR 10358 or by consulting the valve manufacturer.

### 4.8.3 Operating instructions

The manufacturer shall supply the following minimum instructions in his documentation:

#### a) Definitions of “Intended use”

This instruction shall declare the valve functions and the service conditions for which the valve can be used.

#### b) Warnings

Where design of the valve does not exclude hazards in its intended use or where misuses are reasonably foreseeable, the manufacturer shall give adequate warnings in these operating instructions.

#### c) Maintenance and repair

To exclude reasonably foreseeable hazards during the intended life of the valve, instructions for maintenance and — where applicable — for repair shall be included in these operating instructions.

## 5 Test procedures

### 5.1 Documentation of test results

The manufacturer shall maintain test results and documentation as follows:

- a) type tests — available at least ten years after manufacture of the last relevant valve type;
- b) factory production control tests — available at least five years after dispatch.

### 5.2 Initial type tests

#### 5.2.1 General

The initial type tests shall verify conformance to the material and functional requirements given below. Not all tests shall be performed on the complete valve.

These tests shall be carried out by the manufacturer for each DN size per valve design.

The tests according to 5.2.4, 5.2.6, 5.2.7 and 5.2.8 on any valve body and/or obturator material are representative for all other materials listed in Table 1.

The number of the representative type test specimens shall be the responsibility of the manufacturer.

#### 5.2.2 Testing of materials

The testing of the body and bonnet/cover raw materials shall be in accordance with EN 12107. The requirements of 4.2.1 shall apply.

It is not necessary to retest a material which has been tested by the raw material supplier.

#### 5.2.3 Shell test

The valve shell shall be tested in accordance with ISO 9393-2. The requirements of 4.6.1 shall apply.

#### 5.2.4 Seat leaktightness test

The seat leaktightness of a complete valve shall be tested in accordance with ISO 9393-2. The requirements of 4.6.3 shall apply.

#### 5.2.5 Long-term behaviour test of the complete valve

The complete valve shall be tested in accordance with ISO 12092. The requirements of 4.6.1 shall apply.

#### 5.2.6 Durability test

The complete valve shall be endurance-tested for opening and closing, under the following conditions:

- a) the test fluid shall be water at PMA and 15 °C to 30 °C at the upstream side of the valve;
- b) with the valve fully open, establish a flow of water at a velocity of  $(1 \pm 0,2)$  m/s;
- c) then fully close the valve, the pressure downstream shall be atmospheric;
- d) then fully open the valve as specified in b) above;
- e) then repeat until a minimum of 5 000 cycles.

The test method according to ISO 8659 shall apply.

The requirements of 4.6.6 shall apply.

#### 5.2.7 Operating torque test

A valve with a manual operating element shall be tested at PMA at room temperature in accordance with ISO 8233. The requirements of 4.6.4 and 4.6.5 shall apply.

#### 5.2.8 Final test

After the tests in accordance with 5.2.3 to 5.2.7, the test in accordance with 5.2.3 and 5.2.4 shall be repeated to the requirements of 4.6.6.

## 6 Declaration of compliance

The manufacturer shall declare compliance to this International Standard by reference to the number of this International Standard. The requirement of item 7, Table 2 shall apply.

## 7 Designation

Ball valves in accordance with this International Standard shall be designated by the following elements in the sequence given:

- ball valve;
- ISO 16135;
- two-way pattern, or multi-way pattern: (i.e. type as designated in Annex B);
- type of valve end connection (see 4.1.3) and (where applicable) joint dimensions (see 4.4.2);
- symbol DN and number (see Clause 1);
- PN or Class designation (see Clause 1);
- material of the body (see 4.2.1);
- where applicable, material of the soft seating or restriction of maximum service temperature due to the characteristics of the seat or shaft seal material (see 4.3);
- for flanged valves, the face-to-face dimension basic series number (see 4.4.1);
- if not manually actuated, the type and specification of the power actuator.

For guidance on procurement information, see Annex A.

## 8 Marking and preparation for storage and transportation

### 8.1 Marking and documentation

The minimum required marking and documentation of each valve shall be in accordance with Table 2.

The marking items shall be

- printed or formed directly on the valve, or
- marked on a label attached to the valve, or
- included in the valve accompanying documentation.

Markings on the valve surface or on a label shall remain legible at the time of installation of the valve.

**NOTE** The manufacturer is not responsible for the marking becoming illegible due to actions caused during installation and use such as painting, scratching, covering of the valves or by use of detergents, etc. on the valve outside surface.

Markings shall not initiate cracks or other types of defects which adversely influence the performance of the valve.

If printing is used for the markings, the colouring of the printed information shall differ from the basic colouring of the component or of the label.

The size of the marking shall be such that the marking is legible without magnification.



Table 2 — Minimum required marking and valve data sheet

Item	Subject	Marking on valve	Information on data sheet
1	DN	X	—
2	PN or Class	X	—
3	Material designation of the body (as listed in 4.2.1)	X	—
4	Manufacturer's identification	X	—
5	Production code or date of manufacture <sup>a</sup>	X	—
6	<i>p/t</i> rating	—	X
7	Number of this International Standard	—	X
8	Seat/seal material <sup>b</sup> and/or (if any) limitation of allowable pressure <sup>b</sup> and/or allowable temperature <sup>c</sup>	X	X
9	Ball bore reduction [for valves with reduced bore only, see 4.1.2.2 c)]	—	X
10	If applicable: marking of the preferred tightness direction in closed position by an arrow [see 4.1.2.2, a)]	X	—
<sup>a</sup> For providing traceability, the requirements of 4.7.1 shall be respected. <sup>b</sup> A limited pressure — if applicable (see 4.3) — shall be marked on the valve. The seat/seal material shall be marked on the valve. <sup>c</sup> Limitation of service temperature (see 4.3) shall be given in the data sheet.			

Additional specific markings for power actuated valves may be attached at the valve actuator.

## 8.2 Preparation for storage and transportation

Each valve shall be drained of any test liquid.

For two-way pattern ball valves, the obturator shall remain in fully open position, other ball valve types shall be stored in any end position.

Flange covers — when provided — shall extend over the entire gasket face. Body end surfaces to be welded or jointed by cementing with solvents shall be suitably protected to prevent mechanical damage during normal conditions of transportation and storage.

The valve packaging or the body end protection shall prevent the introduction of foreign matter.

## Annex A (informative)

### Procurement information

At least the following information should be supplied by the purchaser for each order of valves:

- ball valve;
- ISO 16135;
- valve type, e.g. two-way pattern or multi-way pattern, as designated in Annex B;
- body end type (and dimension, if applicable), e.g. fusion end SDR 11;
- nominal size, e.g. DN 100;
- PN, e.g. PN 10;
- material of body, e.g. PVC-U;
- material of seat seal, e.g. EPDM;
- type of fluid to be conveyed, e.g. for water 20 °C, 6 bar;
- type of operating element, e.g. lever-operated.

For the application of a valve at control service, the manufacturer needs the following additional information:

- type of fluid;
- minimum and maximum mass flow.

As well, the service conditions at this minimum and maximum mass flow:

- fluid temperature at the valve inlet;
- fluid pressure at the valve inlet and the valve outlet (differential pressure);
- service conditions (fluid, mass flow, pressure and temperature).

In addition, if the absolute pressure differs from 1,0 bar:

- atmospheric conditions.

## Annex B (informative)

### Type alternatives for multi-way ball valves

#### B.1 General

Multi-way ball valves design can differ by

- number of ways (three or more),
- orientation of the shaft, and
- type of ball bore.

The ball bore orientation should be marked on the visible end of the shaft (see 4.1.2.2).

#### B.2 Ball valves with three ways (three-way ball valves)

##### B.2.1 General

The following design alternatives are standardized:

- the shaft orientation is vertical to the body bore plane (see Figure B.1).
- the shaft orientation is parallel to the middle body bore (see Figure B.2).
- the ball bore is L-pattern (see Figures B.3 and B.4).
- the ball bore is T-pattern (see Figures B.5 and B.6).

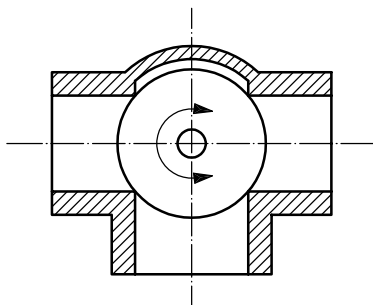


Figure B.1 — Horizontal type

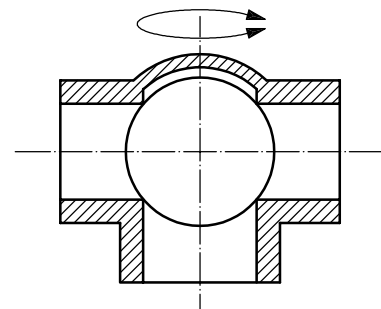


Figure B.2 — Vertical type

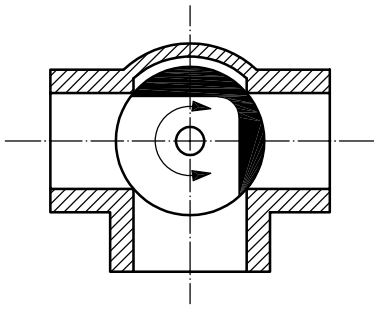


Figure B.3 — Horizontal type, L-bore

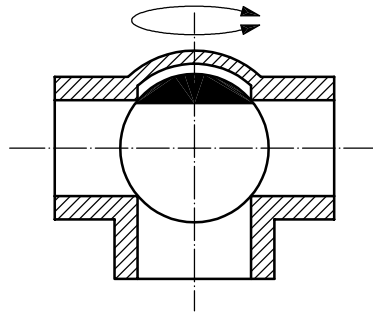


Figure B.4 — Vertical type, L-bore

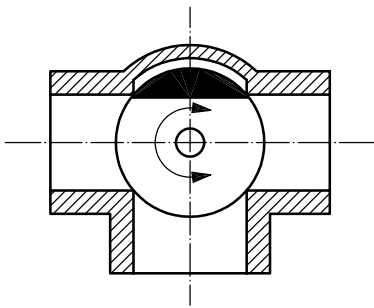


Figure B.5 — Horizontal type, T-bore

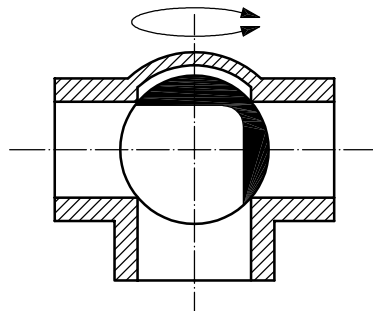


Figure B.6 — Vertical type, T-bore

**B.2.2 Functional alternatives of three-way ball valves, vertical type with L-bore**

See Figures B.7 and B.8.

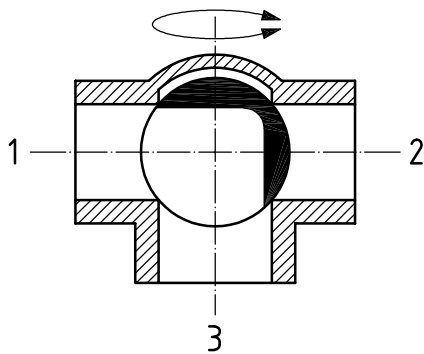


Figure B.7 — Ways 1 and 3 connected, way 2 closed

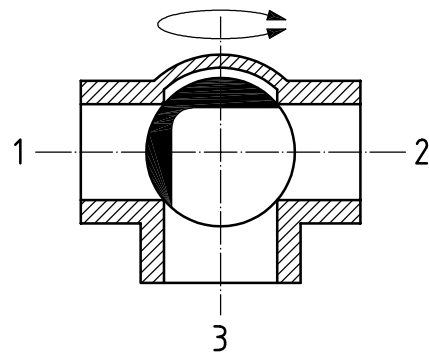
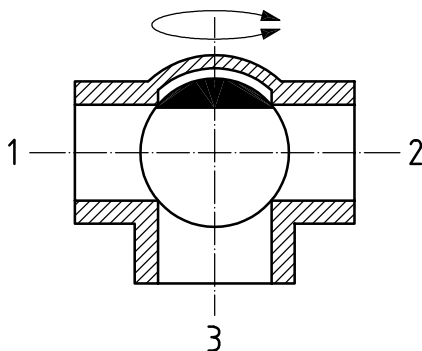


Figure B.8 — Ways 2 and 3 connected, way 1 closed

The valve can be closed (no connection between any way) by a 90° turn clockwise or anticlockwise.

**B.2.3 Functional alternatives of three-way ball valves, vertical type with T-bore**

See Figure B.9.

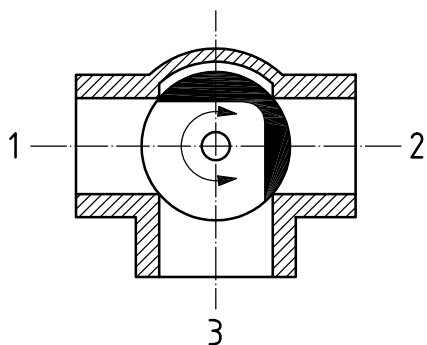


**Figure B.9 — Ways 1, 2 and 3 connected**

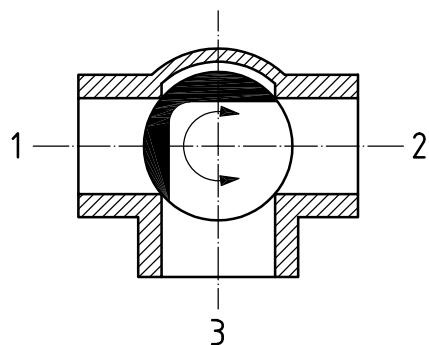
The valve can be closed (no connection between any way) by a 90° turn clockwise or anticlockwise.

**B.2.4 Functional alternatives of three-way ball valves, horizontal type with L-bore**

See Figures B.10 and B.11.

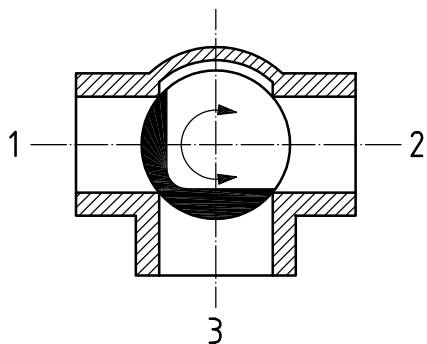


**Figure B.10 — Way 2 closed, ways 1 and 3 connected**

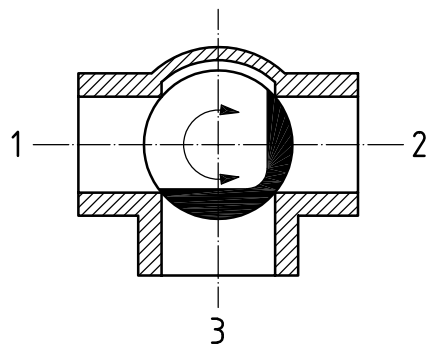


**Figure B.11 — Way 1 closed, ways 2 and 3 connected**

The valve can be closed (no connection between any way) by a 90° turn clockwise or anticlockwise. See Figures B.12 and B.13



**Figure B.12 — Valve closed**



**Figure B.13 — Valve closed**

**B.2.5 Functional alternatives of three-way ball valves, horizontal type with T-bore**

See Figures B.14 to B.17.

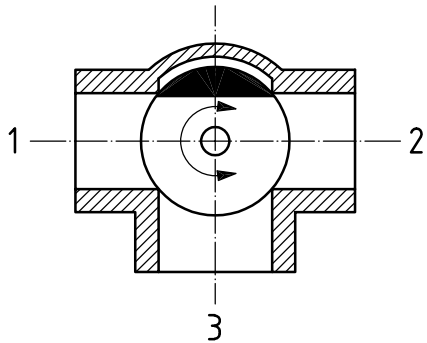


Figure B.14 — Ways 1, 2 and 3 connected

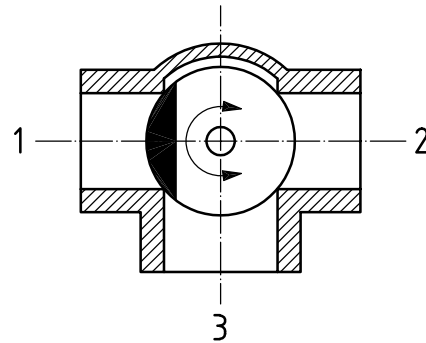


Figure B.15 — Way 1 closed, ways 2 and 3 connected

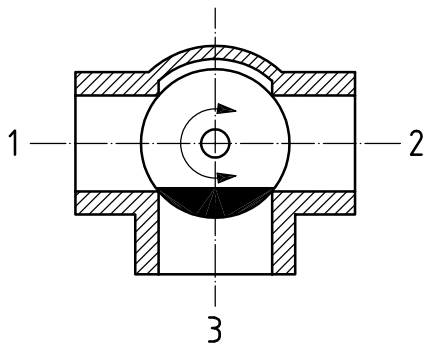


Figure B.16 — Way 3 closed, ways 1 and 2 connected

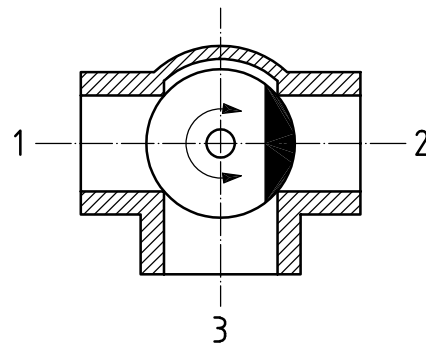


Figure B.17 — Way 2 closed, ways 1 and 3 connected

**B.3 Ball valves with four ways (four-way ball valves)**

**B.3.1 General**

The shaft orientation is vertical to the body bore plane. The following type alternatives are standardized:

- the ball bore is L-pattern, (Figure B.18).
- the ball bore is T-pattern, (Figure B.19).

Special ball bores are possible on request, but are not within the scope of this International Standard.

**B.3.2 Functional alternatives of four-way ball valves with T-bore**

The ball shall be turned 90° to connect three ways and to close one way.

Figure B.18 shows one of these positions: Ways 1, 2 and 3 connected, way 4 closed.

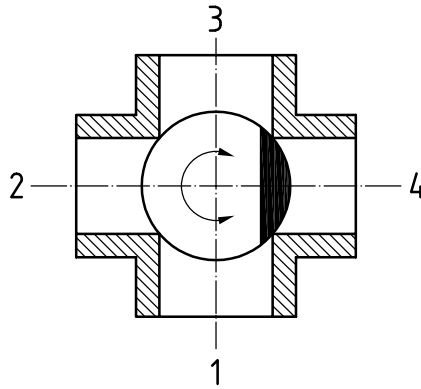


Figure B.18 — Four-way ball valves with T-bore

### B.3.3 Functional alternatives of four-way ball valves with L-bore

The ball shall be turned 90° to connect two ways.

Figure B.19 shows one of these positions: Ways 1 and 2 connected, ways 3 and 4 closed.

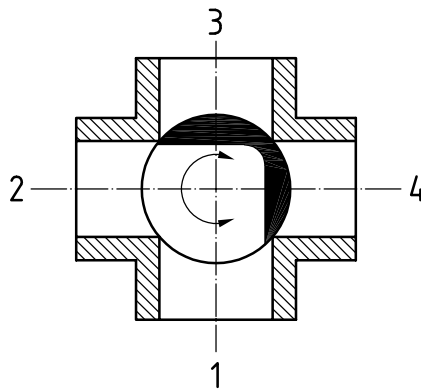


Figure B.19 — Four-way ball valves with L-bore

### B.4 Ball valves with other functional alternatives

Ball valves with other functional alternatives are possible.

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- [1] ISO 6708:1995, *Pipework components — Definition and selection of DN (nominal size)*
- [2] ISO 7268:1983, *Pipe components — Definition of nominal pressure*
- [3] EN 805:2000, *Water supply — Requirements for systems and components outside buildings*
- [4] EU Directive 97/23/EC, *Pressure Equipment Directive (PED)*



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