INTERNATIONAL STANDARD

ISO 7121

Third edition
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Steel ball valves for general-purpose industrial applications

Robinets en acier à tournant sphérique pour les applications industrielles générales

Reference number
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 153, *Valves*.

This third edition cancels and replaces the second edition (ISO 7121:2006), which has been technically revised with the following changes:

— in the scope DN 600, NPS 20 and 24, Class 800 and a note on the applicability of this Class were added;

— the normative references were updated;

— definitions for DN, NPS, PN and Class were added;

— a line for DN 600 was added in Table 2;

— a line for DN 600 and a column for Class 800 were added in Table 3;

— a column for DN 600 was added in Table 4;

— a column for Class 800 was added in Table 6;

— in Tables 7 and 8, DN is up to 600;

— in 5.2.12.3, vertically split glands are not allowed anymore; Annex A was updated accordingly;

— 8.2.2 on site inspection was deleted; Annex A was updated accordingly.

Introduction

The purpose of this International Standard is the establishment, in ISO format, of basic requirements and practices for flanged, butt-welding, socket welding and threaded-end steel ball valves having flow passageways identified as full bore, reduced bore and double reduced bore, suitable for general purpose applications. Flanged end Class designated valves have flanges in accordance with ASME B16.5. Flanged end PN designated valves have flanges in accordance with EN 1092-1. Valves with ends that are threaded can have threads to either ISO 7-1 or ASME B1.20.1.

Steel ball valves for general-purpose industrial applications

1 Scope

This International Standard specifies the requirements for a series of steel ball valves suitable for general-purpose industrial applications.

It covers valves of the nominal sizes

— DN 8, 10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, and 600 (NPS 1/4, 3/8, 1/2, 3/4, 1, 11/4, 11/2, 2, 21/2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20 and 24),

and is applicable to the following pressure designations:

— PN 10; 16; 25; 40; 63; 100;

— Class 150; 300; 600; 800; 900.

NOTE Valve characteristics are not necessarily available in all nominal sizes for all pressure designations. For example, Class 800 applies only for valves with threaded end and socket weld ends up to DN 65 (NPS 21/2) and Class 900 applies only for reduced bore body seat openings.

It includes provisions for valve characteristics as follows:

— flanged and butt-welded ends in sizes 15 ≤ DN ≤ 600 (1/2 ≤ NPS ≤ 24);

— socket welding ends in sizes 8 ≤ DN ≤ 100 (1/4 ≤ NPS ≤ 4);

— threaded ends in sizes 8 ≤ DN ≤ 50 (1/4 ≤ NPS ≤ 2);

— body seat openings designated as full bore, reduced bore and double reduced bore;

— materials;

— testing and inspection.

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.

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

ISO 7-2, *Pipe threads where pressure-tight joints are made on the threads — Part 2: Verification by means of limit gauges*

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

ISO 228-2, *Pipe threads where pressure-tight joints are not made on the threads — Part 2: Verification by means of limit gauges*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 965-2, *ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose external and internal screw threads — Medium quality*

ISO 4032, *Hexagon regular nuts (style 1) — Product grades A and B*

ISO 4033, *Hexagon high nuts (style 2) — Product grades A and B*

ISO 4034, *Hexagon regular nuts (style 1) — Product grade C*

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

ISO 5209, *General purpose industrial valves — Marking*

ISO 5752, *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions*

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

EN 1515-1:1999, *Flanges and their joints — Bolting — Part 1: Selection of bolting*

EN 12982, *Industrial valves — End-to-end and centre-to-end dimensions for butt welding end valves*

ASME B1.1, *Unified Inch Screw Threads, (UN and UNR Thread Form)*

ASME B1.20.1, *Pipe Threads, General Purpose, Inch*

ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard*

ASME B16.10, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.34:2013, *Valves Flanged, Threaded and Welding End*

ASME B18.2.2, *Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)*

MSS-SP-55,[1)] *Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities*

3 Terms and definitions

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

3.1
DN or 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 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 is not used for calculation purposes except where specified in a product standard.

Note 2 to entry: See ISO 6708 and ASME B16.34.

1) Manufacturers Standardization Society standard.

3.2
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

Note 1 to entry: The number following PN or Class does not represent a measurable value and is not used for calculation purposes except where specified in a product standard. There is no definitive correlation that links PN designations to Class designations.

Note 2 to entry: See ISO 7268, EN 1333 and ASME B16.34.

3.3
service pressure/temperature rating
lesser of the shell or seat pressure/temperature rating

3.4
anti-static design
design that provides for electrical continuity between the body, ball and stem of the valve

3.5
anti-blow-out design
design that ensures the valve stem cannot be ejected from the body in the event of the gland being removed while the valve is under pressure

4 Pressure/temperature ratings

4.1 Valve rating

The service pressure/temperature rating applicable to valves specified in this International Standard shall be the littlest of the shell rating (4.2) or the seat rating (4.3).

4.2 Shell rating

4.2.1 The pressure/temperature ratings applicable to the valve pressure containing shell (the pressure boundary elements, e.g. body, body cap, trunnion cap, cover, body inserts) shall be in accordance with that specified in the pressure/temperature tables of either ASME B16.34, Standard Class, for Class designated valves, or EN 1092-1 for PN designated valves.

4.2.2 The temperature for a corresponding shell pressure rating is the maximum temperature that is permitted for the pressure-containing shell of the valve. In general, this maximum temperature is that of the contained fluid. The use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user. For temperatures below, the lowest temperature listed in the pressure/temperature tables (see 4.2.1), the service pressure shall be no greater than the pressure for the lowest listed temperature. Consideration should be given to the loss of ductility and impact strength of many materials at low temperature.

4.3 Seat and seal rating

4.3.1 Non-metallic elements, for example, seat, seals or stem seals, can impose restrictions on the applied pressure/temperature rating. Any such restriction shall be shown on the valve identification plate in accordance with 7.4.

4.3.2 The design shall be such that, when either polytetrafluoroethylene (PTFE) or reinforced PTFE is used for seats, the minimum valve pressure/temperature rating shall be as specified in Table 1. Designs

using these seating materials having pressure/temperature ratings less than those shown in Table 1 are not in compliance with this International Standard.

4.3.3 Seat ratings for other seat materials shall be according to the manufacturer's standard. However, the assigned valve service pressure/temperature rating shall not exceed that of the valve shell.

Table 1 — Minimum seat pressure/temperature rating

Temperature[b] °C	PTFE seats[a] bar[c]				Reinforced PTFE seats[a] bar[c]			
	Floating ball			Trunnion	Floating ball			Trunnion
	DN ≤ 50	50 < DN ≤ 100	DN > 100	DN > 50	DN ≤ 50	50 < DN ≤ 100	DN > 100	DN > 50
	NPS ≤ 2	2 < NPS ≤ 4	NPS > 4	NPS > 2	NPS ≤ 2	2 < NPS ≤ 4	NPS > 4	NPS > 2
–29 to 38	69,0	51,0	19,7	51,0	75,9	51,0	19,7	51,0
50	63,6	47,1	18,2	47,1	70,4	47,8	18,4	47,8
75	53,3	39,2	15,2	39,2	59,9	40,4	15,6	40,4
100	43,0	31,3	12,1	31,3	49,4	33,1	12,8	33,1
125	32,7	23,3	9,1	23,3	38,9	25,8	10,0	25,8
150	22,4	15,4	6,1	15,4	28,3	18,4	7,2	18,4
175	12,1	7,5	3,0	7,5	17,8	11,1	4,4	11,1
200	—	—	—	—	7,3	3,7	1,6	3,7
205	—	—	—	—	5,2	2,3	1,0	2,3

For a given PN or Class designation, the assigned valve pressure/temperature ratings shall not exceed the shell ratings, see 4.2.

[a] Polytetrafluoroethylene seats.

[b] Consult manufacturer for maximum design temperature rating of the valve seats.

[c] 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

5 Design

5.1 Flow passageway

The flow passageway includes the circular seat opening in the ball and the body runs leading thereto. The body runs are the intervening elements that link the seat opening to the end connection, for example, to the thread end, weld end or socket end, or to the end-flange. Collectively, the flow passageway through the ball bore and body runs is referred to as the flow passageway. The ball bore is categorized in this International Standard as full bore, reduced bore and double reduced bore. The minimum effective diameter for each category shall be such that a hypothetical cylinder having a diameter according to Table 2 can be passed through.

Table 2 — Cylindrical diameter for categorizing bore size

Nominal size DN	Minimum bore diameter mm					Nominal size NPS
	Full bore			Reduced bore	Double reduced bore	
	PN 10, 16, 25 and 40	PN 63	PN 100	PN: all	PN: all	
	Class 150 and 300	—	Class 600	Class: all	Class: all	
8	6	6	6	6	N/A	1/4
10	9	9	9	6	N/A	3/8
15	11	11	11	8	N/A	1/2
20	17	17	17	11	N/A	3/4
25	23	23	23	17	14	1
32	30	30	30	23	18	11/4
40	37	37	37	27	23	11/2
50	49	49	49	36	30	2
65	62	62	62	49	41	21/2
80	74	74	74	55	49	3
100	98	98	98	74	62	4
150	148	148	148	98	74	6
200	198	196	194	144	100	8
250	245	245	241	186	151	10
300	295	293	291	227	202	12
350	325	322	318	266	230	14
400	375	371	365	305	250	16
450	430	423	421	335	305	18
500	475	467	453	375	335	20
600	586	N/A	N/A	487	436	24

NOTE 1 N/A: Valves having this configuration are not within the scope of this International Standard.

NOTE 2 Full bore valves meeting the minimum bore diameter in this International Standard may not meet the minimum bore diameters of ISO 17292.

NOTE 3 For Class 900, only valves having reduced bore are within the scope of this International Standard.

5.2 Body

5.2.1 Body wall thickness

5.2.1.1 The minimum valve body wall thickness, t_m, shall be as specified in Table 3, except that for butt-welding end valves the welding ends for connection to pipe shall be in accordance with the requirements of Figure 1.

5.2.1.2 The minimum thickness requirements are applicable to, and are measured from, internally wetted surfaces, i.e. up to the point where body seals are effective.

Table 3 — Valve body wall thickness

PN	10 and 16			25 and 40			63			100			—	—	PN
Class	150			300			—			600			800	900[a]	Class
Nom. size DN	Minimum valve body wall thickness, t_m mm														Nom. size NPS
	Full bore	Reduced bore	Double reduced bore	Full bore	Reduced bore	Double reduced bore	Full bore	Reduced bore	Double reduced bore	Full bore	Reduced bore	Double reduced bore	Full bore, reduced bore, double reduced bore	Reduced bore	
8	2,7	2,7	N/A	2,9	2,9	N/A	2,7	2,7	N/A	3,1	3,1	N/A	3,3	3,4	1/4
10	2,9	2,9	N/A	3,0	2,9	N/A	2,9	2,9	N/A	3,4	3,3	N/A	3,6	3,8	3/8
15	3,1	3,1	N/A	3,2	3,2	N/A	3,1	3,1	N/A	3,6	3,6	N/A	3,9	4,1	1/2
20	3,4	3,4	N/A	3,7	3,7	N/A	3,5	3,5	N/A	4,1	4,1	N/A	5,2	5,8	3/4
25	3,9	3,8	3,8	4,1	4,1	4,1	4,0	4,0	4,0	4,7	4,6	4,6	6,0	6,0	1
32	4,3	4,2	4,2	4,7	4,6	4,6	4,4	4,3	4,3	5,1	5,0	5,0	6,4	6,4	11/4
40	4,7	4,5	4,5	5,2	5,0	5,0	4,8	4,7	4,7	5,5	5,4	5,4	5,8	5,8	11/2
50	5,5	5,3	5,3	6,2	5,9	5,9	5,6	5,5	5,5	6,3	6,0	6,0	7,0	7,0	2
65	5,7	5,6	5,6	6,7	6,5	6,5	6,5	6,3	6,3	6,7	6,4	6,4	7,9	7,9	21/2
80	6	5,9	5,9	7,1	6,9	6,9	7,2	7,0	7,0	7,6	7,2	7,2	N/A	9,4	3
100	6,3	6,3	6,3	7,6	7,6	7,6	8,2	7,9	7,9	9,2	8,7	8,7	N/A	11,8	4
150	7,1	6,9	6,9	9,3	8,9	8,9	10,1	9,8	9,8	12,6	11,8	11,8	N/A	16,3	6
200	7,9	7,7	7,7	10,9	10,4	10,4	12,5	12,0	12,0	15,7	14,7	14,7	N/A	20,5	8
250	8,7	8,4	8,4	12,55	12,0	12,0	14,5	13,5	13,5	18,9	17,6	17,6	N/A	24,9	10
300	9,5	9,2	9,2	14,2	13,5	13,5	16,5	15,5	15,5	22,3	20,7	20,7	N/A	29,1	12
350	10	9,6	9,6	15,2	14,4	14,4	17,8	16,8	16,8	24,1	22,5	22,5	N/A	31,8	14
400	10,8	10,4	10,4	16,8	16	16	19,8	18,6	18,6	27,3	25,4	25,4	N/A	36,0	16
450	11,7	11,1	11,1	18,7	17,3	17,3	21,7	20,4	20,4	31,1	28,9	28,9	N/A	42,0	18
500	12,4	11,9	11,9	20,2	18,8	18,8	24,0	22,5	22,5	33,2	30,8	30,8	N/A	44,3	20
600	14,3	13,3	13,3	23,7	21,8	21,8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24

NOTE N/A: Valves having this configuration are not within the scope of this International Standard.

[a] For Class 900, only valves having reduced ball ports are within the scope of this International Standard.

5.2.1.3 Local areas having less than minimum wall thickness are acceptable, provided that all of the following conditions are satisfied:

— the area of sub-minimum thickness can be enclosed by a circle, the diameter of which is not greater than $0,35\sqrt{d\,t_m}$, where d is the minimum bore diameter given in Table 2 and t_m is the minimum wall thickness given in Table 3;

— the measured thickness is not less than 0,75 t_m;

— enclosed circles are separated from each other by an edge-to-edge distance of not less than $1,75\sqrt{d\,t_m}$.