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Metal ball valves for general-purpose industrial applications

Robinets à tournant sphérique pour les applications industrielles générales

[Revision of first edition (ISO 7121:1986)]

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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.

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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 7121 was prepared by Technical Committee ISO/TC 153, *Valves*, Subcommittee SC 1, *Design, manufacture, marking and testing*.

This second edition cancels and replaces the first edition (ISO 7121:1986), which has been technically revised.

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 threaded may have threads to either ISO 7-1 or ASME B1.20.1.

Metal ball valves for general-purpose industrial applications

1 Scope

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

It covers valves of the nominal sizes[1] :

— DN 8 ; 10 ; 15 ; 20 ; 25 ; 32 ; 40 ; 50 ; 65 ; 80 ; 100 ; 125 ; 150 ; 200 ; 250 ; 300 ; 350 ; 400 ; 450 ; 500 (NPS ¼ ; 3/8 ; ½ ; ¾ ; 1 ; 1¼ ; 1½ ; 2 ; 2½ ; 3 ; 4 ; 5 ; 6 ; 8 ; 10 ; 12 ; 14 ; 16 ; 18 ; 20) ;

and applies for pressure designations[2] [3] :

— Class 150 ; 300 ; 600 ; 900 and PN 10 ; 16 ; 25 ; 40 ; 63 ; 100.

It includes provisions for valve characteristics[4] as follows :

— flanged and butt-welded ends : in sizes 15 ≤ DN ≤ 500 (½ ≤ NPS ≤ 20) ;

— socket welding ends : in sizes 8 ≤ DN ≤ 100 (¼ ≤ NPS ≤ 4) ;

— threaded ends : in sizes 8 ≤ DN ≤ 50 (¼ ≤ NPS ≤ 2) ;

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

— materials ;

— testing and inspection.

1) See ISO 6708 and ASME B16.34.

2) See ISO 7268 or EN 1333.

3) See ASME B16.34.

4) Valve characteristics are not necessarily available in all nominal sizes for all pressure designations, e.g., Class 900 applies only for reduced bore body seat openings.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to (including amendments) applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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 thread – Part 2: Verification by means of limit gauges*

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

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 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 nuts, style 1 – Product grades A and B*

ISO 4033, *Hexagon nuts, style 2 – Product grades A and B*

ISO 4034, *Hexagon nuts – Product grade C*

ISO 5208, *Industrial valves – Pressure testing of 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*

ISO 10497, *Testing of valves – Fire type-testing requirements*

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

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

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

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*

ASME B16.10, *Face-to-face and end-to-end dimensions of valves*

ASME B16.34, *Valves - Flanged, threaded and welding end*

ASME B18.2.2*, Square and hex nuts*

MSS-SP-55, *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 International Standard, the following terms and definitions apply.

3.1
service pressure/temperature rating
the lesser of the shell or seat pressure/temperature rating

3.2
anti-static design
a design that provides for electrical continuity between the body, ball and stem of the valve

3.3
anti-blow-out design
a design that ensures the valve stem cannot be blown out of 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 lesser 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, e.g. seat, seals or stem seals may 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 that have pressure/temperature ratings less than those shown in Table 1 are not in compliance with this standard.

4.3.3 Seat ratings for other seat materials shall be 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				Reinforced PTFE seats [a] bar			
	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

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

[a] Polytetrafluoroethylene seats.

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

5 Design

5.1 Flow passageway

The flow passageway includes the circular seat opening in the ball (the port) and the body runs leading thereto. The body runs are the intervening elements that link the seat opening to the end connection e.g. to the thread end, weld end or socket end or to the end-flange. Collectively, the flow passageway through the ball port and body runs is referred to as the flow passageway. The ball port is categorized in this 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 shown in Table 2, can be passed through.

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.

Table 2 — Cylindrical diameter for categorizing bore size

Nominal size DN	Minimum bore diameter mm — Full bore PN 10, 16, 25 and 40 Class 150 and 300	Full bore PN 63 —	Full bore PN 100 Class 600	Reduced bore PN - all Class - all	Double reduced bore PN - all Class - all	Nominal size NPS
8	6	6	6	6	NA	¼
10	9	9	9	6	NA	3/8
15	11	11	11	8	NA	½
20	17	17	17	11	NA	¾
25	23	24	24	17	14	1
32	30	30	30	23	18	1¼
40	37	37	37	27	23	1½
50	49	49	49	36	30	2
65	62	62	62	49	41	2½
80	74	75	75	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

NOTE 1 NA signifies that valves having this configuration are not within the scope of this International Standard.

NOTE 2 For Class 900, only valves having reduced port are within the scope of this International Standard

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.

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 $0{,}35\sqrt{dt_m}$; 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 $1{,}75\sqrt{dt_m}$.

5.2.1.4 The manufacturer, taking into account such factors as component bolting or thread assembly loads, rigidity needed for component alignment, other valve design details and the specified operating conditions, is responsible for determining if larger wall thickness is required.