INTERNATIONAL STANDARD

ISO 17292

Second edition
2015-11-15

Metal ball valves for petroleum, petrochemical and allied industries

Robinets à tournant sphérique métalliques pour les industries du pétrole, de la pétrochimie et les industries connexes

Reference number
ISO 17292:2015(E)

Contents

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 153, *Valves*, Subcommittee SC 1, *Design, manufacture, marking and testing*.

This second edition cancels and replaces the first edition (ISO 17292:2004), which has been technically revised with the following changes:

— scope increased to include DN 600, NPS 24, PN 63, and PN 100;

— Clause 2 "Normative references" was updated;

— Class 800 no longer restricted to reduce bore only;

— inclusion of reference and purchaser option to request valves conforming to ISO 15156 or NACE MR0103;

— expanded seat materials to include modified PTFE and reinforced modified PTFE;

— in Table 1, inclusion of higher pressure temperature ratings that are more closely aligned with BS 5351 and account for improved performance attained from modified PTFE; separate listing for trunnion valves has been removed from Table 1;

— revised selected bore diameters in Table 2;

— purchaser needs to specify long or short pattern face-to-face dimension on ASME flanged valves;

— clarification that the strength of the stem above the packing shall be stronger than the internal portion at the maximum rated temperature;

— addition of purchaser option for requesting valve locking device;

— reduction of the permissible radial gap on end face flange interruptions to 0,8 mm;

— added provision for purchaser to request manufacturer to provide method for preventing excessive pressure when fluid is trapped in centre cavity between seats;

— expanded required information on identification tag to include separate trim and seat/seal materials. In addition, material for identification plate limited to stainless steel or nickel alloys;

— added requirement that thread sealant used on plugs for tapped auxiliary connections be capable of the fully pressure-temperature rating of the valve;

— added purchaser option to request export packaging;

— added purchaser option to request manufacturer identify recommended spare parts.

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 seat openings suitable for petroleum, petrochemical, and allied industries applications.

It is not the purpose of this International Standard to replace ISO 7121 or any other International Standard that is not identified with petroleum refinery, petrochemical, or natural gas industry applications.

In this International Standard, 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 petroleum, petrochemical and allied industries

1 Scope

This International Standard specifies the requirements for a series of metal ball valves suitable for petroleum, petrochemical, natural gas plants, and related 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, 600;

corresponding to nominal pipe sizes NPS:

— ¼, ⅜, ½, ¾, 1, 1 ¼, 1 ½, 2, 2 ½, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24;

and applies for pressure designations:

— Class 150; 300; 600; 800 (Class 800 applies only for valves with threaded and socket welding end);

— PN 16, 25, 40, 63, 100.

It includes provisions for testing and inspection and for valve characteristics as follows:

— flanged and butt-welded ends, in sizes 15 ≤ DN ≤ 600 (½ ≤ NPS ≤ 24);

— socket welding and threaded ends, in sizes 8 ≤ DN ≤ 50 (¼ ≤ NPS ≤ 2);

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

— materials.

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 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*

ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

ISO 15156-1, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials*

ISO 15156-2, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons*

ISO 15156-3, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 3: Cracking-resistant CRAs (corrosion resistant alloys) and other alloys*

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15610, *Specification and qualification of welding procedures for metallic materials — Qualification based on tested welding consumables*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 15614-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys*

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

EN 10269, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 12516-1, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells*

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)*

ASME BPVC-IX, *Boiler and Pressure Vessel Code — Section IX — Welding, Brazing, and fusing Qualifications*

ASTM A307, *Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength*

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

NACE MR0103, *Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments*

3 Terms and definitions

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

3.1
DN
alphanumeric designation of size common for components used in a piping system, used for reference purposes, comprising the letters DN followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connection as appropriate

Note 1 to entry: The dimensionless number following DN does not represent a measurable value and is not used for calculation purposes except where specified in this International Standard. Prefix DN usage is applicable to steel valves bearing PN designations.

3.2
nominal pipe size
NPS
alphanumeric designation of size common for components used in a piping system, used for reference purposes, comprising the letters NPS followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connection as appropriate

Note 1 to entry: The dimensionless number may be used as a valve size identifier without the prefix NPS. The dimensionless size identification number does not represent a measurable value and is not used for calculation purposes except where specified in this International Standard. Prefix NPS usage is applicable to steel valves bearing Class designations.

3.3
PN
dimensionless alphanumeric designation used to define a maximum pressure/temperature rating applicable to the valve pressure containing shell comprising the letters PN followed by a dimensionless whole number

Note 1 to entry: The number following the letters PN does not represent a measurable value and is not used for calculation purposes except where specified in this International Standard.

3.4
Class
dimensionless alphanumeric designation used in ASME standards to define a maximum pressure/temperature rating applicable to the valve pressure containing shell comprising the letters Class followed by a dimensionless whole number

Note 1 to entry: The number following the letters Class does not represent a measurable value and is not used for calculation purposes except where specified in this International Standard.

3.5
anti-static design
design that provides for electrical continuity between the body, ball, and stem of the valve

3.6
polytetrafluoroethylene
PTFE
synthetic fluoropolymer of tetrafluoroethylene which is a high-molecular-weight thermoplastic consisting wholly of carbon and fluorine

3.7
reinforced PTFE
PTFE (3.6) compounded with filler or reinforcing materials such as glass fibre, carbon, metal powders, and graphite uniformly dispersed within to achieve greater strength, increase creep resistance, lower wear rate, and higher pressure-temperature rating

3.8
modified PTFE
PTFE (3.6) compounded with a small percentage of perfluoropropyl vinyl ether (PPVE) to reduce melt viscosity during processing enabling better fusion of the PTFE particles during sintering thereby increasing creep resistance

3.9
reinforce modified PTFE
modified PTFE (3.8) compounded with filler or reinforcing materials such as glass fibre, carbon, metal powders, and graphite uniformly dispersed within to achieve greater strength, increase creep resistance, lower wear rate, and higher pressure-temperature rating

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 (see 4.2) or the seat rating (see 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 those specified in the pressure/temperature tables of either ASME B16.34, Standard Class for Class-designated valves, or EN 12516-1 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. seats, 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 polytetrafluoroethylene (PTFE), modified PTFE, reinforced PTFE, or modified reinforced PTFE is used for seats, the minimum seat pressure/temperature rating shall as specified in Table 1.

4.3.3 Seat ratings for other seat materials shall be the manufacturer's standard. Seats made from hard materials such as solid cobalt-chromium alloy, ceramics, or metal seats coated with hard materials such as carbide coatings are also acceptable and shall have seat pressure-temperature ratings per the manufacturer's standard. The seat pressure/temperature rating shall not exceed that of the valve shell.

Table 1 — Minimum seat pressure/temperature rating

Temperature[a] °C	PTFE and modified PTFE seats			Reinforced PTFE and reinforced modified PTFE seats		
	DN ≤ 50	50 < DN ≤ 100	DN > 100	DN ≤ 50	50 < DN ≤ 100	DN > 100
	NPS ≤ 2	2 < NPS ≤ 4	NPS > 4	NPS ≤ 2	2 < NPS ≤ 4	NPS > 4
−29 to 38	69,0	51,0	21,0	75,9	51,0	26,7
50	66,0	49,0	21,0	73,0	50,0	26,1
75	56,7	42,2	18,4	63,3	43,7	22,7
100	47,4	35,4	15,8	53,7	37,3	19,1
125	38,1	28,6	13,2	44,0	31,0	15,7
150	28,8	21,8	10,6	34,3	24,7	12,2
175	19,5	15,0	8,0	24,7	18,3	8,7
200	—	—	—	15,0	12,0	5,3

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

Pressure in bar (1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2).

[a] Consult the 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 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 and body runs is referred to as the flow passageway. The bore is categorized in this International Standard as full bore, reduced bore, and double reduced bore. The minimum bore for each category shall be such that a hypothetical cylinder having a diameter in accordance with Table 2 can be passed through when the handle or gear operator is moved to the full open position stop.

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 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 2 — Cylinder diameter for categorizing bore size

DN	Minimum bore diameter mm			NPS
	Full bore	Reduced bore	Double reduced bore	
	PN: All	PN: All	PN: All	
	Class: All	Class: All	Class: All	
8	5	N/A	N/A	¼
10	8	5	N/A	⅜
15	11	8	N/A	½
20	17	12	8	¾
25	24	17	14	1
32	30	22	18	1 ¼
40	37	27	23	1 ½
50	49	37	30	2
65	62	49	37	2 ½
80	75	56	49	3
100	100	75	62	4
150	148	100	75	6
200	198	151	100	8
250	245	202[a]	151	10
300	295	251[b]	202	12
350	334	302	251	14
400	385	334	302	16
450	436	385	334	18
500	487	436	385	20
600	586	487	436	24

NOTE N/A signifies that valves having this configuration are not within the scope of this International Standard.

[a] For one-piece (unibody) design, the minimum flow passage is 186 mm.

[b] For one-piece (unibody) design, the minimum flow passage is 227 mm.

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 $0{,}35\sqrt{dt_{\mathrm{m}}}$, 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 $0{,}75\ t_{\mathrm{m}}$;

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

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.

5.2.2 Flanged ends

5.2.2.1 Body end flanges shall comply with the requirements of ASME B16.5 for Class-designated valves and EN 1092-1 for PN-designated valves. Raised face end flanges shall be provided unless otherwise specified by the purchaser.

5.2.2.2 Face-to-face dimensions for flanged end valves shall be in accordance with ASME B16.10 long or short pattern for Class-designated valves or ISO 5752 basic series 1, 14, and 27 for PN-designated valves with an appropriate tolerance as follows:

— for DN ≤250, a tolerance of ±2 mm;

— for DN ≥300, a tolerance of ±4 mm.

5.2.2.3 Body or body cap end flanges shall be either cast or forged integral with the body or cap or cast or forged flanges attached by full penetration butt-welding. A purchaser requiring integral flange construction shall so specify.

When a flange is attached by welding, it is required that the welding operator and welding procedure shall be qualified in accordance with the rules of ASME-BPVC-IX or the rules of ISO 9606-1, ISO 15607, ISO 15609-1, ISO 15614-1, ISO 15614-2, and ISO 15610.

Alignment rings, either integral or loose used as a welding aid, shall be completely removed following welding with care being taken that the minimum wall thickness is maintained. Heat treatment, following welding, to ensure that the valve body and flange materials are suitable for the full range of service conditions shall be performed as required by the material specification.

5.2.2.4 End flange facing finish shall be in accordance with ASME B16.5 for Class-designated valves or EN 1092-1 for PN-designated valves unless otherwise specified by the purchaser.

5.2.3 Butt-welding ends

5.2.3.1 Butt-welding ends shall be in accordance with Figure 1 and Table 4 unless otherwise specified by the purchaser.

5.2.3.2 End-to-end dimensions for Class-designated valves shall be in accordance with ASME B16.10 for either the long or short pattern or in accordance with EN 12982 for PN-designated valves.

Table 3 — Valve body wall thickness

PN	16			25 and 40			63			100			—	PN
Class	150			300			—			600			800	Class
DN	Minimum valve body wall thickness, t_m, mm													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	All 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	¼
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	⅜
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	½
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	¾
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	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	1 ¼
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	1 ½
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	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	N/A	2 ½
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	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	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	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	8
250	8,7	8,4	8,4	12,5	12,0	12,0	14,5	13,5	13,5	18,9	17,6	17,6	N/A	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	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	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	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	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	20
600	14,3	13,3	13,3	23,7	21,8	21,8	31,9	25,9	25,9	42,3	38,4	38,4	N/A	24

NOTE N/A signifies that valves having this configuration are not within the scope of this International Standard.

5.2.4 Socket welding ends

5.2.4.1 The socket bore axis shall coincide with the end entry axis. Socket end faces shall be perpendicular to the socket bore axis. The socket bore diameter and its depth shall be as specified in Table 5.

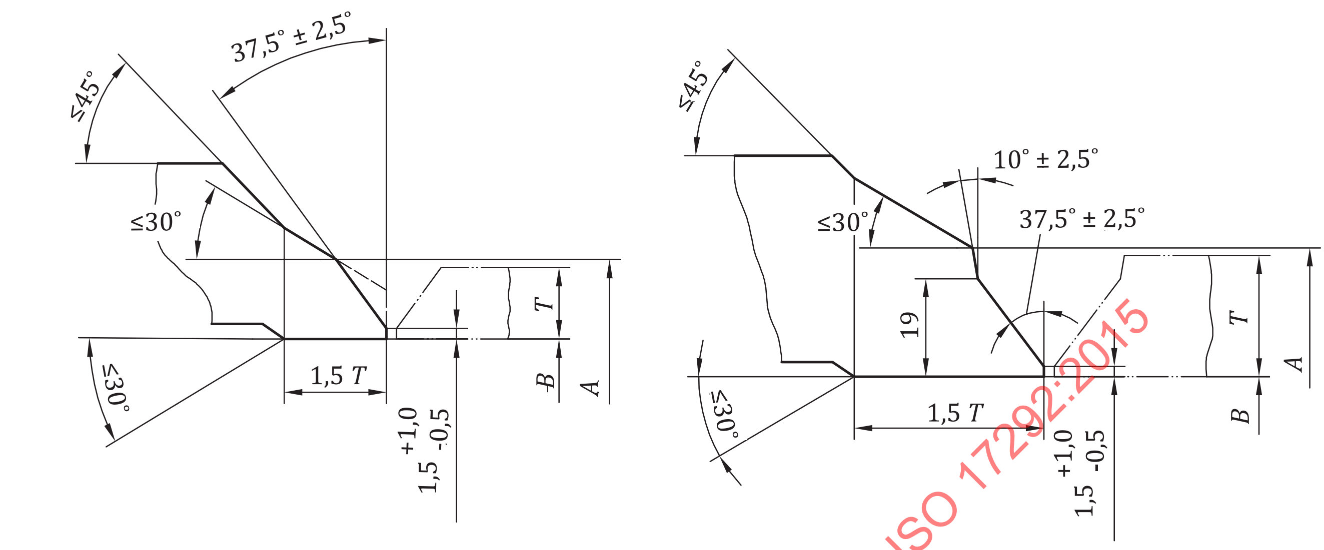
5.2.4.2 The minimum socket wall thickness extending over the full socket depth shall be as specified in Table 6.

5.2.4.3 End-to-end dimensions for socket welding end valves shall be established by the manufacturer.

The inside and outside surfaces of valve welding ends are machine finished overall. The contour within the envelope is at the option of the manufacturer unless specifically ordered otherwise.

Intersections should be slightly rounded.

Valves minimum wall thickness equal to 3 mm or less may have ends cut square or slightly chamfered.



a) Welding end for connection to pipe of wall thickness *T* ≤ 22 mm

b) Welding end for connection to pipe of wall thickness *T* > 22 mm

Key

A nominal outside diameter of welding end

B nominal inside diameter of pipe

T nominal wall thickness of pipe

NOTE 1 For nominal outside diameters and wall thickness of standard steel pipe, see ISO 4200 or ASME B36.10.

NOTE 2 Linear dimensions and tolerances shown are in millimetres.

Figure 1 — Welding ends

Table 4 — Welding ends

DN		15	20	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600
NPS		½	¾	1	1 ¼	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24
A mm	diameter	22	28	35	44	50	62	78	91	117	172	223	278	329	362	413	464	516	619
	tolerance	+2,5 −1,0									+4,0 −1,0								
B mm	tolerance	+1,0 −1,0									+2,0 −2,0							+3,0 −2,0	

Table 5 — Socket diameter and depth

DN	Diameter[a]	Depth[b]	NPS
	mm		
8	14,1	9,5	¼
10	17,5	9,5	⅜
15	21,7	10	½
20	27,0	13	¾
25	33,8	13	1
32	42,5	13	1 ¼
40	48,6	13	1 ½
50	61,1	16	2

[a] The applicable diametral tolerance is $^{+0,5}_{\ \ 0}$ mm.

[b] The depth dimension is a minimum value.

Table 6 — Socket and threaded end wall thickness

PN	16, 25, and 40	63 and 100	—	PN
Class	150 and 300	600	800	Class
DN	Minimum wall thickness mm			NPS
8	3,0	3,3	3,3	¼
10	3,0	3,6	3,6	⅜
15	3,3	4,1	4,1	½
20	3,6	4,3	4,3	¾
25	3,8	5,1	5,1	1
32	3,8	5,3	5,3	1 ¼
40	4,1	5,6	5,8	1 ½
50	4,6	6,1	6,9	2

5.2.5 Threaded ends

5.2.5.1 The threaded end thread axis shall coincide with the end entry axis. The minimum wall thickness at the threaded end shall be as specified in Table 6. An approximate 45° lead-in chamfer having an approximate depth of one-half the thread pitch shall be applied at each threaded end.

5.2.5.2 The end threads for PN-designated valves shall be taper pipe threads meeting the requirements of ISO 7-1 or for Class-designated valves, shall be taper pipe threads meeting the requirements of ASME B1.20.1. Pipe threads shall be gauged in accordance with ISO 7-2 or ASME B1.20.1 as applicable.

5.2.5.3 End-to-end dimensions for threaded end valves shall be established by the manufacturer.

5.2.6 Body openings

Trunnion-mounted valves that employ upstream sealing seats shall be fitted with a DN 15 (NPS ½) solid test plug having threads in accordance with 5.2.5.2 in order to complete the closure tightness test. Other tapped openings, for any purpose, are permitted only when specified by the purchaser.

5.2.7 Anti-static design

Valves shall incorporate an anti-static feature that ensures electrical continuity between the stem and body of valves, DN ≤ 50, and between the ball, stem, and body of larger valves. The anti-static feature shall have electrical continuity across the discharge path with a resistance not exceeding 10 Ω from a power source not exceeding 12 V d.c. when type tested on a new, dry, as-built valve after pressure testing and cycling of the valve at least five times.

5.2.8 Anti-blow-out stem

The valve design shall be such that the stem seal retaining device is not the sole means used to retain the stem. The design shall ensure that while under pressure, the stem is not ejected from the valve by the disassembly of valve external parts, e.g. gland and gland flange bolting (see Annex B).

5.2.9 Ball-stem construction

5.2.9.1 The valve design shall be such that if a failure occurs either at the stem-to-ball connection or any part of the stem within the pressure boundary, no portion of the stem is ejected when the valve is under pressure.

5.2.9.2 Both the stem-to-ball connection and all of that part of the stem within the pressure boundary (below top of packing) shall be designed to exceed the torsional strength of the stem external to the packing (above the top of the packing) by at least 10 % at the maximum valve rated temperature.

5.2.9.3 The stem and the connection between the stem and the ball shall be designed to preclude permanent deformation or failure of any part when a force applied to the direct operating lever or the operational means of a manual gear operator, whichever is furnished with the valve, transmits a torque to the valve stem equal to the greater of either

a) 20 N·m, or

b) twice the manufacturer's published torque.

The manufacturer's published torque shall be based on clean water, dry air, or nitrogen at a differential pressure equal to the maximum differential service pressure rating of the valve.

5.2.10 Ball construction

The ball shall have a cylindrical bore and shall be of a solid, one-piece construction. Other constructions such as two-piece construction, cored cavity, sealed cavity, or hollow ball may be furnished only if agreed to by the purchaser.

5.2.11 Operating means

5.2.11.1 Valves that are solely manually operated, i.e. without an attached gear or power assist device, shall be fitted with lever-type handles unless otherwise specified by the purchaser.

5.2.11.2 Gear operators when specified or required to meet the operating force requirements of 5.2.11.3 shall be provided with handwheels for actuation.

5.2.11.3 Unless otherwise specified by the purchaser, the length of the lever type handle or the diameter of the manual gear handwheel shall be sized so that the applied input force to open or close the valve does not exceed 360 N at the torque value specified in 5.2.9.3.

5.2.11.4 For lever-operated valves, position stops shall be provided at both the full open and full closed positions.

5.2.11.5 Valves shall be designed to close when the lever or handwheel is turned in a clockwise direction.

5.2.11.6 Handwheels on manual gear operators shall be marked to indicate either the direction of opening or closing.

5.2.11.7 Lever-type handles shall be mounted with the handle parallel to the ball bore. If the purchaser specifies round or oval direct operating handwheels, a permanent means of indicating the open and closed positions shall be provided.

5.2.11.8 Lever or manual gear box handwheel design shall be such that the lever or gearbox indicating means do not assemble in other than the correct configuration for indicating the open and closed positions.

5.2.11.9 An indication of the position of the flow passageway through the ball shall be integral with the valve stem. This indication may be by a permanent marking on the stem or by a shaping of the stem.

5.2.11.10 Levers, handwheels, and other operating mechanisms shall be fitted to the valve such that they can be removed and replaced without affecting the integrity of the stem or body seal or retention of the stem.

5.2.11.11 When specified in the purchase order, valves shall be furnished with a lockable device that accepts a purchaser-supplied padlock that allows the valve to be locked in both the fully open and fully closed positions. The lockable device shall be designed such that a lock with no less than 5 mm diameter shank, not more than 102 mm long, can be inserted directly through the hole(s) in the lockable device and locked. Provision for a lockable device is permitted on a valve even when it is not specified on the purchase order.

5.2.12 Glands

5.2.12.1 Adjustable packing glands shall be accessible for tightening stem seals without the disassembly of either the valve or operator parts.

5.2.12.2 Packing glands that are threaded into bodies or covers (see Annex B) shall not be used.

5.2.12.3 Vertically split glands shall not be used.

5.2.12.4 Position stops integral with the gland, gland flange, or gland bolting shall not be used.

5.2.13 End flange facing interruptions

5.2.13.1 Ring-shaped radial gaps located in what would be the seating face area of a centred ASME B16.20-style spiral wound gasket on the flange facing area of end flanges shall not exceed 0,8 mm. The gap is shown as dimension, *b*, in Figure 2. An example of the occurrence of this type of gap is one that can exist between the outer periphery of a body insert and the inner bore of the body end flange of the valve. This is illustrated in Figure 2.

5.2.13.2 For ball valves designed with a body insert (see Annex B) with a gasket seating face outer diameter located within the seating area of a centred ASME B16.20-style spiral wound gasket, the body insert flange face shall not protrude beyond the valve body end flange face. The body insert flange face shall not be recessed below the body end flange face by more than 0,25 mm. The recess is shown as dimension, *a*, in Figure 2.

5.2.13.3 Threads for body inserts shall have a thread shear area such that the resultant thread shear stress is ≤70 MPa at an internal pressure equal to the 38 °C pressure rating.

5.2.14 Shell joints

5.2.14.1 Shell joints are characterized as bolted body-to-cap joints, threaded body-to-cap joints, bolted cover joints, and threaded cover joints. Body-to-cap joints are those that could be subject to piping mechanical loads; cover joints, those that are not (see Annex B for part name identification).

5.2.14.2 Bolting used for assembly of shell joints shall be studs or continuously threaded stud bolts with nuts or cap screws.

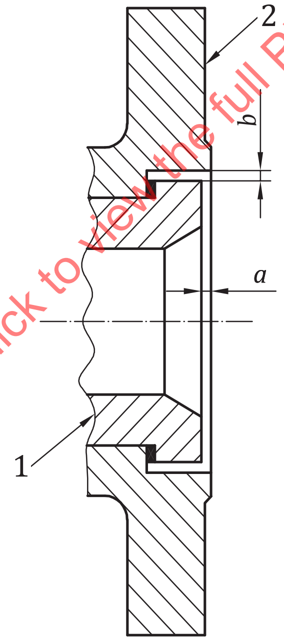
Nuts shall be semi-finished hexagons conforming to ASME B18.2.2, ISO 4032, ISO 4033, or ISO 4034.

ASME specified bolting 1 inch (25,4 mm) diameter and smaller shall have coarse (UNC) threads. ASME specified bolting larger than 1 inch (25,4 mm) diameter shall be 8 thread series (8UN).

ASME specified bolt threads shall be Class 2A and nut threads shall be Class 2B conforming to ASME B1.1.

Metric specified bolting M30 and smaller shall have coarse threads. Metric specified bolting larger than M30 shall be fine threads with 3 mm pitch.

Metric specified threads shall be in accordance with ISO 261 and ISO 965-2 tolerance Class 6 g.



Key

1 body insert

2 valve body end flange

Figure 2 — Flange face interruption limits

5.2.14.3 Nut and bolt head bearing surfaces in shell joints assembled by bolting shall be perpendicular to the centreline of the tapped or clearance hole for the fastener with a tolerance of ±1°.

5.2.14.4 A bolted body-to-body cap joint shall be secured by a minimum of four bolts. The minimum bolt size shall be as follows:

— M10 or ⅜ for sizes 25 ≤ DN ≤ 65;

— M12 or ½ for sizes 80 ≤ DN ≤ 200;

— M16 or ⅝ for sizes 250 ≤ DN.

5.2.14.5 At assembly, gasket contact surfaces shall be free of heavy oils, grease, and sealing compounds. A light coating of a lubricant no heavier than kerosene may be applied if needed to assist in proper gasket assembly.

5.2.14.6 Each bolted or threaded shell joint included in the valve design shall meet one of the following applicable minimum bolting area requirements which are the minimum requirements of this International Standard and as such, do not relieve the valve manufacturer from the responsibility to provide additional design basis bolting for specific valve designs.

— Bolted body-to-cap: $P_c \frac{A_g}{A_b} \leq 50{,}76\, S_b \leq 7\,000$

— Threaded body-to-cap: $P_c \frac{A_g}{A_s} \leq 3\,300$

— Bolted cover: $P_c \frac{A_g}{A_b} \leq 65{,}26\, S_b \leq 9\,000$

— Threaded cover: $P_c \frac{A_g}{A_s} \leq 4\,200$

where

S_b is the allowable bolt stress at 38 °C, expressed in megapascals, MPa: when its value is >138 MPa, use 138 MPa;

P_c is the Class designation number for Class-designated valves (e.g. 600), or the PN designation number for PN-designated valves (e.g. 40), multiplied by 6;

A_g is the area bounded by the effective outside periphery of the gasket, expressed in square millimetres, mm^2;

A_b is the total effective bolt tensile stress area, expressed in square millimetres, mm^2;

A_s is the total effective thread shear stress area, expressed in square millimetres, mm^2.

5.2.15 Packing gland bolting

5.2.15.1 When a packing gland is included, the packing gland bolting shall pass through holes in the gland. Open slots for bolting are not permitted in the cover flange, cover, or gland.

5.2.15.2 Packing gland bolts shall be sized so that the bolt tensile stress does not exceed one-quarter of the ultimate tensile strength of the bolting material for a compressive packing stress of 38 MPa.

5.2.16 Fluid thermal expansion

Ball valves capable of sealing in either flow direction can trap fluid inside the cavity between the seats when the valve is fully open or closed. Under such conditions where the centre cavity is filled or partially filled with liquid, an increase in temperature could result in an excessive rise in pressure that may lead to failure of the pressure boundary. When specified in the purchase order, the manufacturer shall provide a means to protection against excessive pressure within the centre cavity between the seats.

6 Materials

6.1 Shell

The shell which comprises, as applicable, the body, body insert, body cap, cover, and trunnion cap shall be of a material specified in ASME B16.34 for Class-designated valves or in EN 1092-1 for PN designated valves. These shell parts are identified in Annex B.

6.2 Shell material repair

Defects in cast or forged valve pressure shell materials that are revealed during manufacturing operations or testing may be repaired as permitted by the most nearly applicable material specification for forgings or castings.

6.3 Trim

The internal metal parts of the valve such as the ball, stem, metal seats, or seat retainers shall have corrosion-resistant properties equivalent to or better than those of the shell. The purchaser may specify materials having greater corrosion resistance or higher strength for these parts.

6.4 Identification plate

The material used for the identification plate shall be an austenitic stainless steel or a nickel alloy. The identification plate shall be attached to the valve by corrosion-resistant fasteners or by welding.

6.5 Bolting

6.5.1 Unless otherwise specified by the purchaser, bolts for assembling shell pressure retaining components and packing gland bolting shall be as a minimum intermediate strength as specified in ASME B16.5 for Class-designated valves or EN 1092-1 for PN-designated valves. For service temperatures below −29 °C, the purchase order shall specify the bolting material.

6.5.2 Unless otherwise specified by the purchaser, packing gland bolting material shall have mechanical properties at least equal to either ASTM A307 Grade B or EN 10269 Grade C35E (1.1181).

6.6 Seals

Material for stem seals, body seals, cover seals, and gaskets shall be suitable for use at the maximum allowable temperature and its corresponding pressure rating applied to the valve by the manufacturer. Metallic parts used in seals shall have corrosion-resistant properties equivalent to or better than those of the shell material.

6.7 Threaded plugs

Threaded plugs used for sealing tapped openings shall have corrosion-resistant properties equivalent to or better than those of the shell. Malleable, grey, or any other form of cast iron shall not be used for plugs.

6.8 Low temperature service

For service at temperatures −29 °C and lower, materials shall be specified by the purchaser.

6.9 Hydrogen sulfide environment

When specified by purchaser, shell, trim, and bolting materials shall comply with either NACE MR0103 or ISO 15156-1, ISO 15156-2, and ISO 15156-3.

7 Marking

7.1 Legibility

Each valve manufactured in accordance with this International Standard shall be clearly marked in accordance with ISO 5209 except that the requirements of this Clause shall apply.

7.2 Body marking

7.2.1 The mandatory valve body markings subject to the provisions of 7.2.2 shall be as follows:

— manufacturer's name or trade mark;

— body material;

— pressure rating as PN followed by the appropriate pressure number (e.g. PN 16 for PN-designated valves) or pressure Class number (e.g. Class 150 for Class-designated valves);

— nominal size, as either DN, followed by the appropriate size number (e.g. DN 500) or the NPS number (e.g. 20).

7.2.2 For valves smaller than DN 50, if the size or shape of the valve body precludes the inclusion of all the required markings, one or more may be omitted provided that they are shown on the identification plate. The sequence of omission shall be as follows:

— nominal size;

— PN designation or Class number;

— body material.

7.3 Ring joint marking

Body end flanges require marking only when the end flanges are grooved for a ring type end flange gasket. When so grooved, the ring joint gasket number (e.g. R25) shall be marked on the rim of both end flanges. For ring joint gasket numbers, see ASME B16.5.

7.4 Identification plate

Each valve shall have an identification plate with the following marking:

— the manufacturer's name;

— pressure rating designation, PN or Class;

— manufacturer's identification number;

— maximum pressure at 38 °C;

— limiting temperature and associated pressure, if applicable;

— limiting differential pressure and associated temperature, if applicable;

— trim identification, e.g. 316SS;

— seat and seal material, e.g. PTFE/graphite;

— pipe thread identification, NPT or Rc.

The number of this International Standard may be included provided that all of its applicable requirements have been met.

The material of the identification plate(s) shall be austenitic stainless steel or nickel alloy. The identification plate shall be attached to the valve body by welding or by pins made from the same materials allowed for the identification plate. Other methods of attachment are acceptable only by agreement with the purchaser.

7.5 Special marking for unidirectional valves

Valves designed for or modified to only have unidirectional capability, i.e. capability to block flow in only one direction, shall have a separate identification plate attached to the valve body to identify the unidirectional seat. The unidirectional seat shall be shown on the identification plate as shown in Figure 3.

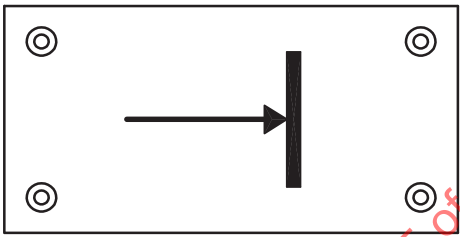


Figure 3 — Typical unidirectional valve identification plate symbol

8 Testing and inspection

8.1 Pressure tests

8.1.1 General

Each valve shall be given a shell pressure test and a seat closure test in accordance with the requirements of ISO 5208 except as modified herein. Sealing compounds, greases, or oils shall be removed from seating surfaces prior to pressure testing. It is permissible, however, for a film of oil that is not heavier than kerosene to be applied to prevent metal-to-metal sealing surfaces from galling.

8.1.2 Shell test

8.1.2.1 The shell test shall be at a pressure no less than 1,5 times the pressure corresponding to the valve 38 °C pressure rating. If the valve design includes an adjustable stem seal, it shall be adjusted so as to maintain the shell test pressure.

8.1.2.2 The duration of the shell test (the minimum period of time that the shell test pressure is to be sustained) shall be in accordance with Table 7.

8.1.2.3 Over the duration of the shell test, there shall be no visually detectable leakage through either the shell wall or any of the gasket seals.

Table 7 — Test duration

Valve size range	Minimum test duration s	
	Shell test	Seat test
DN ≤ 50	15	15
65 ≤ DN ≤ 150	60	60
200 ≤ DN ≤ 300	120	120
350 ≤ DN ≤ 600	300	120

8.1.3 Closure tightness test

8.1.3.1 For valve designs having resilient seats, the closure tightness test shall be a gas test with the test gas at a pressure between 400 kPa (4 bar) and 700 kPa (7 bar).

For floating ball designs, the test method shall be one that fills the body cavity between the seats and the body ball chamber with test gas so as to ensure that no seat leakage can escape detection.

For trunnion-mounted valves of upstream sealing design, the test method shall be one that measures leakage across the upstream seat. For trunnion-mounted valves of downstream sealing design, the test method shall be one that measures leakage across the downstream seat.

8.1.3.2 For valve designs having metal or ceramic seats, the closure tightness test shall be a liquid test with the test fluid at a pressure not less than 1,1 times the rated pressure at 38 °C (100 °F).

For floating ball designs, the test method shall be one that fills the body cavity between the seats and the body ball chamber with test liquid so as to ensure that no seat leakage can escape detection.

For trunnion-mounted valves of upstream sealing design, the test method shall be one that measures leakage across the upstream seat. For trunnion-mounted valves of downstream sealing design, the test method shall be one that measures leakage across the downstream seat.

8.1.3.3 The applicable closure test of 8.1.3.1 and 8.1.3.2 shall be applied one flow direction at a time for each seating direction.

8.1.3.4 The duration of the closure test (the minimum period of time that the test pressure is to be sustained for the purpose of obtaining a closure leakage measurement) shall be in accordance with Table 7.

8.1.3.5 Over the duration of the gas closure test, the maximum permitted leakage rate past the seats shall be in accordance with Table 8.

Table 8 — Maximum allowable seat leakage

Valve size range	Maximum allowable seat leakage rate		
	Gas test, resilient seats	Liquid test, metal or ceramic seats[a]	
		mm^3/s	drops/s
DN ≤ 50	0	6,3	0,1
65 ≤ DN ≤ 150	0	12,5	0,2
200 ≤ DN ≤ 300	0	20,8	0,4
350 ≤ DN ≤ 600	0	29,2	0,5

[a] The manufacturer may choose either method of quantifying liquid leakage. It is recognized that the unit conversions are inexact.

8.1.3.6 Visual evidence of leakage through the ball, behind the seats, or past stem seals is not permitted. There shall be no structural damage as a result of the closure test. Plastic deformation of resilient seats or seals is not considered to be structural damage.

8.1.3.7 For the purposes of the gas closure test, zero leakage is defined as 3 mm^3 (1 bubble) over the duration of the test.

8.2 Inspection

8.2.1 Extent of inspection

Inspection by the purchaser may be specified in the purchase order. If not otherwise specified, inspection shall be limited to the following:

— inspection of the valve assembly to ensure compliance with the specifications of the purchase order which may include specified non-destructive methods of examination;

— witnessing of the required pressure tests and examinations;

— review of mill test reports and, if specified, non-destructive examination records and radiographs.

8.2.2 Site inspection

8.2.2.1 When a purchaser specifies that the purchaser witness tests and examinations at the valve manufacturer's factory, the purchaser's inspector shall have free access to those parts of the factory concerned with the manufacture of the valves when work on the order is under way.

8.2.2.2 When a purchaser specifies examinations that include valve pressure boundary parts manufactured at locations other than the valve manufacturer's factory, these components shall be available for inspection at the location where they are being manufactured.

8.3 Examination

8.3.1 For each valve, the items listed in Annex A shall be checked by the manufacturer before release for shipment.

8.3.2 Castings of pressure boundary parts and closure elements (balls) shall be visually examined by the manufacturer during the course of manufacture so as to ensure conformance with the surface condition requirements of MSS-SP-55.

8.3.3 The valve manufacturer shall examine each valve to ensure compliance with this International Standard.

8.3.4 Examinations shall be performed in accordance with written procedures that are in accordance with the applicable standards.

8.4 Supplementary examination

8.4.1 Supplementary types of examination are required only if specified in the purchase order.

8.4.2 Magnetic particle, radiographic, liquid penetrant, and ultrasonic examination of castings or forgings may be specified as either the purchaser's own procedures and acceptance standards or those standardized in ASME B16.34:2013, Clause 8.