भारतीय मानक

Indian Standard

IS 11790 : 2024

पाइप, वॉल्व, फ्लैंज एवं फिटिंग के लिए बट वेल्डिंग सिरों की तैयारी — रीति संहिता

(पहला पुनरीक्षण)

Preparation of Butt Welding Ends for Pipes, Valves, Flanges and Fittings — Code of Practice

(First Revision)

ICS 23.040.40

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

January 2024 **Price Group 7**

Chemical Engineering Plants and Related Equipment Sectional Committee, MED 17

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Engineering Plants and Related Equipment Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was originally issued in 1986. This revision has been taken up with a view incorporating the modification found necessary as a result of experience gained in the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references to Indian Standards, wherever applicable have been updated.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PREPARATION OF BUTT WELDING ENDS FOR PIPES, VALVES, FLANGES AND FITTINGS — CODE OF PRACTICE

(First Revision)

1 SCOPE

1.1 This standard covers the preparation of butt welding ends of pipes, valves, welding neck flanges and pipe fittings. It is also applicable to other piping components which are connected to piping system by butt welding.

1.2 Materials for piping components for which these welding ends are primarily intended are carbon and alloy steels. They may also be used for nonferrous materials, upon satisfactory qualifications of welding procedures for the particular material.

1.3 The standard includes requirement for re-entrant shapes for heavy wall ends, welding bevel profiles, inside contours, for joints made with or without backing rings and internal and machining dimensions with their tolerances. The preparation of backing rings, if any, must be specified in ordering material to this specification.

1.4 This standard covers welding end preparation for four general types of joints but does not prescribe specific types of welding processes nor procedures. The four types of joints are:

a) No backing ring;
b) Split or non-continuous backing ring;
c) Solid or continuous backing ring; and
d) Consumable insert ring.

1.5 This standard also covers welding end preparation for gas tungsten arc welding (GTAW) of the root pass.

2 REFERENCE

The standard given below contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of this standard:

IS No.	*Title*
IS/ISO 3183 : 2019	Petroleum and natural gas industries — Steel pipe for pipeline transportation systems (*second revision*)

3 TRANSITION CONTOURS

The maximum envelope in which the transition from welding bevel to the outer surface of the component and from the root face to the inner surface of the component must lie as shown in Fig 1. The exact contour within this envelope is the manufacturer's option providing it maintains the specified minimum wall thickness and it has no slopes steeper than those indicated for respective regions and includes the proper surface for backing rings, if specified (except as specified in Note 5 under Fig. 1).

4 WELDING BEVEL DESIGN

4.1 Welding Bevels for Other than 'GTAW' Root Pass

4.1.1 Components having nominal wall thicknesses of 3 mm and less may have ends cut square or slightly chamfered ends.

4.1.2 Components having nominal thickness over 3 mm to 22 mm inclusive shall have single angle bevels as shown in Fig. 2.

4.1.3 Components having nominal wall thickness greater than 22 mm shall have compound angle bevels as illustrated in Fig. 3.

4.2 Welding Bevels for 'GTAW' Root Pass

4.2.1 Components having nominal wall thickness 3 mm and less may have ends cut square or slightly chamfered.

4.2.2 Components having nominal wall thickness over 3 mm to 10 mm inclusive may have $37\frac{1}{2}° \pm 2\frac{1}{2}°$ bevels, or slightly concave bevels as shown in Fig. 4.

4.2.3 Components having nominal wall thickness over 10 mm to 25 mm inclusive shall have welding levels as shown in Fig. 5.

4.2.4 Components having nominal wall thickness greater than 25 mm shall have welding bevels as shown in Fig. 6.

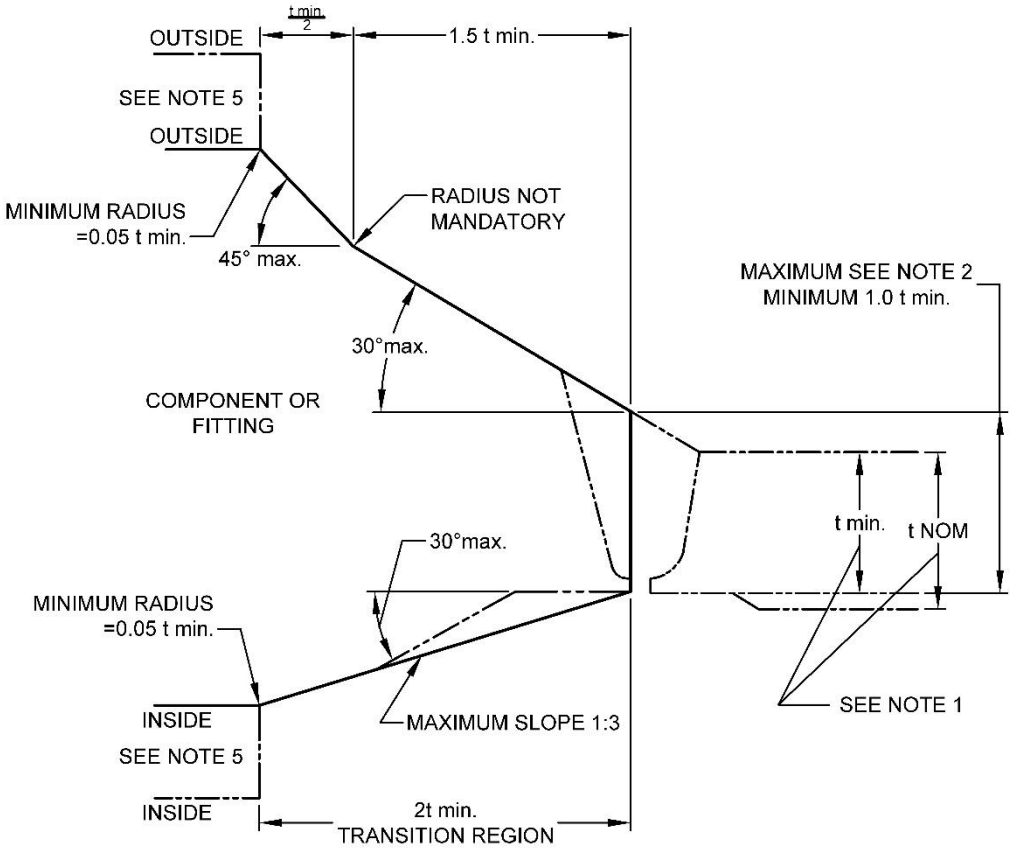
5 MACHINING

Any machining of the inside diameter at ends is related to the type welding joint intended as follows.

5.1 Components intended for welding without backing ring may be furnished as required in the relevant standard. Fig. 2A and 3A illustrate a curved interior for example. Other contours within the envelope may be supplied to suit the component being furnished.

5.2 Components intended for welding using split or non-continuous backing ring may be furnished as required in the relevant component standard, providing the inner surface at the end is essentially cylindrical. Taper boring does not always satisfy this requirement when rectangular backing rings are to be used and the purchase order shall specifically make this distinction. Fig. 2B and 3B illustrate a component counter bored to suit a split rectangular backing ring.

5.3 Components intended for use with solid or continuous backing rings require special manufacturing operations beyond those normally used in the manufacture of standard components. Fig. 2C and 3C illustrate a component prepared for a continuous rectangular backing ring and Fig. 2D and 3D illustrate a component prepared for a continuous tapered backing ring.



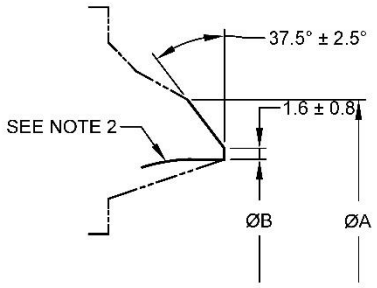
NOTES

1 The value of *t* min is whichever of the following applicable:
- a) The minimum ordered wall thickness of the pipe.
- b) 0.875 times the nominal wall thickness of pipe ordered to a pipe schedule wall thickness with an under tolerance of 12.5 percent.
- c) The minimum ordered wall thickness of the cylindrical welding end of a components or fitting (or the thinner of the two) when the joint is between two components.

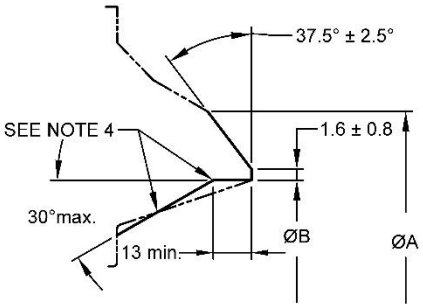
2 The maximum thickness at the end of the component is:
- a) The greater of *t Min* + 4 mm or 1.15 *t Min* when ordered on a minimum wall basis.
- b) The greater of *t Min* + 4 mm or 1.10 *t* nom when ordered on a nominal wall basis.

3 Weld bevel is shown for illustration only.
4 The weld reinforcement permitted by applicable code may lie outside the maximum envelope.
5 Where transitions using maximum slope do not intersect inside or outside surface as shown by phantom outlines maximum slopes shown or alternate radii shall be used.

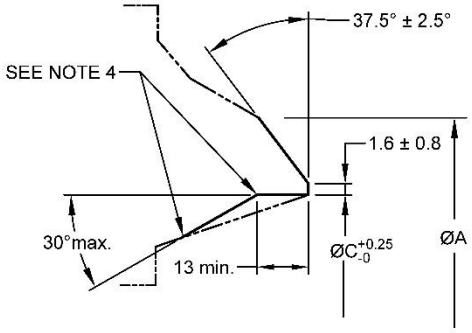
FIG. 1 WELDING AND TRANSITIONS MAXIMUM ENVELOPE



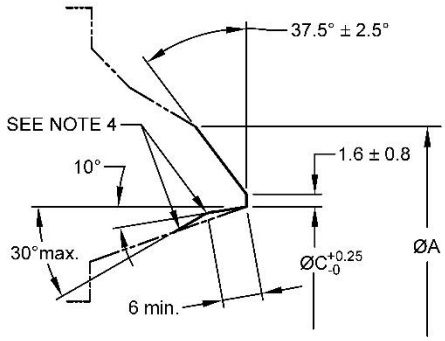
2A WELDING END DETAIL FOR JOINT WITHOUT BACKING RING



2B WELDING END DETAIL FOR JOINT USING SPLIT RECTANGULAR BACKING RING



2C WELDING END DETAIL FOR JOINT USING CONTINUOUS RECTANGULAR BACKING RING



2D WELDING END DETAIL FOR JOINT USING CONTINUOUS TAPERED BACKING RING

NOTES

1 Dotted lines denote maximum envelope for transitions from welding bevel and root face into body of component (*see* Fig. 1 for details).
2 Internal surface may be as formed or machined for dimension B at root face. Contour with in the envelope is manufacturer's option unless otherwise specifically ordered.
3 *See* **6** for tolerances other than those given in these figures.
4 Intersections shall be slightly rounded.
5 Purchase order shall specify contour of ring intended to be used.

FIG. 2 WELDING END DETAILS INTENDED FOR USE ON 22 mm AND THINNER NOMINAL WALL THICKNESS

5.4 Components intended for use with consumable insert ring or 'GTAW' root pass, with or without consumable insert rings also require special manufacturing operations as indicated in Fig. 4, 5 and 6.

5.5 Dimension *C* shown in Fig. 2C, 2D, 3C, 3D, 5 and 6 are tabulated in Table 1 for 65 mm NPS to 600 mm NPS inclusive. The dimensions for other sizes and/or wall thickness may be determined by the following formula.

$$C = A - 0.8 - 1.75\,t - 0.25$$

where

A = nominal outside diameter of pipe;

0.8 = minus tolerance in OD of pipe;

1.75 = minimum wall of $87\frac{1}{2}$ percent of nominal wall multiplied by two to convert into terms of diameter;

t = nominal wall thickness of pipe, in mm; and

0.25 = plus machining tolerance on bore C.

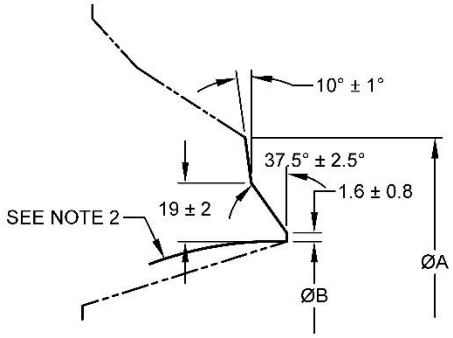
On the number of components in the smaller sizes and light duty it may be necessary to deposit weld metal on the inside diameter or use thicker wall material in order to machine for the backing ring and maintain required wall thickness. This condition may also arise when using material whose nominal dimensions indicate sufficient metal but whose actual ID considering tolerances may be large enough to require additional metal.

6 TOLERANCES

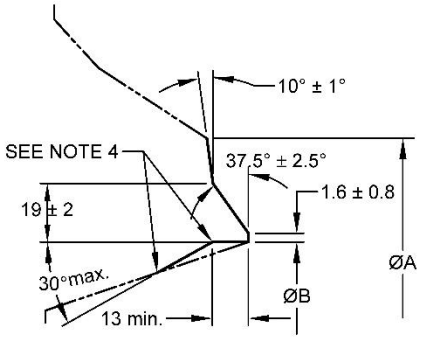
See Fig. 2, 3, 5 and 6.

6.1 Dimensions B

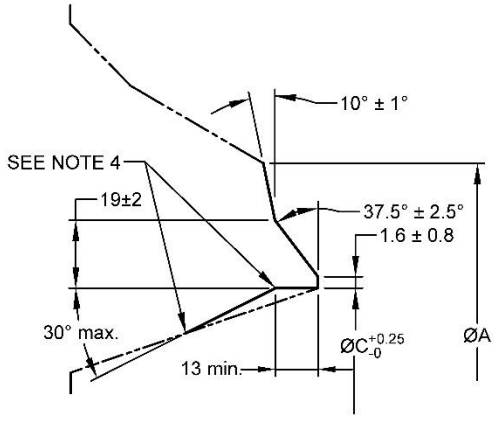
Inside diameter at welding end (*see* Fig. 2A, 2B, 3A and 3B).



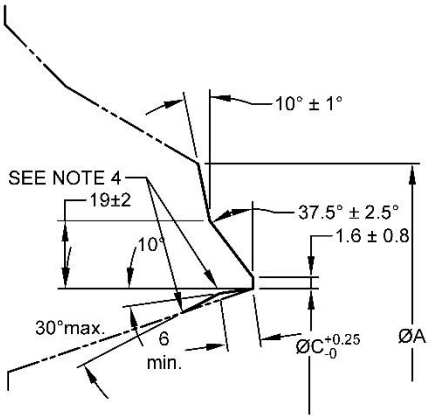
3A WELDING END DETAIL FOR JOINT WITHOUT BACKING RING



3B WELDING END DETAIL FOR JOINT USING SPLIT RECTANGULAR BACKING RING



3C WELDING END DETAIL FOR JOINT USING CONTINUOUS RECTANGULAR BACKING RING



3D WELDING END DETAIL FOR JOINT USING CONTINUOUS TAPERED BACKING RING

NOTES

1 Dotted lines denote maximum envelope for translations from welding groove and root face into body of components (*see* Fig. 1 for details).
2 Internal surface may be as formed or machined for dimension B at root face. Contour within the envelope is manufacturer's option otherwise specifically ordered.
3 *See* 6 for tolerances other than those given in these figures.
4 Intersections shall be slightly rounded.
5 Purchase order shall specify contour of ring intended to be used.

FIG. 3 WELDING END DETAILS INTENDED FOR USE ON NOMINAL WALL THICKNESSES GREATER THAN 22 mm

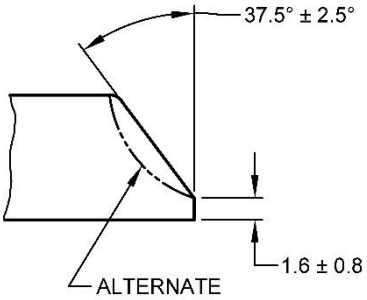
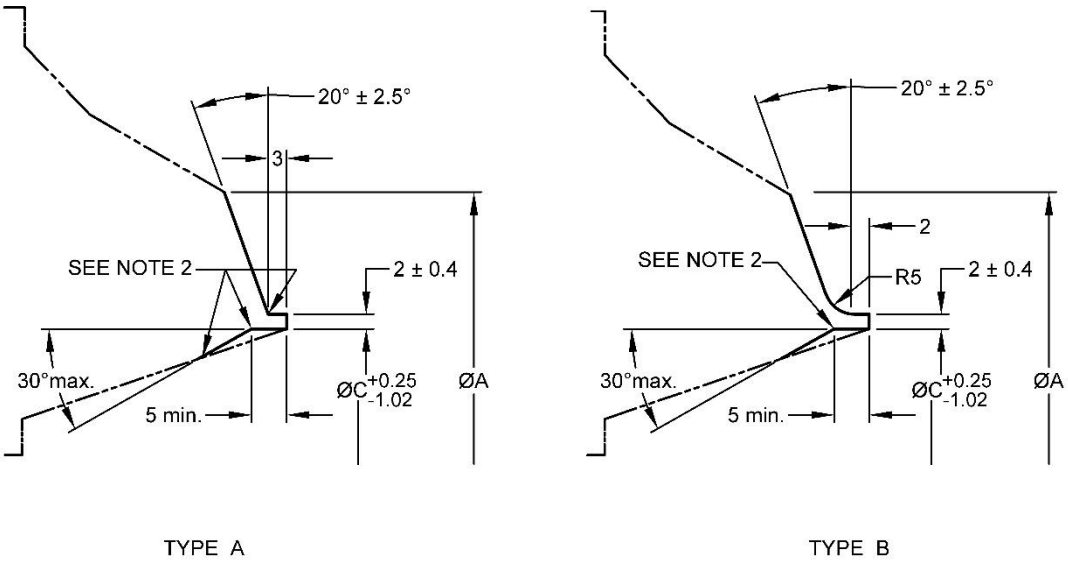


FIG. 4 WELD BEVEL DETAILS INTENDED FOR USE OF GAS TUNGSTEN ARC ROOT PASS WELDING OF NOMINAL WALL THICKNESSES OVER 3 mm TO 10 mm INCLUSIVE



NOTES

1 Dotted lines denote maximum envelope for transitions from welding groove and land into body of component (*see* Fig. 1 for details).
2 Inside corners shall be slightly rounded.
3 *See* 6 for tolerances other than those given in these sketches.

FIG. 5 WELDING END DETAILS INTENDED FOR USE OF GAS TUNGSTEN ARC ROOT PASS WELDING OF NOMINAL WALL THICKNESSES OVER 10 mm TO 25 mm INCLUSIVE

6.1.1 *All Components*

As specified in applicable relevant specifications for particular component.

a) For pipe — According to IS/ISO 3183.

b) Valves and welding neck flanges:

Sl No.	*Without/With Split Backing Ring*	*With Continuous Taper or Solid Backing Ring*
(1)	(2)	(3)
i)	250 mm and smaller $^{+0.8}_{-0.8}$	$^{0.0}_{-0.8}$
ii)	300 mm to 450 mm ± 1.6	300 mm and above $^{0.0}_{-1.6}$
iii)	500 mm and larger $^{+3.0}_{-1.6}$	—

c) Butt welding ends-without/or split backing rings:

80 mm to 200 mm	± 1.6
250 mm to 450 mm	± 3.0
500 mm and above	± 4.8

6.2 Welding Bevels, Root Face and Dimension C

6.2.1 *All Components*

As indicated in Fig. 2, 3, 4, 5 and 6.

6.2.2 It must be recognized that large diameter pipe and fittings with a relatively thin wall have a tendency to spring out of round after removal from the machining fixture. For this reason, the measured diameters may vary with orientation and the tolerance of 0.25 mm shall apply to the average diameter.

6.3 Dimension A

Nominal outside diameter of component at welding end.

6.3.1 *Pipe* — According to IS/ISO 3183.

6.3.2 *Valves* — 125 mm and smaller $^{+2.4}_{-0.8}$

150 mm and larger $^{+4.0}_{-0.8}$

6.3.3 *Butt Welding Fittings* — 80 mm to 100 mm ± 1.6

125 mm to 200 mm	$^{+2.4}_{-1.6}$
250 mm to 450 mm	$^{+4.0}_{-3.0}$
500 mm and above	$^{+6.0}_{-5.0}$

6.3.4 *Welding Neck Flanges* — As per valve, that is, 5 : 3 : 2.

6.3.5 *All other Components* — As specified in applicable Indian Standard specification.

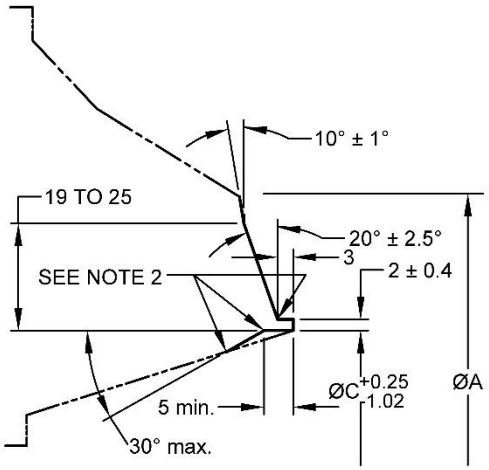
6.4 Wall Thickness

6.4.1 *All components* — Maximum *t* (*Max*) – The maximum thickness at the end of component is:

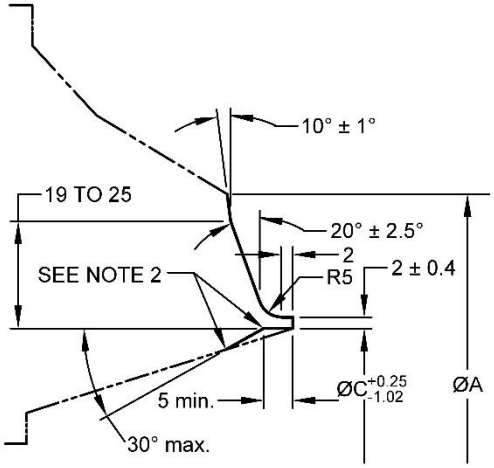
a) Greater of *t Min* + 4 mm or 1.15 *t Min* when ordered on a minimum wall basis; and

b) Greater of *t Min* + 4 mm or 1.10 *t* nominal when ordered on nominal wall basis.

Minimum *t* (*Min*) — As specified in applicable Indian Standard specification.



TYPE A



TYPE B

NOTES

1 Dotted lines denote maximum envelope for transitions from welding groove and land into body of component (*see* Fig. 1 for details).
2 Inside corners shall be slightly rounded.
3 *See* 6 for tolerances other than those given in these sketches.

FIG. 6 WELDING END DETAILS INTENDED FOR USE OF GAS TUNGSTEN ARC ROOT PASS WELDING OF NOMINAL WALL THICKNESS GREATER THAN 25 mm

Table 1 Dimensions of Welding Ends

(*Clause* 5.5)

All dimensions in millimetres.

Sl No.	Nominal Pipe Size	OD at Welding Ends *A*		*B*	*C*	*t*
		Wrought or Fabricated Components	Cast Steel Valves			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	65	73	75	63	63	5
				59	59.7	7
				54	55.3	9.5
				45	47.5	14
ii)	80	89	91	78	78.3	5.5
				74	74.5	7.6
				67	68.4	11
				58	51.2	15
iii)	100	114	117	102	103	6
				97	98	8.5
				92	94	11
				87	89.7	13.5
				80	83.3	17
iv)	125	141	144	128	129	6.5
				122	123.6	9.5
				116	118	13
				110	112.5	16
				103	107	19
v)	150	168	172	154	154.8	7
				146	148	11
				140	142.3	14
				132	135.5	18
				124	129	22
vi)	200	219	223	203	203.7	8
				198	200	10
				194	196	13
				189	192	15
				183	186	18
				178	182	21
				175	179	22
				173	178	23

Table 1 (*Continued*)

Sl No.	Nominal Pipe Size	OD at Welding Ends *A*		*B*	*C*	*t*
		Wrought or Fabricated Components	Cast Steel Valves			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
vii)	250	273	278	255	255.8	9
				248	250	13
				243	246	15
				237	240	18
				230	239	22
				222	228	25
				216	222	28
viii)	300	324	329	305	306	9.5
				303	305	10
				298	301	13
				295	298	14
				289	292	18
				281	285	22
				273	278	25
				267	273	28
				257	264	33
ix)	350	356	362	337	338	9.5
				333	335	11
				330	332	13
				325	328	15
				318	321	19
				308	313	24
				300	306	28
				295	299	32
				284	292	36
x)	400	406	413	387	389	9.5
				381	383	13
				373	376	17
				364	368	22
				354	360	26
				344	351	31
				333	341	37
				325	334	40
xi)	450	457	464	438	340	9.5
				432	434	13
				429	431	14
				419	423	19
				410	414	24
				398	405	29
				387	395	35
				378	387	40
				367	377	45

Table 1 (*Concluded*)

Sl No.	Nominal Pipe Size	OD at Welding Ends *A*		*B*	*C*	*t*
		Wrought or Fabricated Components	Cast Steel Valves			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
xii)	500	508	516	489	490	9.5
				483	485	13
				478	481	15
				467	471	21
				456	461	26
				443	450	32
				432	440	38
				419	429	45
				403	420	50
xiii)	600	610	619	591	592	9.5
				584	586	13
				581	584	14
				575	578	18
				560	565	25
				548	554	31
				532	541	39
				518	528	46
				505	517	52
				491	504	60

NOTES**1** Dimensions are in millimetres.
2 For tolerance *see* 6.
3 The diameters ‘B’ is not mandatory.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Chemical Engineering Plants and Related Equipment Sectional Committee, MED 17

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
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