ASME B16.25-1997

(Revision of ASME B16.25-1992)

BUTTWELDING ENDS

AN AMERICAN NATIONAL STANDARD

The American Society of
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The 1997 edition of this Standard is being issued with an automatic addenda subscription service. The use of an addenda allows revisions made in response to public review comments or committee actions to be published as necessary; revisions published in addenda will become effective 6 months after the Date of Issuance of the addenda. The next edition of this Standard is scheduled for publication in 2002.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. The interpretations will be included with the above addenda service. Interpretations are not part of the addenda to the Standard.

The American Society of Mechanical Engineers
345 East 47th Street, New York, NY 10017

FOREWORD

(This Foreword is not part of ASME B16.25–1997.)

In July 1953, the American Welding Society presented a proposal on Welding End Preparation to Sectional Committee B16 of the American Standards Association (ASA), with the recommendation that it be considered as a candidate American Standard. The proposal was expanded to include welding preparation for flanges and valves covered by ASA B16.5, Steel Pipe Flanges and Flanged Fittings, and for fittings covered by ASA B16.9, Buttwelding Fittings. Consideration was also given to Pipe Fabrication Institute Standard ES-1.

The third draft reviewed by Subcommittee 3, Subgroup 6 (now Subcommittee F) of the B16 Sectional Committee was forwarded to the Committee, to the cosponsor organizations, and then to ASA for approval. Final approval was given on September 14, 1955, with the designation ASA B16.25–1955.

Revisions were developed as need for clarification and improvement became known, and were approved as ASA B16.25–1958 and ASA B16.25–1964. After ASA reorganized as the American National Standards Institute (ANSI) and the Sectional Committee became American National Standards Committee B16, a further revision was approved as ANSI B16.25–1972.

Subcommittee F immediately began work on a major expansion and updating of the standard, adding illustrations and requirements for welding end configurations applicable to a number of specific circumstances, including cast steel and alloy valves. When a draft had been developed that overcame the many problems and conflicting demands, the Standards Committee, cosecretariat organizations, and ANSI concurred in approval of ANSI B16.25–1979 on July 18, 1979.

In 1982, American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. In the 1986 edition, inch dimensions were established as the standard and numerous changes in text and format were made. Notes for illustrations were also clarified. Following approval by the Standards Committee and ASME, approval as American National Standard was given by ANSI on October 8, 1986, with the new designation ASME/ANSI B16.25–1986.

In 1992, the subcommittee revised the requirements for the preparation of the inside diameter of welding end. The references in Annex B were also updated. After public review and approval by ASME, this edition was approved by ANSI on October 26, 1992, with the new designation ASME B16.25–1992.

In this 1997 Edition, metric dimensions were added as an independent but equal standard to the inch units. An Annex was also added to reference quality system requirements. Following approval by the Standards Committee and ASME, this revision to the 1992 edition of B16.25 was approved as an American National Standard by ANSI on April 17, 1997, with the new designation ASME B16.25–1997.

Requests for interpretation or suggestions for revision should be sent to the Secretary, B16 Committee, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

ASME B16 COMMITTEE
Standardization of Valves, Flanges, Fittings, and Gaskets

(The following is the roster of the Committee at the time of approval of this Standard.)

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SPECIAL NOTE:

The interpretations to ASME B16.25 are included in this Edition as a separate section for the user's convenience. This section, however, is not part of the Standard.

BUTTWELDING ENDS

1 SCOPE

1.1 General

This Standard covers the preparation of buttwelding ends of piping components to be joined into a piping system by welding. It includes requirements for welding bevels, for external and internal shaping of heavy-wall components, and for preparation of internal ends (including dimensions and tolerances). Coverage includes preparation for joints with the following:

(a) no backing rings;
(b) split or noncontinuous backing rings;
(c) solid or continuous backing rings;
(d) consumable insert rings;
(e) gas tungsten arc welding (GTAW) of the root pass.

Details of preparation for any backing ring must be specified in ordering the component.

1.2 Application

This Standard applies to any metallic materials for which a welding procedure can be satisfactorily qualified, but does not prescribe specific welding processes or procedures. Unless otherwise specified by the purchaser, it does not apply to welding ends conforming to ASME B16.5, B16.9, or B16.28.

1.3 Standard Units

The values stated in either metric or inch units are to be regarded separately as standard. Within the text, the inch units are shown in parentheses. The values stated in each system are not exact equivalents; therefore each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the Standard.

1.4 Referenced Standards

Standards and specifications adopted by reference in this Standard are shown in Annex C, which is part of this Standard. It is not considered practical to identify the specific edition of each standard and specification in the individual references; instead the specific edition is identified in Annex C. An end preparation made in conformance to this Standard in all other respects, will be considered to be in conformance to the Standard even though the edition reference may be changed in a subsequent addendum to or revision of the Standard.

1.5 Quality Systems

Nonmandatory requirements relating to the manufacturer's Quality System Program are described in Annex B.

1.6 Convention

For the purpose of determining conformance with this Standard, the convention for fixing significant digits where limits, maximum or minimum values, are specified shall be "rounding off" as defined in ASTM Practice E 29. This requires that an observed or calculated value shall be rounded off to the nearest unit in the last right-hand digit used for expressing the limit. Decimal values and tolerances do not imply a particular method of measurement.

2 TRANSITION CONTOURS

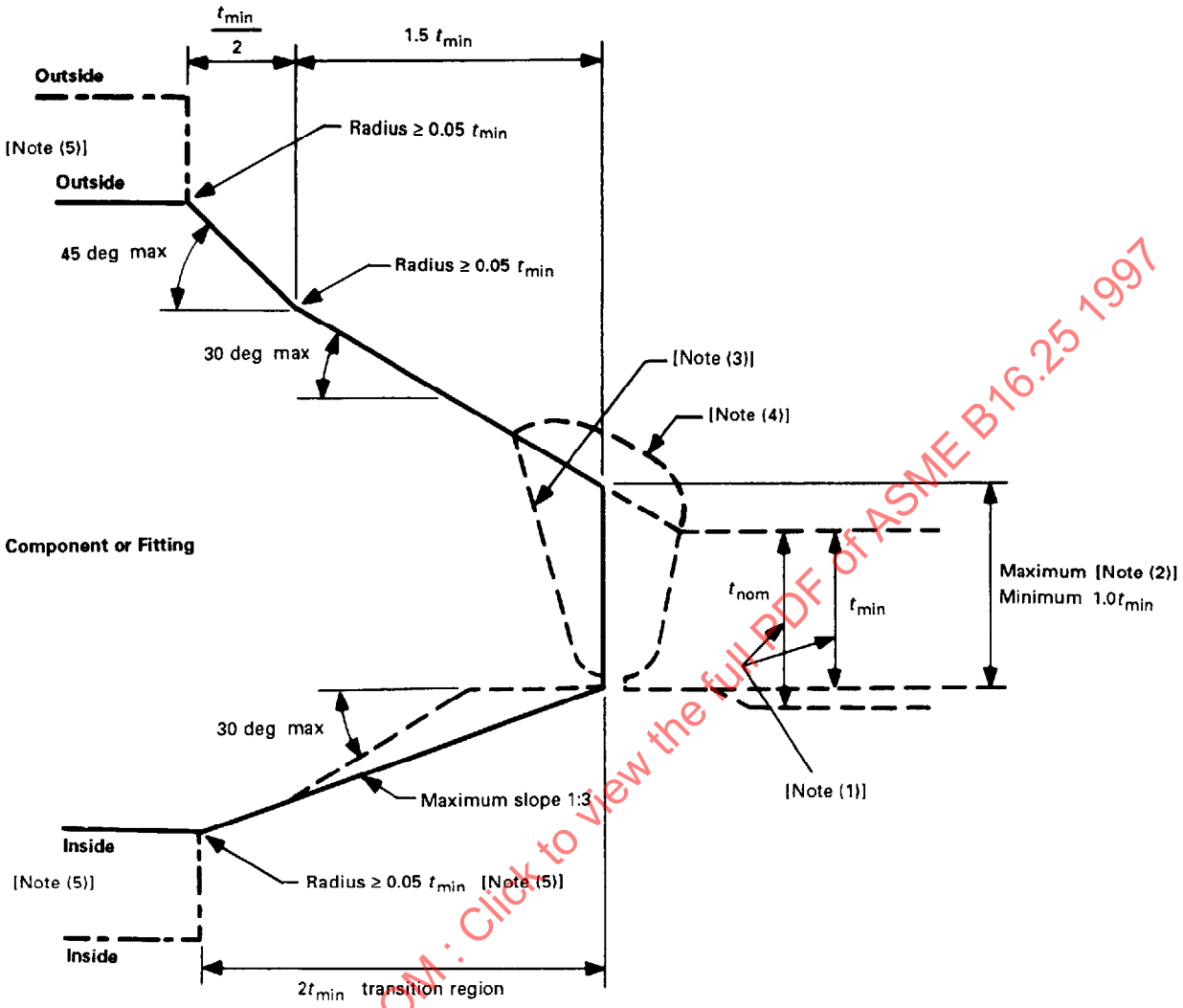
Figure 1 delineates the maximum envelope in which transitions from welding bevel to the outer surface of the component and from the root face to the inner surface of the component must lie. Except as specified in Note (5) to Fig. 1 and as otherwise specified by the purchaser, the exact contour within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

3 WELDING BEVEL DESIGN

3.1 Bevels for Other Than GTAW Root Pass

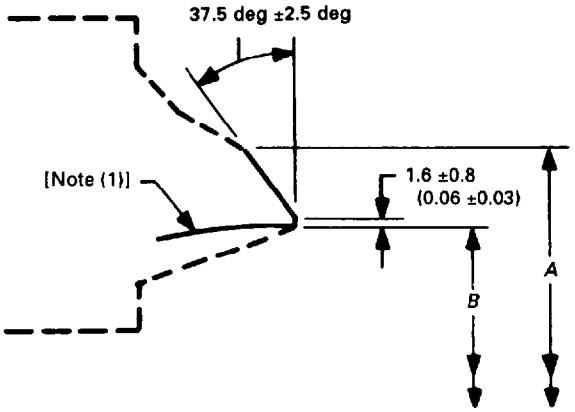
(a) Components having nominal wall thicknesses of 3 mm (0.12 in.) and less shall have ends cut square or slightly chamfered.

(b) Components having nominal wall thicknesses over 3 mm (0.12 in.) to 22 mm (0.88 in.) inclusive shall have single angle bevels as illustrated in Fig. 2.

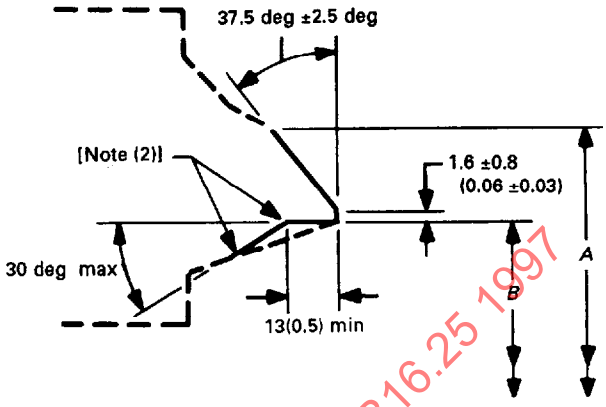


NOTES:
(1) The value of t_{min} is whichever of the following is applicable:
  (a) the minimum ordered wall thickness of the pipe;
  (b) 0.875 times the nominal wall thickness of pipe ordered to a pipe schedule wall thickness that has an under-tolerance of 12.5%;
  (c) the minimum ordered wall thickness of the cylindrical welding end of a component 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 (0.16 in.) or 1.15t_{min} when ordered on a minimum wall basis;
  (b) the greater of t_{min} + 4 mm (0.16 in.) or 1.10t_{nom} when ordered on a nominal wall basis.
(3) Weld bevel shown is 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.

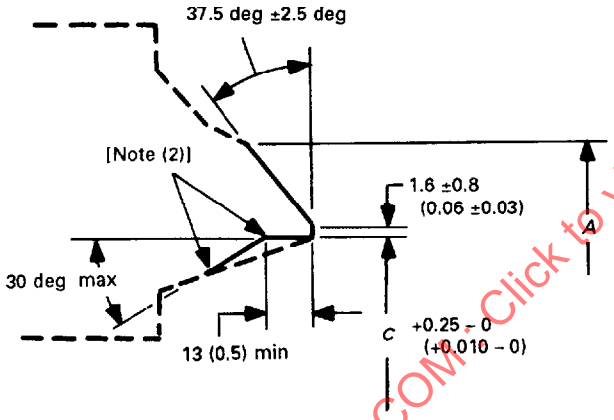
FIG. 1 MAXIMUM ENVELOPE FOR WELDING END TRANSITIONS



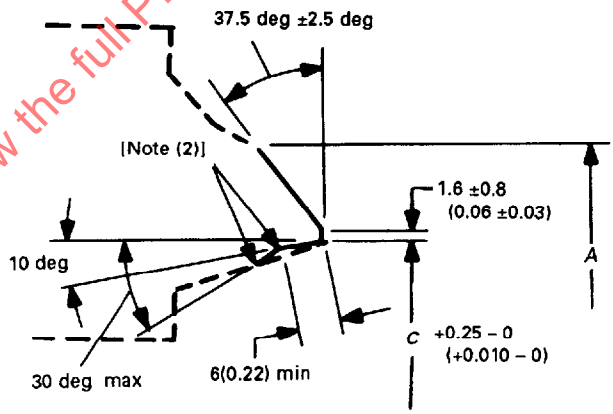
(a) Welding End Detail for Joint Without Backing Ring



(b) Welding End Detail for Joint Using Split Rectangular Backing Ring



(c) Welding End Detail for Joint Using Continuous Rectangular Backing Ring

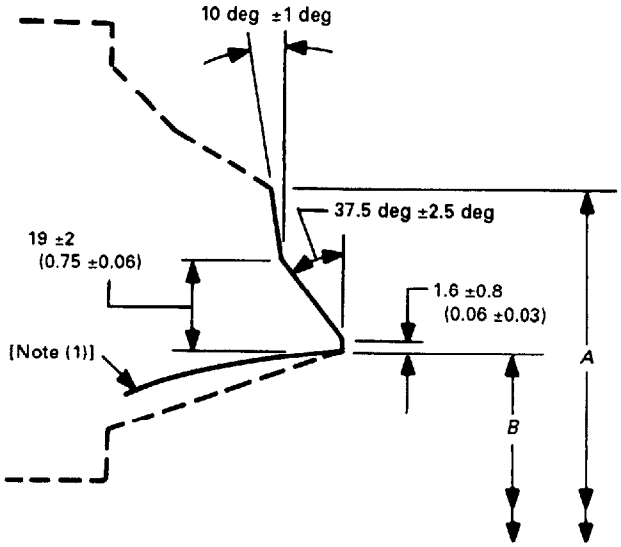


(d) Welding End Detail for Joint Using Continuous Tapered Backing Ring

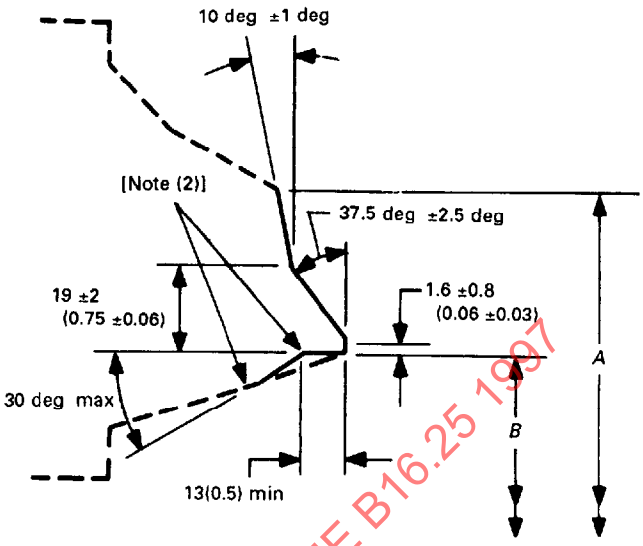
GENERAL NOTES:
(a) Broken lines denote maximum envelope for transitions from welding bevel and root face into body of component. See Fig. 1 for details.
(b) See Section 5 for tolerances other than those given in these sketches.
(c) Purchase order must specify contour of any backing ring to be used.
(d) Linear dimensions are in millimeters with inch values in parentheses.

NOTES:
(1) Internal surface may be as-formed or machined for dimension *B* at root face. Contour within the envelope shall be in accordance with Section 2.
(2) Intersections should be slightly rounded.

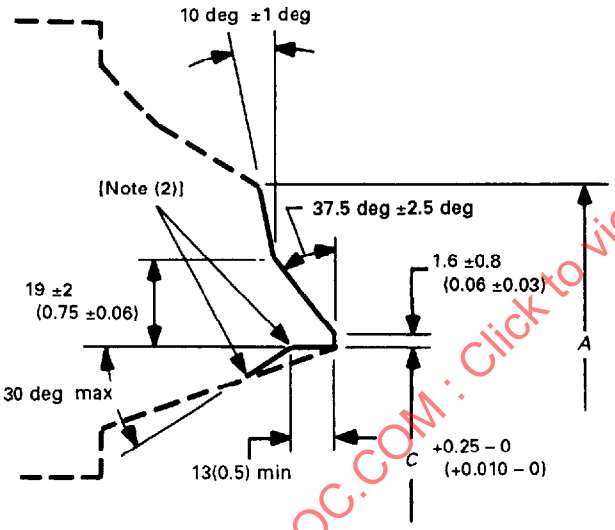
FIG. 2 WELD BEVELS FOR WALL THICKNESS NOT OVER 22 mm (0.88 in.)



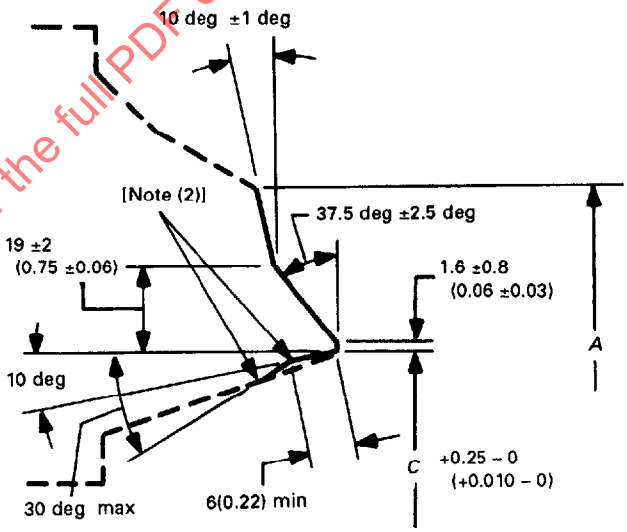
(a) Welding End Detail for Joint Without Backing Ring



(b) Welding End Detail for Joint Using Split Rectangular Backing Ring



(c) Welding End Detail for Joint Using Continuous Rectangular Backing Ring



(d) Welding End Detail for Joint Using Continuous Tapered Backing Ring

GENERAL NOTES:
(a) Broken lines denote maximum envelope for transitions from welding groove and root face into body of components. See Fig. for details.
(b) See Section 5 for tolerances other than those given in these sketches.
(c) Purchase order must specify contour of any backing ring to be used.
(d) Linear dimensions are in millimeters with inch values in parentheses.

NOTES:
(1) Internal surface may be as-formed or machined for dimension *B* at root face. Contour within the envelope shall be in accordance with Section 2.
(2) Intersections should be slightly rounded.

FIG. 3 WELD BEVEL DETAILS FOR WALL THICKNESS OVER 22 mm (0.88 in.)

(c) Components having nominal wall thicknesses greater than 22 mm (0.88 in.) shall have compound angle bevels as illustrated in Fig. 3.

3.2 Bevels for GTAW Root Pass

(a) Components having nominal wall thicknesses of 3 mm (0.12 in.) and less shall have ends cut square or slightly chamfered.

(b) Components having nominal wall thicknesses over 3 mm (0.12 in.) to 10 mm (0.38 in.) inclusive shall have 37½ deg ± 2½ deg bevels or slightly concave bevels. See Fig. 4.

(c) Components having nominal wall thicknesses over 10 mm (0.38 in.) to 25 mm (1.0 in.) inclusive shall have bevels as shown in Fig. 5.

(d) Components having nominal wall thicknesses greater than 25 mm (1.0 in.) shall have bevels as shown in Fig. 6.

4 PREPARATION OF INSIDE DIAMETER OF WELDING END

4.1 General

Preparation of the inside diameter at the end of a component shall be in accordance with one of the following, as specified by the purchaser.

(a) Components to be welded without backing rings shall meet the requirements of the standard or specification for the component.

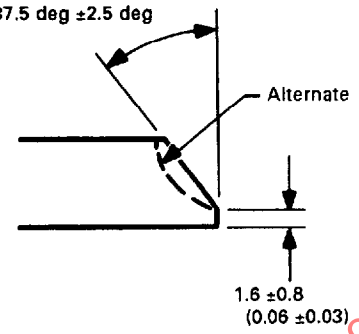
(b) Components to be welded using split or noncontinuous backing rings shall be contoured with a cylindrical surface at the end as shown in Fig. 2, sketch (b) and Fig. 3, sketch (b). If the backing ring contour is other than rectangular, details must be furnished by the purchaser.

(c) Components to be welded using solid or continuous backing rings shall be contoured with a cylindrical or tapered surface at the end as specified by the purchaser. End preparation is illustrated in Fig. 2, sketch (c) and Fig. 3, sketch (c) for rectangular ends and in Fig. 2, sketch (d) and Fig. 3, sketch (d) for tapered ends.

(d) Components to be welded using consumable insert rings or GTAW root pass shall be contoured with a cylindrical surface at the end as shown in Figs. 4, 5, and 6.

4.2 Dimension *C*

Values for dimension *C* shown in Fig. 2, sketches (c) and (d); Fig. 3, sketches (c) and (d); and Figs. 5 and 6 are tabulated in Table 1 for DN 65 through 900 (NPS 2½ through 36).



GENERAL NOTES:
(a) This detail applies for gas tungsten arc welding (GTAW) of the root pass where nominal wall thickness is over 3 mm (0.12 in.) to 10 mm (0.38 in.) inclusive.
(b) Linear dimensions are in millimeters with inch values in parentheses.

FIG. 4 WELD BEVEL DETAILS FOR GTAW ROOT PASS [Wall Thickness Over 3 mm (0.12 in.) to 10 mm (0.38 in.), Inclusive]

Dimensions for other sizes and/or wall thicknesses can be determined by the following formulas:

$$C = A - 0.79 - 1.75t - 0.25 \text{ mm}$$

$$(C = A - 0.031 - 1.75t - 0.010 \text{ in.})$$

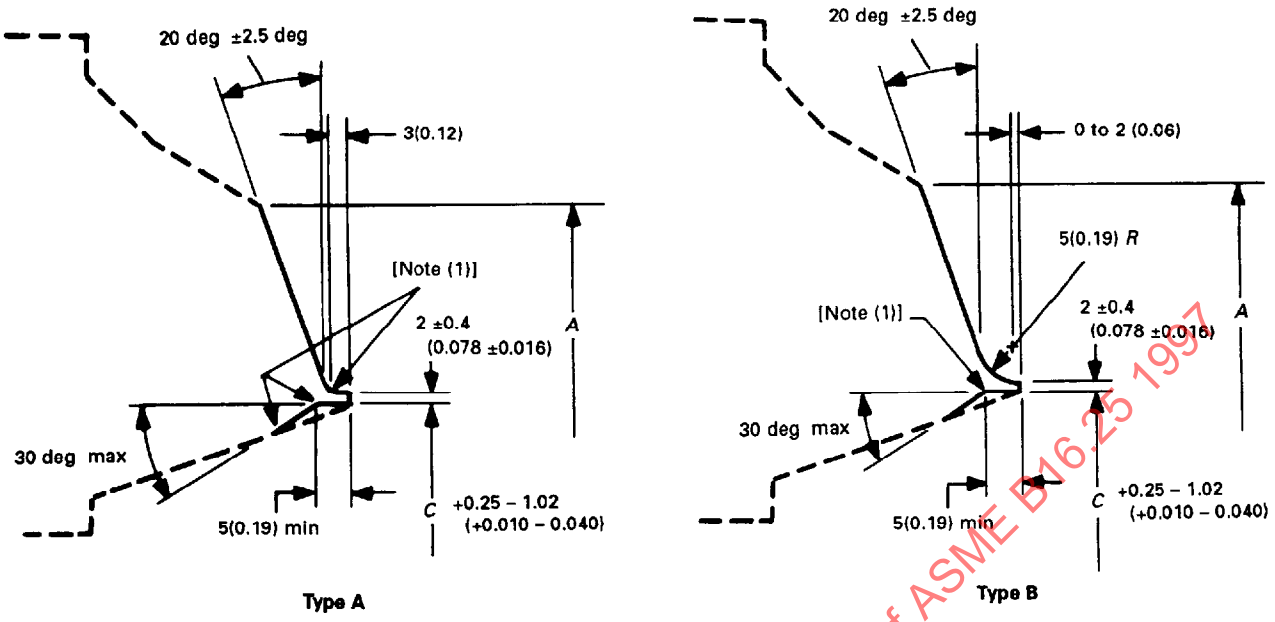
where

A = nominal O.D. of pipe (see column 3 in Tables 1 and A1, taken from ASME B36.10M)

0.79 (0.031) = minus tolerance on O.D. of pipe, mm (in.), as covered by ASTM specifications having the more restrictive requirements such as A 106, A 335, etc.

1.75 = minimal wall of 87½% of nominal wall (permitted by ASTM specification having the more restrictive requirements such as A 106, A 335, etc.) multiplied by 2 to convert into terms of diameter

t = nominal wall thickness of pipe, mm (in.)



GENERAL NOTES:
(a) This detail applies for gas tungsten arc welding (GTAW) of the root pass where nominal wall thickness is over 10 mm (0.38 in.) to 25 mm (1.0 in.) inclusive.
(b) Broken lines denote maximum envelope for transitions from welding groove and land into body of component. See Fig. 1 for details.
(c) See Section 5 for tolerances other than those given in these sketches.
(d) Linear dimensions are in millimeters with inch values in parentheses.

NOTE:
(1) Inside corners should be slightly rounded.

FIG. 5 WELD BEVEL DETAILS FOR GTAW ROOT PASS
[Wall Thickness Over 10 mm (0.38 in.) to 25 mm (1.0 in.), Inclusive]

0.25
(0.010) = plus machining tolerance on Bore *C*, mm (in.)

4.3 Exceptions

(a) For pipe or tubing varying from the ASTM A 106 and A 335 types, having different wall thickness and/or outside diameter tolerances (such as forged and bored pipe), the foregoing formulas may be inapplicable.

(b) For components in smaller sizes and lower schedule numbers, it may be necessary to deposit weld metal on the inside diameter or use thicker wall materials in order to machine the backing ring while maintaining required wall thickness. This condition may also arise when using material whose nominal dimensions indicate sufficient metal but whose actual inside diameter (I.D.), considering tolerances, is large enough to require additional metal.

5 TOLERANCES (See Figs. 2, 3, 5, and 6)

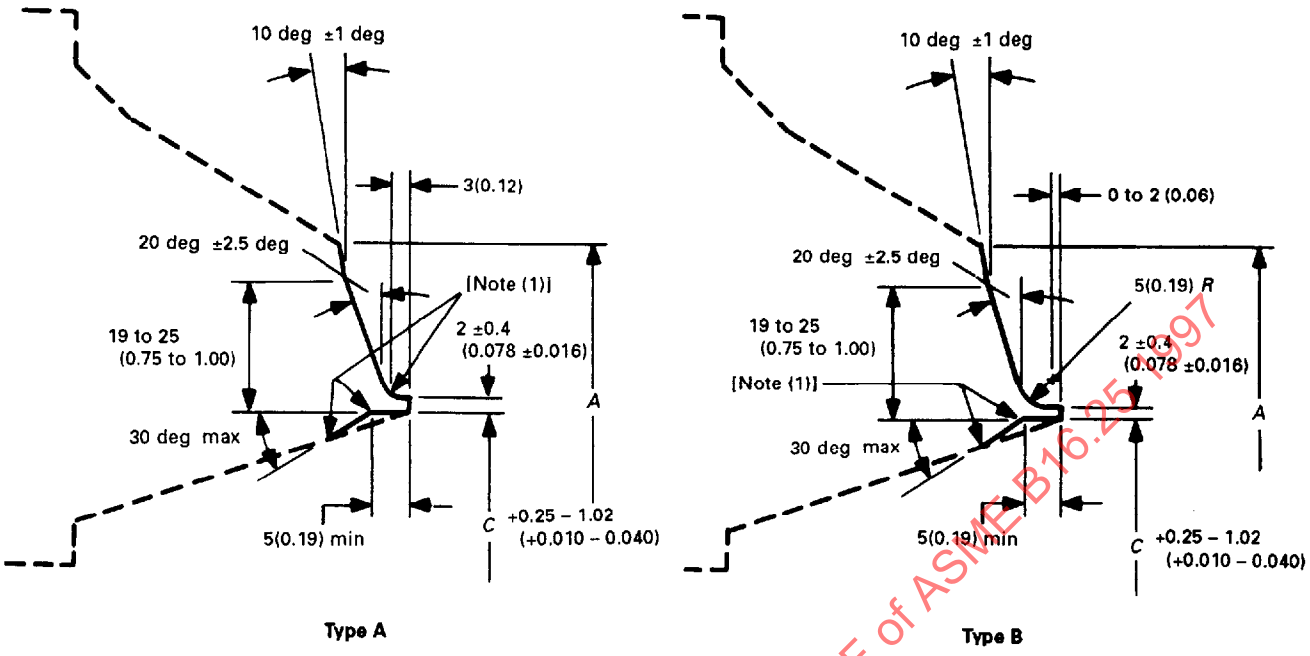
5.1 Dimension *B*

Values for the I.D. at the welding end [see dimension *B*, Fig. 2, sketches (a) and (b); and Fig. 3, sketches (a) and (b)] shall be as specified in the applicable standard or specification for the component.

5.2 Welding Bevels, Root Face, and Dimension *C*

Values of welding bevels, root face, and dimension *C* shall be as indicated in Figs. 2, 3, 4, 5, and 6.

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. A tolerance of +0.25 mm (+0.010 in.) shall apply to the average diameter.



GENERAL NOTES:
(a) This detail applies for gas tungsten arc welding (GTAW) of root pass where nominal wall thickness is greater than 25 mm (1.0 in.).
(b) Broken lines denote maximum envelope for transitions from welding groove and land into body of component. See Fig. 1 for details.
(c) See Section 5 for tolerances other than those given in these sketches.
(d) Linear dimensions are in millimeters with inch values in parentheses.

NOTE:
(1) Inside corners should be slightly rounded.

FIG. 6 WELD BEVEL DETAILS FOR GTAW ROOT PASS [Wall Thickness Over 25 mm (1.0 in.)]

5.3 Dimension *A*

Dimension *A* is the nominal outside diameter of the component at the welding end.

5.3.1 Valves (Column 4 of Tables 1 and A1)

Nominal Size	Tolerance
≤ DN 125 (NPS 5)	+2.4 mm (0.09 in.) −0.8 mm (0.03 in.)
≥ DN 150 (NPS 6)	+4.0 mm (0.16 in.) −0.8 mm (0.03 in.)

5.3.2 Other Components. Dimension *A* values for other components shall be as specified in the applicable standard or specification for the component.

5.4 Wall Thickness

The maximum thickness, t_{max}, at the end of the component is:

(a) greater of t_{min} + 4 mm (0.16 in.) or $1.15t_{min}$ when ordered on a minimum wall basis;

(b) greater of t_{min} + 4 mm (0.16 in.) or $1.10t_{nom}$ when ordered on a nominal wall basis (see Fig. 1).

The minimum thickness, t_{min}, shall be as specified in the applicable standard or specification for the component (see Figs. 2, 3, 5, and 6).

TABLE 1 DIMENSIONS OF WELDING ENDS
(See Figs. 1 to 6, Inclusive)

Nominal Pipe Size (DN)	Schedule No. [Note (1)]	O.D. at Welding Ends: Wrought or Fabricated Components, *A* [Note (1)]	O.D. at Welding Ends: Cast Steel Valves, *A* [Note (2)]	*B*	*C* [Note (3)]	*t*
65	40	73.0	75	62.5	62.93	5.16
	80	73.0	75	59	59.69	7.01
	160	73.0	75	54	55.28	9.53
	XXS	73.0	75	45	47.43	14.02
80	40	88.9	91	78	78.25	5.49
	80	88.9	91	73.5	74.53	7.62
	160	88.9	91	66.5	68.38	11.13
	XXS	88.9	91	58.5	61.19	15.24
90	40	101.6	105	90	90.52	5.74
	80	101.6	105	85.5	86.42	8.08
100	40	114.3	117	102	102.73	6.02
	80	114.3	117	97	98.28	8.56
	120	114.3	117	92	93.78	11.13
	160	114.3	117	87.5	89.65	13.49
	XXS	114.3	117	80	83.30	17.12
125	40	141.3	144	128	128.80	6.55
	80	141.3	144	122	123.58	9.53
	120	141.3	144	116	118.04	12.70
	160	141.3	144	109.5	112.47	15.88
	XXS	141.3	144	103	106.92	19.05
150	40	168.3	172	154	154.82	7.11
	80	168.3	172	146.5	148.06	10.97
	120	168.3	172	140	142.29	14.27
	160	168.3	172	132	135.31	18.26
	XXS	168.3	172	124.5	128.85	21.95
200	40	219.1	223	203	203.75	8.18
	60	219.1	223	198.5	200.02	10.31
	80	219.1	223	193.5	195.84	12.70
	100	219.1	223	189	191.65	15.09
	120	219.1	223	182.5	186.11	18.26
	140	219.1	223	178	181.98	20.62
	XXS	219.1	223	174.5	179.16	22.23
	160	219.1	223	173	177.79	23.01
250	40	273.0	278	254.5	255.74	9.27
	60	273.0	278	247.5	249.74	12.70
	80	273.0	278	243	245.55	15.09
	100	273.0	278	236.5	240.01	18.26
	120	273.0	278	230	234.44	21.44
	140	273.0	278	222	227.51	25.40
	160	273.0	278	216	221.95	28.58
300	STD	323.8	329	305	306.08	9.53
	40	323.8	329	303	304.72	10.31
	XS	323.8	329	298.5	300.54	12.70
	60	323.8	329	295	297.79	14.27

(Notes follow at end of table)

(Table 1 continues on next page)

TABLE 1 DIMENSIONS OF WELDING ENDS (CONT'D)
(See Figs. 1 to 6, Inclusive)

Nominal Pipe Size (DN)	Schedule No. [Note (1)]	O.D. at Welding Ends: Wrought or Fabricated Components, *A* [Note (1)]	O.D. at Welding Ends: Cast Steel Valves, *A* [Note (2)]	*B*	*C* [Note (3)]	*t*
300	80	323.8	329	289	292.17	17.48
	100	323.8	329	281	285.24	21.44
	120	323.8	329	273	278.31	25.40
	140	323.8	329	266.5	272.75	28.58
	160	323.8	329	257	264.45	33.32
350	STD	355.6	362	336.5	337.88	9.53
	40	355.6	362	333.5	335.08	11.13
	XS	355.6	362	330	332.34	12.70
	60	355.6	362	325.5	328.15	15.09
	80	355.6	362	317.5	321.22	19.05
	100	355.6	362	308	312.86	23.83
	120	355.6	362	300	305.93	27.79
	140	355.6	362	292	299.00	31.75
	160	355.6	362	284	292.07	35.71
400	STD	406.4	413	387.5	388.68	9.53
	40	406.4	413	381	383.14	12.70
	60	406.4	413	373	376.21	16.66
	80	406.4	413	363.5	367.84	21.44
	100	406.4	413	354	359.53	26.19
	120	406.4	413	344.5	351.18	30.96
	140	406.4	413	333.5	341.43	36.53
	160	406.4	413	325.5	334.50	40.49
450	STD	457.2	464	438	439.48	9.53
	XS	457.2	464	432	433.94	12.70
	40	457.2	464	428.5	431.19	14.27
	60	457.2	464	419	422.82	19.05
	80	457.2	464	409.5	414.46	23.83
	100	457.2	464	398.5	404.78	29.36
	120	457.2	464	387.5	395.03	34.93
	140	457.2	464	378	386.77	39.67
	160	457.2	464	366.5	376.99	45.24
500	STD	508.0	516	489	490.28	9.53
	XS	508.0	516	482.5	484.74	12.70
	40	508.0	516	478	480.55	15.09
	60	508.0	516	467	470.88	20.62
	80	508.0	516	455.5	461.13	26.19
	100	508.0	516	443	450.02	32.54
	120	508.0	516	432	440.29	38.10
	140	508.0	516	419	429.17	44.45
	160	508.0	516	408	419.44	50.01
550	STD	558.8	567	539	541.08	9.53
	XS	558.8	567	533	535.54	12.70
	60	558.8	567	514	518.86	22.23
	80	558.8	567	501	507.75	28.58

(Notes follow at end of table)

(Table 1 continues on next page)

TABLE 1 DIMENSIONS OF WELDING ENDS (CONT'D)
(See Figs. 1 to 6, Inclusive)

Nominal Pipe Size (DN)	Schedule No. [Note (1)]	O.D. at Welding Ends: Wrought or Fabricated Components, *A* [Note (1)]	O.D. at Welding Ends: Cast Steel Valves, *A* [Note (2)]	*B*	*C* [Note (3)]	*t*
550	100	558.8	567	488.5	496.63	34.93
	120	558.8	567	476	485.52	41.28
	140	558.8	567	463	474.41	47.63
	160	558.8	567	450.5	463.30	53.98
600	STD	609.6	619	590.5	591.88	9.53
	XS	609.6	619	584	586.34	12.70
	30	609.6	619	581	583.59	14.27
	40	609.6	619	574.5	577.97	17.48
	60	609.6	619	560.5	565.49	24.61
	80	609.6	619	547.5	554.38	30.96
	100	609.6	619	532	540.49	38.89
	120	609.6	619	517.5	528.03	46.02
	140	609.6	619	505	516.91	52.37
	160	609.6	619	490.5	504.37	59.54
650	10	660.4	670	645.5	645.50	7.92
	20	660.4	670	635	637.14	12.70
700	10	711.2	721	695.5	696.30	7.92
	20	711.2	721	686	687.94	12.70
	30	711.2	721	679.5	682.37	15.88
750	10	762.0	772	746	747.10	7.92
	20	762.0	772	736.5	738.74	12.70
	30	762.0	772	730	733.17	15.88
800	10	812.8	825	797	797.90	7.92
	20	812.8	825	787.5	789.54	12.70
	30	812.8	825	781	783.97	15.88
	40	812.8	825	778	781.17	17.48
850	10	863.6	876	848	848.70	7.92
	20	863.6	876	838	840.34	12.70
	30	863.6	876	832	834.77	15.88
	40	863.6	876	828.5	831.97	17.48
900	10	914.4	927	898.5	899.50	7.92
	20	914.4	927	889	891.14	12.70
	30	914.4	927	882.5	885.57	15.88
	40	914.4	927	876.5	880.02	19.05

GENERAL NOTES:
(a) Dimensions are in millimeters.
(b) See Section 5 for tolerances.

NOTES:
(1) Letter designations signify:
  (a) STD = standard wall thickness
  (b) XS = extra-strong wall thickness
  (c) XXS = double extra-strong wall thickness
(2) The diameters listed are not requirements. They are provided for the convenience of the user.
(3) Internal machining for continuous backing rings for sizes DN 50 and smaller is not contemplated. See para. 4.2 for *C* dimension for sizes not listed.

ANNEX A
INCH TABLE

(This Annex is an integral part of ASME B16.25 and is placed after the main text for convenience.)

This Annex provides a table of the standard inch dimensions for fittings.