

ASME B16.24-2006
(Revision of ASME B16.24-2001)

Cast Copper Alloy Pipe Flanges and Flanged Fittings

**Classes 150, 300, 600, 900,
1500, and 2500**

AN AMERICAN NATIONAL STANDARD



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**The American Society of
Mechanical Engineers**

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FOREWORD

The development of the first Bronze Flanged Standard began in 1910 to eliminate the confusion prevailing in the trade with respect to bronze flange dimensions and service ratings. The work culminated and was published in 1914 under the title "1914 Brass Standard Flange Dimensions" for 150-lb and 250-lb (now Class 150 and Class 250) steam pressures.

This was superseded in 1928 by the Manufacturers Standardization Society of Valves and Fittings Industry (MSS) "Standard Practice" SP-2, which contained changes to provide interchangeability with the American Cast-Iron Flange Standards for 125-lb (now Class 125) and Class 250 steam pressures. Subsequent revisions were issued in 1930 and 1936. In the latter, a new column of thickness for 300-lb (now Class 300) flanges was added.

In the 1937 edition, illustrations and dimensions of bronze-flanged fittings were added. This was edited and reprinted in 1943 to make it conform to the U.S. Department of Commerce, National Bureau of Standards, Simplified Practice Recommendation R-183-42 and to the War Production Board Limitation Order L-252, dated January 23, 1943.

In the 1946 edition, the pressure-temperature ratings were added for the Class 150 and Class 300 standards and the dimensions for that reference to the Class 250 standard were omitted. Limitation Order L-252 was cancelled on April 28, 1945. The period of government prohibition of manufacture and civilian use of the Class 250 standard (during the life of Order L-252) caused no hardship on the part of either the manufacturer or the consumer, indicating that this pressure class in bronze products does not warrant being recognized as a standard.

This Standard was reviewed and reaffirmed in 1949. In October 1951, MSS ceded it to Sectional Committee B16 on Pipe Flanges and Flanged Fittings for review and possible approval as an American Standard.

Following approval of the sectional committee and sponsor organizations, it was sent to the American Standards Association (ASA), now the American National Standards Institute (ANSI), for approval and designation as an American Standard. This was granted on February 27, 1953.

In 1961, following the organization of Subcommittee No. 11 (now Subcommittee J), the 1953 edition was revised. Chief among the changes recommended was the deletion of reference to brass. This resulted from an action of ASTM redefining the alloys that could properly be called bronze. Several other changes that brought the standard up to date were also approved by the B16 Committee, with approval designation as an American Standard being granted on July 20, 1962.

Subcommittee J, in keeping with regulations of ANSI, reviewed the standard in 1969. Only minor changes were made. Among these were the presentation of pressure-temperature ratings in tabular form, and the gasket-retaining grooves being made permissible rather than recommended. Final approval of the changes was granted by ANSI on January 27, 1971.

A revision was undertaken in 1977 and several changes were proposed. Foremost among these was the addition of metric equivalents and the elimination of the optional gasket-retaining grooves. In addition, the standard was extensively revised editorially. Following approvals by Subcommittee J and the Standards Committee, ANSI granted its approval on June 26, 1979.

In 1982, the American National Standard Committee B16 was reorganized as an ASME Committee, operating under procedures accredited by ANSI.

In 1991, the scope of the standard was changed from bronze pipe flanges and fittings to cast copper alloy flanges and flanged fittings, and it was expanded to include class designations 150, 300, 600, 900, 1500, and 2500. The 1991 edition also established U.S. Customary units as the standard and editorial revisions were made to improve the text. Following approval by the Standards Committee and ASME, this edition of the standard was approved as an American National Standard by ANSI on February 1, 1991, with the new designation ASME B16.24-1991 and the new title "Cast Copper Alloy Pipe Flanges and Flanged Fittings."

In 2001, the standard was revised to include Nonmandatory Appendix A, Quality System Program. Editorial revisions were made for clarification. Following approval by the B16 Standards

Committee and the ASME Supervisory Board, this Standard was approved as an American National Standard by ANSI on October 24, 2001.

This edition includes metric units as the primary reference units while maintaining U.S. Customary units in either parenthetical or separate forms. Requirements for Class 400 flanges have been omitted from this Standard. In addition, several editorial revisions have been made for clarity. Following approval by the Standards Committee and the ASME Board, ASME B16.24-2006, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500 was approved as an American National Standard by ANSI on November 9, 2006.

Requests for interpretations or suggestions for revisions should be sent to the Secretary, B16 Committee, The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

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Standardization of Valves, Flanges, Fittings, and Gaskets

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B16 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to: SecretaryB16@asme.org.

Proposing Revisions. Revisions are made periodically to the standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Interpretations. Upon request, the B16 Committee will render an interpretation of any requirement of the standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B16 Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings, which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

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CAST COPPER ALLOY PIPE FLANGES AND FLANGED FITTINGS

CLASSES 150, 300, 600, 900, 1500, AND 2500

1 SCOPE

1.1 General

This Standard covers cast copper alloy threaded-joint pipe flanges and blind pipe flanges having rating class designations 150, 300, 600, 900, 1500, and 2500. This Standard also covers flanged fittings having rating class designations 150 and 300. It establishes requirements for

- (a) pressure–temperature ratings
- (b) size and method of designating openings for reduced fittings
- (c) markings
- (d) materials
- (e) dimensions
- (f) bolting and gaskets
- (g) tolerances
- (h) tests

This Standard also provides dimensional requirements for flanged ends of valves conforming to MSS SP-80.

1.2 Convention

For the purpose of determining conformance with this Standard, the convention for fixing significant digits where limits (maximum and minimum values) are specified shall be rounded off as defined in ASTM 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.

1.3 Relevant Units

This Standard states values in both SI (metric) and U.S. Customary units. As an exception, diameters of bolts and flange bolt holes are expressed in Customary units only. These systems of units are to be regarded separately as the standard. Within the text, the Customary units are shown in parentheses or in separate tables. (Tables showing dimensions in equivalent Customary units are found in Mandatory Appendix I.) The values stated in each system are not exact equivalents; therefore, it is required that each system of units be used independently of the other. Except for the diameter of bolts and flange bolt holes, combining values from the two systems constitutes nonconformance with the standard.

1.4 References

Codes, standards, and specifications, containing provisions to the extent referenced herein, constitute requirements of this Standard. These reference documents are listed in Mandatory Appendix II.

1.5 Quality Systems

Guidelines relating to the product manufacturer's quality system programs are described in Nonmandatory Appendix A.

1.6 Service Conditions

Criteria for selection of material suitable for particular fluid service are not within the scope of this Standard.

1.7 User Accountability

This Standard cites duties and responsibilities that are to be assumed by the flange or flange fitting user in the following areas:

- (a) application
- (b) installation
- (c) system hydrostatic testing
- (d) operation
- (e) material selection

1.8 Time of Purchase, Manufacture, or Installation

The pressure–temperature ratings in this Standard are applicable upon its publication to all flanges and flanged fittings within its scope that otherwise meet its requirements. For unused flanges or flanged fittings maintained in inventory, the manufacturer of the flanges or flanged fittings may certify conformance to this edition, provided that it can be demonstrated that all requirements of this edition have been met. Where such components were installed in accordance with the pressure–temperature ratings of an earlier edition of this Standard, those ratings are applicable except as may be governed by the applicable code or regulation.

1.9 Denotation

1.9.1 Pressure Rating Designation. Class, followed by a dimensionless number, is the designation for pressure–temperature ratings as follows: Classes 150, 300, 600, 900, 1500, and 2500.

Table 1 Pressure–Temperature Ratings for ASTM B 61 Alloy C92200 and ASTM B 62 Alloy C83600

Service Temperature, °C	Working Pressure, bar			
	Class 150		Class 300	
	ASTM B 62 C83600	ASTM B 61 C92200	ASTM B 62 C83600	ASTM B 61 C92200
–29 to 66	15.5	15.5	34.5	34.5
100	14.3	14.6	31.4	32.4
125	13.4	14.1	29.1	30.9
150	12.4	13.4	26.8	29.3
175	11.4	12.4	24.3	27.6
200	...	11.9	...	26.1
208 [Note (1)]	10.3	...	21.4	...
225	...	11.5	...	24.6
232	9.3	...	19.3	...
250	...	10.5	...	23.0
275	...	10.0	...	21.6
289	...	9.7	...	20.7
Test Pressure	24.1	24.1	51.7	51.7

GENERAL NOTE: 1 bar = 100 kPa.

NOTE:

- (1) Some codes (e.g., ASME Boiler and Pressure Vessel Code, Section I; ASME B31.1; and ASME B31.5) limit the rating temperature of the indicated material to 208°C (406°F).

1.9.2 Size. NPS, followed by a dimensionless number, is the designation for nominal fittings size. NPS is related to the reference nominal diameter (DN) used in international standards. The relationship is typically as follows:

NPS	DN
½	15
¾	20
1	25
1¼	32
1½	40
2	50
2½	65
3	80
4	100

GENERAL NOTE: For NPS ≥ 4, the related DN = 25 × (NPS).

2 PRESSURE–TEMPERATURE RATINGS

2.1 General

(a) For flanges and flanged fittings, the tabulated pressure–temperature ratings of Table 1 (Table I-1) shall apply for the materials listed in paras. 5.2.1, 5.2.2, 5.3.1, and 5.3.2, provided that the dimensional requirements of Tables 2 through 5 (Tables I-2 through I-5) are met.

(b) For flanges only, the tabulated pressure–temperature ratings of Table 6 (Table I-6) shall apply for the material listed in para. 5.2.3, provided that the dimensional requirements of ASME B16.5 are met.

(c) Pressure ratings at temperatures intermediate to those tabulated may be obtained by linear interpolation.

(d) Linear interpolation of pressure ratings between class designations is not permitted.

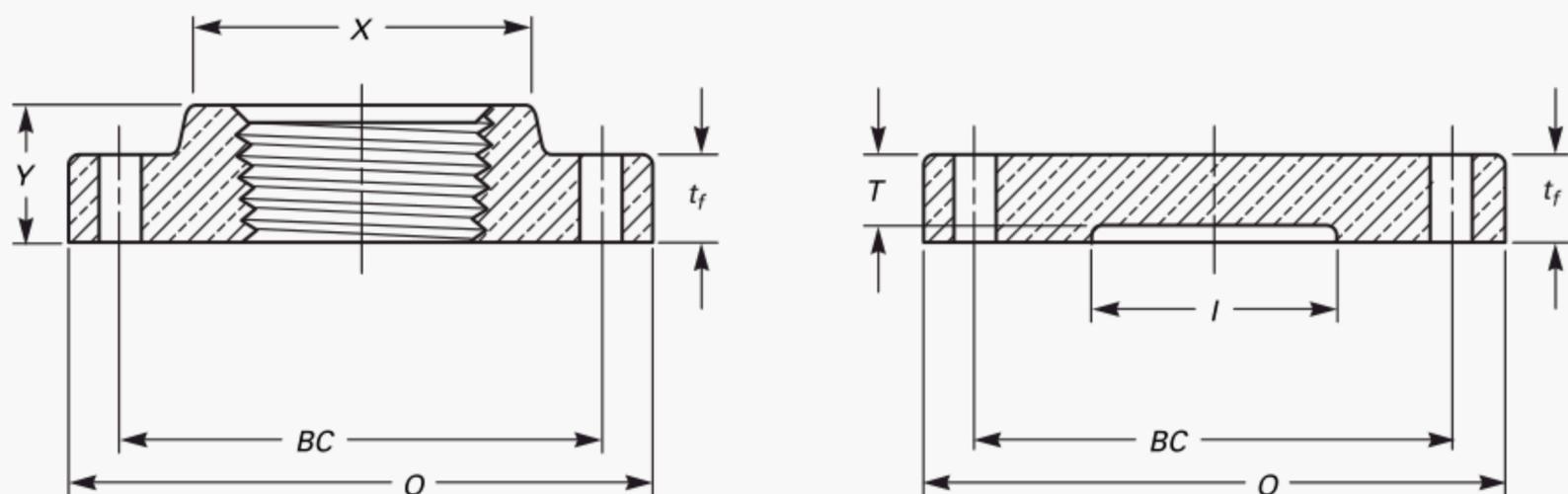
2.2 Flanged Joints

A flanged joint is composed of separate and independent, although interrelated, components. The flanges, the gasket, and the bolting are assembled by another influence — the assembler. Proper controls must be exercised in the selection and application for all these elements to attain a joint that has acceptable leak tightness. Special techniques (e.g., controlled bolt tightening) are described in ASME PCC-1.

2.3 Ratings of Flanged Joints

Ratings in this Standard apply to flanged joints that conform to the requirements on bolting in paras. 5.4 and 8.1, on gaskets in paras. 5.5 and 8.2, and flanged joints that are made up in accordance with good practice for alignment and assembly. Use of the ratings for flanged joints not conforming to these requirements is the sole responsibility of the user. Requirements for alignment and assembly of joints and consideration of leakage due to forces and moments developed in the connected piping or equipment are not covered in this Standard. If the two flanges in a flanged joint do not have the same pressure–temperature ratings, the rating of the joint at any temperature is the lower of the two flange ratings at that temperature.

Table 2 Dimensions of Class 150 Threaded Companion and Blind Flanges for Alloys C83600 and C92200



NPS	Diameter of Flange, O	Minimum Thickness of Flange, t_f [Note (1)]	Bolt Circle, BC	Number of Bolts [Note (2)]	Nominal Bolt Size (Inch)	Nominal Diameter of Bolt Hole (Inch)	Minimum Diameter of Hub, X	Minimum Length Overall, Y	Maximum Diameter of Counter-bore, l	Minimum Thickness at Recess, T
1/2	90	7.9	60.3	4	1/2	5/8	30	15	13	6.4
3/4	100	8.6	69.9	4	1/2	5/8	38	16	19	7.1
1	110	9.7	79.4	4	1/2	5/8	49	17	25	7.9
1 1/4	115	10.4	88.9	4	1/2	5/8	59	21	32	8.6
1 1/2	125	11.2	98.4	4	1/2	5/8	65	22	38	9.6
2	150	12.7	120.7	4	5/8	3/4	78	25	51	11.2
2 1/2	180	14.2	139.7	4	5/8	3/4	90	29	64	12.7
3	190	15.7	152.4	4	5/8	3/4	108	30	76	14.2
3 1/2	215	17.5	177.8	8	5/8	3/4	122	32	89	15.7
4	230	17.5	190.5	8	5/8	3/4	135	33	102	15.7
5	255	19.1	215.9	8	3/4	7/8	164	37	127	17.5
6	280	20.6	241.3	8	3/4	7/8	192	40	152	19.1
8	345	23.9	298.5	8	3/4	7/8	246	44	203	22.4
10	405	25.4	362.0	12	7/8	1	305	49	254	23.9
12	485	26.9	431.8	12	7/8	1	365	56	305	25.4

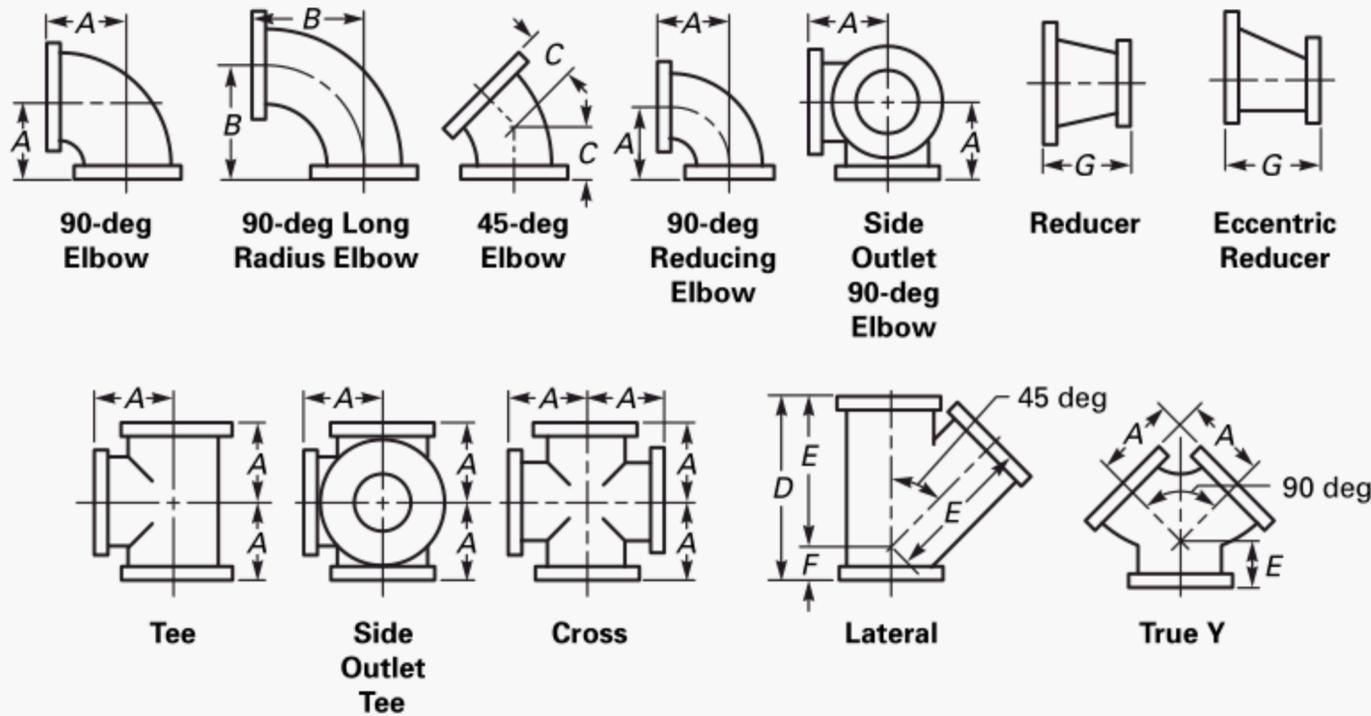
GENERAL NOTES:

- (a) Dimensions are in millimeters.
 (b) For flange facing, see para. 6.2.
 (c) Flange diameters and drilling templates correspond to those prescribed in ASME B16.1, B16.5, and B16.42.

NOTES:

- (1) For flange spot facing and thickness, see para. 6.9.
 (2) For flanges integral with fittings or valves, see para. 6.8.

Table 3 Dimensions of Class 150 Elbows, Tees, Crosses, Laterals, True Ys (Straight Sizes), and Reducers



NPS	Center-to-Face, A [Notes (1)–(7)]	Face-to-Face, A+A	Center-to-Face, B [Note (1)]	Center-to-Face, C [Note (1)]	Face-to-Face, D [Notes (4), (5)]	Center-to-Face, E [Notes (4), (5)]	Center-to-Face, F [Notes (4), (5)]	Face-to-Face, G [Note (8)]	Wall Thickness, t [Note (9)]	Minimum Port Diameter, l
1/2	76	152	...	41	...	...	...	...	2.3	13
3/4	83	166	...	45	...	...	...	...	2.8	19
1	89	178	127	45	191	146	45	...	3.0	25
1 1/4	95	190	140	51	204	159	45	...	3.6	32
1 1/2	102	204	152	57	229	178	51	...	4.1	38
2	114	228	165	64	267	203	64	127	4.8	51
2 1/2	127	254	178	76	305	241	64	140	5.1	64
3	140	280	197	76	330	254	76	152	5.6	76
3 1/2	152	304	216	89	368	292	76	165	6.4	89
4	165	330	229	102	381	305	76	178	6.8	102
5	191	380	260	114	432	343	89	203	7.6	127
6	203	406	292	127	457	368	89	229	8.4	152
8	229	458	356	140	559	445	114	279	10.4	203
10	279	558	419	165	648	521	127	305	12.2	254
12	305	610	483	191	762	622	140	356	14.2	305

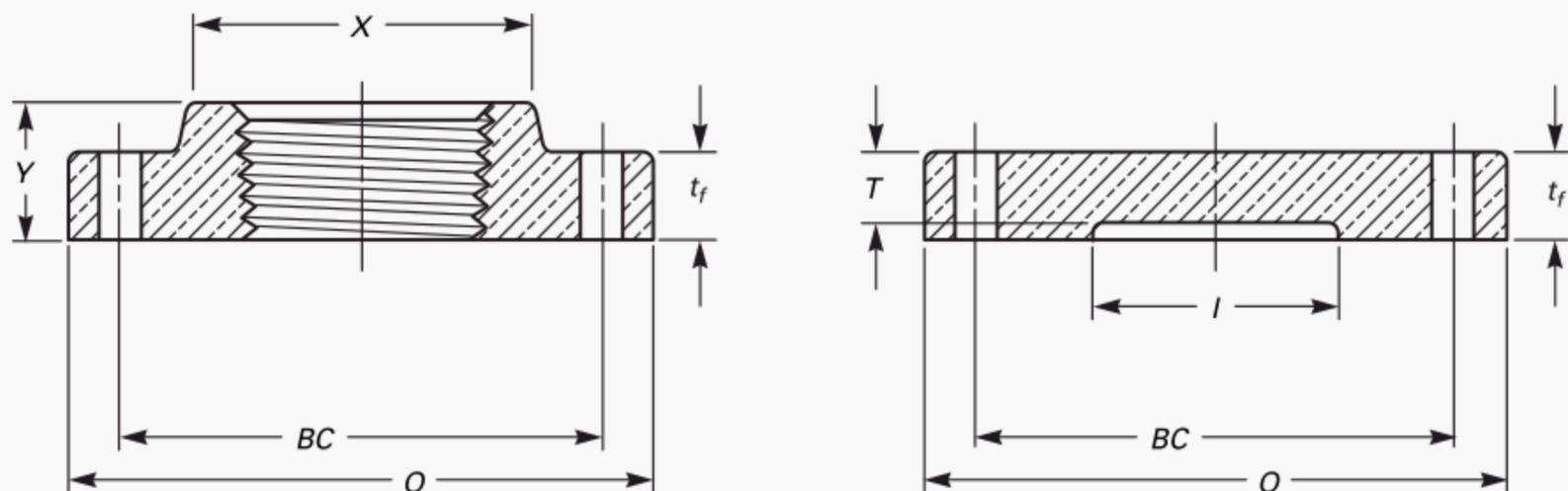
GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For flange and bolt hole dimensions, see Table 2 and para. 6.8.
- (c) For center-to-face tolerance, see para. 9.2.

NOTES:

- (1) For intersecting centerlines of side outlet fittings, see para. 7.1.1.
- (2) For center-to-face dimensions of reducing elbows, see para. 7.1.2(b).
- (3) For center-to-face dimensions of special degree elbows, see para. 7.1.2(c).
- (4) For reinforcements of crosses and laterals, see para. 7.2.
- (5) For center-to-face dimensions of reducing tees, crosses, and laterals, see para 7.1.3(a).
- (6) For center-to-face dimensions of tees reducing on both runs, see para 7.1.3(b).
- (7) For center-to-face dimensions of reducing side outlet tees having two different size reductions on the outlets, see para. 7.1.3(a).
- (8) For face-to-face dimensions of reducers and eccentric reducers, see para. 7.1.5.
- (9) For wall thickness tolerance, see para. 9.1.

Table 4 Dimensions of Class 300 Threaded Companion and Blind Flanges for Alloys C83600 and C92200



NPS	Diameter of Flange, O	Minimum Thickness of Flange, t_f [Note (1)]	Bolt Circle, BC	Number of Bolts [Note (2)]	Nominal Bolt Size (Inch)	Nominal Diameter of Bolt Hole (Inch)	Minimum Diameter of Hub, X	Minimum Length Overall, Y	Maximum Diameter of Counter-bore, I	Minimum Thickness at Recess, T
1/2	95	12.7	66.7	4	1/2	5/8	30	15	13	11.2
3/4	115	13.5	82.6	4	5/8	3/4	38	16	19	11.9
1	125	15.0	88.9	4	5/8	3/4	49	18	25	13.5
1 1/4	135	15.7	98.4	4	5/8	3/4	59	21	32	14.2
1 1/2	155	17.5	114.3	4	3/4	7/8	65	22	38	15.7
2	165	19.1	127.0	8	5/8	3/4	78	25	51	17.5
2 1/2	190	20.6	149.2	8	3/4	7/8	90	28	64	19.1
3	210	23.1	168.3	8	3/4	7/8	108	30	76	21.3
3 1/2	230	24.6	184.2	8	3/4	7/8	122	32	89	23.1
4	255	26.9	200.0	8	3/4	7/8	135	33	102	25.4
5	280	28.4	235.0	8	3/4	7/8	164	37	127	26.9
6	320	30.2	269.9	12	3/4	7/8	192	40	152	28.4
8	380	35.1	330.2	12	7/8	1	246	44	203	33.3

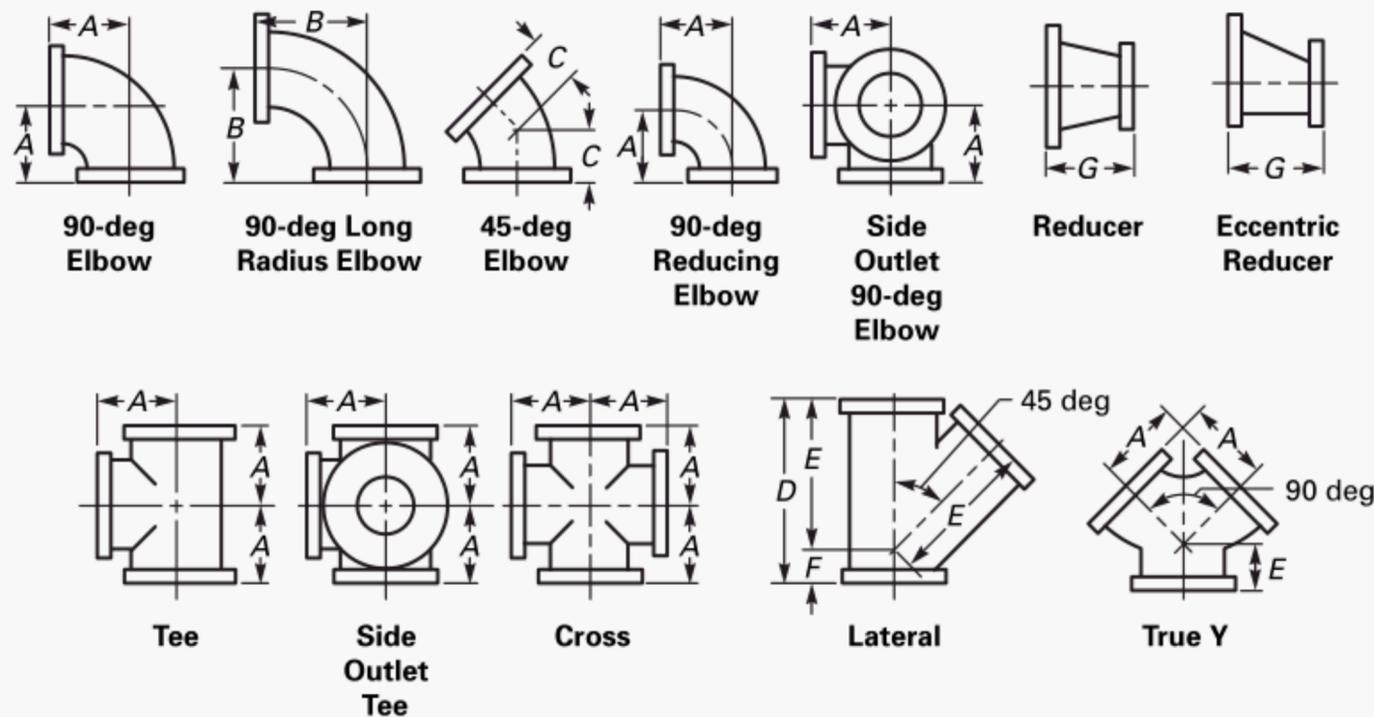
GENERAL NOTES:

- (a) Dimensions are in millimeters.
 (b) For flange facing, see para. 6.2.
 (c) For flanges integral with fittings or valves, see para. 6.8.

NOTES:

- (1) Flange diameters and drilling templates correspond to those prescribed in ASME B16.1, B16.5, and B16.42.
 (2) For flange spot facing and thickness, see para. 6.9.

Table 5 Dimensions of Class 300 Elbows, Tees, Crosses, Laterals, True Ys (Straight Sizes), and Reducers



NPS	Center-to-Face, A [Notes (1)–(7)]	Face-to-Face, A+A	Center-to-Face, B [Note (1)]	Center-to-Face, C [Note (1)]	Face-to-Face, D [Notes (4), (5)]	Center-to-Face, E [Notes (4), (5)]	Center-to-Face, F [Notes (4), (5)]	Face-to-Face, G [Note (8)]	Wall Thickness, t [Note (9)]	Minimum Port Diameter, l
1/2	76	152	...	44	...	...	...	...	3.0	13
3/4	89	178	...	57	...	...	...	...	4.1	19
1	102	204	127	57	216	165	51	...	4.3	25
1 1/4	108	216	140	64	241	184	57	...	4.8	32
1 1/2	114	228	152	70	280	216	64	...	5.1	38
2	127	254	165	76	293	229	64	127	6.4	51
2 1/2	140	280	178	89	331	267	64	140	7.1	64
3	152	304	197	89	355	279	76	152	8.4	76
3 1/2	165	330	216	102	394	318	76	165	9.1	89
4	178	356	229	114	419	343	76	178	10.4	102
5	203	406	260	127	470	381	89	203	12.2	127
6	216	432	292	104	547	445	102	229	14.2	152
8	254	508	356	152	648	521	127	279	18.3	203

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For flange and bolt hole dimensions, see Table 4 and para. 6.8.
- (c) For center-to-face tolerance, see para. 9.2.

NOTES:

- (1) For intersecting centerlines of side outlet fittings, see para 7.1.1.
- (2) For center-to-face dimensions of reducing elbows, see para. 7.1.2(b).
- (3) For center-to-face dimensions of special degree elbows, see para. 7.1.2(c).
- (4) For reinforcement of crosses and laterals, see para. 7.2.
- (5) For center-to-face dimensions of reducing tees, crosses, and laterals, see para. 7.1.3(a).
- (6) For center-to-face dimensions of tees reducing on both runs, see para. 7.1.3(b).
- (7) For center-to-face dimensions on reducing side outlet tees having two different size reductions on the outlets, see para. 7.1.3(a).
- (8) For face-to-face dimensions of reducers and eccentric reducers, see para. 7.1.5.
- (9) For wall thickness tolerance, see para. 9.1.

Table 6 Pressure–Temperature Ratings for ASTM B 148 Alloy C95200

Service Temperature, °C	Working Pressure, bar					
	Class 150	Class 300	Class 600	Class 900	Class 1500	Class 2500
–29 to 38	13.4	35.6	71.1	106.6	177.6	295.8
50	12.5	33.0	65.7	98.7	164.4	273.9
100	10.5	27.4	54.7	82.2	136.9	228.0
125	9.9	26.3	52.8	78.9	131.7	219.5
150	9.7	25.5	51.0	76.5	127.5	212.6
175	9.7	25.2	50.7	75.8	126.6	211.0
200	9.7	25.2	50.1	75.3	125.6	209.3
225	9.7	24.9	50.0	74.9	124.7	207.9
250	9.7	24.9	49.7	74.5	124.2	207.0
260	9.7	24.9	49.7	74.5	124.2	206.9
Test Pressure	20.7	53.5	106.9	160.4	267.2	444.8

2.4 Rating Temperature

The temperature shown for a corresponding pressure rating is the temperature of the pressure-containing shell of the flange or flanged fitting. In general, this temperature is the same as that of the contained fluid. Use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user, subject to the applicable code or regulation. For any temperature below -29°C (-20°F), the rating shall be no greater than the rating for -29°C (-20°F). See para. 5.4.1 for temperature limitations on use of ASTM A 307 bolting.

2.5 Low-Temperature Service

It is the responsibility of the user to verify that all of the component materials (i.e., flange, bolting, and gasket, etc.) selected are acceptable for use in temperature applications below -29°C (-20°F). When permitted, copper alloy flanges and flanged fittings manufactured in accordance with this Standard, assembled with suitable bolting and gaskets, and subject to the applicable code or regulations, shall not be used at temperatures below -198°C (-325°F).

2.6 System Hydrostatic Test

Flanged joints and flanged fittings may be subjected to system hydrostatic tests at pressures not to exceed 1.5 times the tabulated working pressure at 38°C (100°F). System testing at higher pressures is the responsibility of the user, subject to the requirements of the applicable code or regulations.

3 SIZE AND METHOD OF DESIGNATING OPENINGS

3.1 Flanges or Fittings

The size of a flange or fitting is identified by the corresponding NPS.

3.2 Reducing Fittings

Reducing fittings shall be designated by the size of the openings in their proper sequence as indicated in Fig. 1.

4 MARKING

4.1 General

Except as modified herein, flanges and flanged fittings shall be marked as required in MSS SP-25.

4.1.1 Name. The manufacturer's name or trademark shall be applied.

4.1.2 Material. All flanges and flanged fittings shall be marked with the material's applicable ASTM designation (e.g., B 61, B 62, and B 148). In addition, the grade identification symbol "952" is required for flanges cast to ASTM B 148.¹

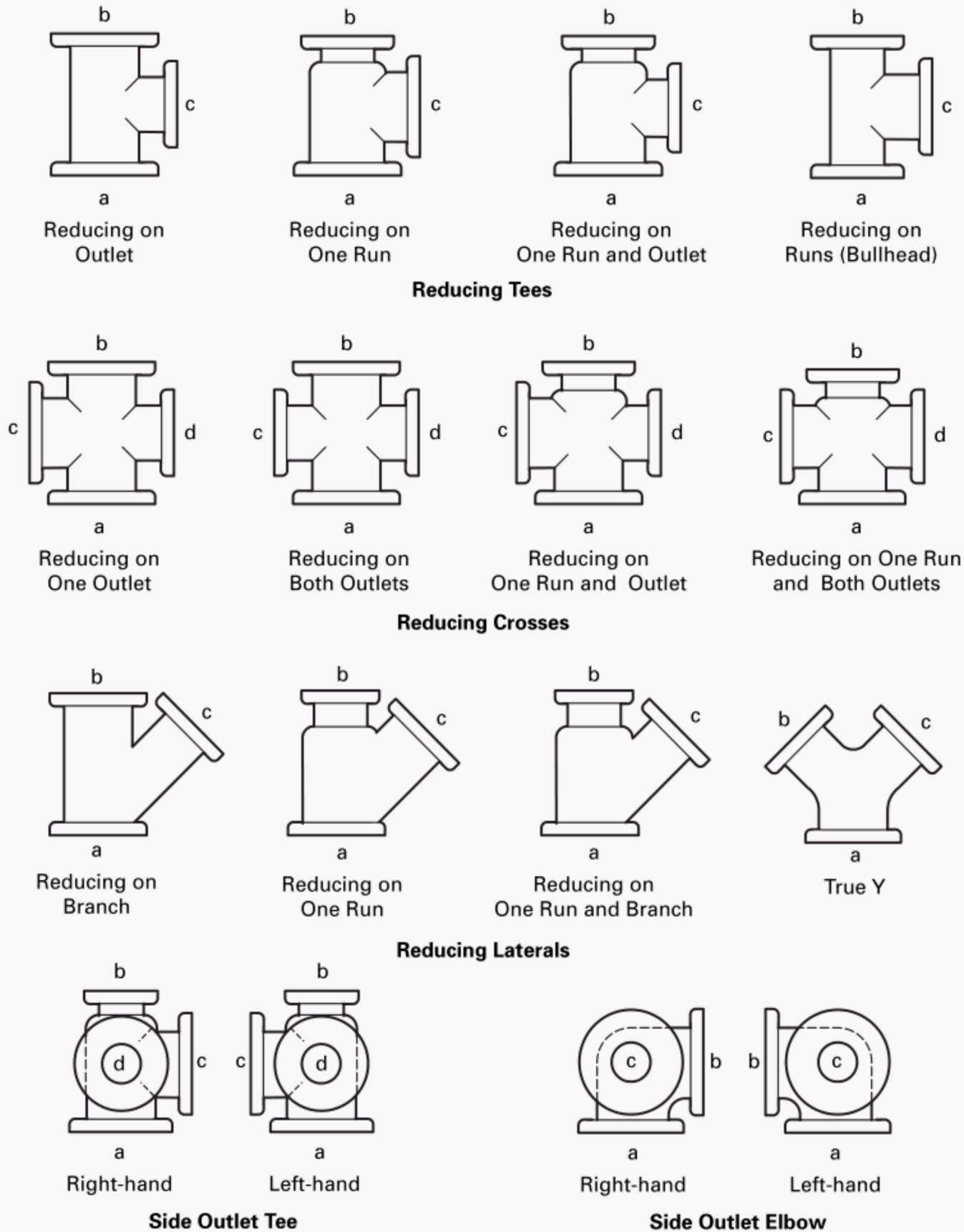
4.1.3 Rating Designation. The flange or flanged fitting shall be marked with the number that corresponds to its pressure rating class designation (i.e., 150, 300, 600, 900, 1500, or 2500).

4.1.4 Conformance. The designation B16 or B16.24 shall be applied to the flange or flanged fitting, preferably located adjacent to the class designation, to include conformance to this Standard. The use of the prefix ASME is optional.

4.1.5 Size. The NPS designation shall be marked on flanges and flanged fittings. Reducing flanges and reducing flanged fittings shall be marked with the applicable NPS designations as required by paras. 3.1 and 3.2.

¹ Unless otherwise stated, tolerances are equal, plus, and minus.

Fig. 1 Method of Designating Outlets of Reducing Fittings



GENERAL NOTES:

- (a) In designating the openings of reducing fittings, they should be read in the order indicated by the sequence of the letters "a," "b," "c," and "d." In designating the outlets of side outlet reducing fittings, the side outlet is named last and in the case of the cross which is not shown, the side outlet is designated by the letter "e."
- (b) The largest opening establishes the basic size of a reducing fitting. The largest opening is named first, except for bullhead tees, which are reducing on both runs, and for double branch elbows where both branches are reducing, the outlet is the largest opening and named last in both cases. (Double branch elbows are not included in this Standard.)

5 MATERIALS

5.1 General

Products covered by this Standard shall be made of castings produced to the requirements of para. 5.2 or 5.3.

5.2 Flanges

Flanges shall be in accordance with the material requirements specified in paras. 5.2.1 through 5.2.3.

5.2.1 ASTM B 61. Castings shall meet the requirements of ASTM B 61 alloy UNS C92200.

5.2.2 ASTM B 62. Castings shall meet the requirements of ASTM B 62 alloy UNS C83600.

5.2.3 ASTM B 148. Castings shall meet the requirements of ASTM B 148 alloy UNS C95200, and the additional requirements specified in paras. 5.2.3.1 through 5.2.3.5.

5.2.3.1 Ordering Information. Ordering information for ASTM B 148 castings shall include tests on each lot and the form of the test bar.

5.2.3.2 Test Bars. For ASTM B 148 castings, a minimum of three test bars shall be poured from each lot of cast metal. Chemical composition and mechanical property tests shall be performed using the test bars from each lot.

5.2.3.3 Sampling. For ASTM B 148 castings, the sample for chemical analysis shall be taken from the test bar casting or other casting sample in such a manner as to be representative of each casting lot.

5.2.3.4 Weld Repair Approval. For ASTM B 148 castings, a flange casting shall not be repaired, plugged, welded, or burned-in unless permission from the user of the flange has been previously secured. This will be requested of the user upon the manufacturer's determination that casting defects are such that after the approved repair, the usefulness and the strength of the casting will not be impaired.

5.2.3.5 Weld Repair. For ASTM B 148 castings, preparation for repair welding shall include inspection to ensure complete removal of the defect. Repairs shall be made utilizing welding procedures qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Repair welding shall be done by welders or welding operators meeting the qualification requirements of that Code.

5.3 Flanged Fittings

Material for flanged fittings shall be in accordance with either para. 5.2.1 or 5.2.2.

5.4 Bolting

Bolting materials recommended for use with copper alloy flanges and flanged fittings are described in paras. 5.4.1 and 5.4.2.

5.4.1 Steel Bolting. Carbon steel bolting conforming to ASTM A 307 is not recommended to be used below -29°C (-20°F) nor above 204°C (400°F) and is limited to use with Classes 150 and 300 flanges and flanged fittings.

5.4.2 Nonferrous Boltings. The following nonferrous bolting materials are recommended for Classes 150 and 300 flanges and flanged fittings within the temperature limitation stated. Other bolting materials that have a specified minimum yield strength of at least a 206 MPa (30 ksi) may be used when permitted by the applicable code or regulation.

ASTM Spec.	Alloy UNS No.	Condition	Notes
B 98	C65100	Half hard	(1)
	C65500	Half hard	(1)
	C66100	Half hard	(1)
B 150	C61400	...	(2)
	C63000	...	(2)
	C64200	...	(2)
B 164	N04400	Hot finish	
	N04400	Cold drawn	(2)
	N04400	Cold drawn, stress relieved	(2)
	N04400	Cold drawn, stress equalized	(2)
	N04405	Hot finish	
	N04405	Cold drawn	(2)

NOTES:

(1) Maximum operating temperature is 177°C (350°F).

(2) Maximum operating temperature is 288°C (550°F).

5.5 Gaskets

Materials for gaskets are described in ASME B16.5. The user is responsible for selection of gasket materials that will withstand the expected bolt loading without injurious crushing and that are suitable for the service conditions. Particular attention needs to be given to gasket selection if a hydrostatic test approaches or exceeds the test pressure specified in para. 2.6.

5.6 Materials Selection

Criteria for the selection of materials are not within the scope of this Standard. The possibility of material deterioration in service should be considered by the user. A discussion of precautionary considerations can be found in Appendix F of ASME B31.3.

6 FLANGE DIMENSIONS

6.1 General

Flange dimensions are dependent upon the flange casting material.

6.1.1 ASTM B 61 and B 62. For castings made of ASTM B 61 alloy UNS C92200 or ASTM B 62 alloy UNS C83600, the flange dimensions shall be in accordance with Tables 2 and 4 (Tables I-2 and I-4) with alternative facings as permitted in para. 6.2.

6.1.2 ASTM B 148. For castings made of ASTM B 148 alloy C95200, the flange dimensions shall be in accordance with the dimensional requirements of ASME B16.5.

6.2 End-Flange Facings

Unless otherwise specified by the purchaser, Classes 150 and 300 blind and companion flanges shall be furnished with a flat face. Unless otherwise specified by the purchaser, Classes 600 and higher companion flanges shall be furnished with a 7-mm (0.25-in.) raised face, with the exception of the small male face (on end of pipe) and the small female face (on end of pipe). When using straight pipe threads, any of the flange pipe threads shown in ASME B16.5 may be used with copper alloy flanges. When flanges of ASTM B 61 or B 62 are furnished with one of the alternative ASME B16.5 facings, any required raised-face dimension shall be in addition to the basic flange thickness C of Tables 2 and 4 (Tables I-2 and I-4).

6.3 Threaded Flanges

Threaded flanges shall have a taper pipe thread in accordance with ASME B1.20.1. Variations in alignment of the thread with the axis of the flange shall not exceed 5 mm/m (0.06 in./ft) (0.5%).

6.4 Thread Chamfer

All flanges of ASTM B 61 and B 62 materials shall be made without a counterbore. The threads shall be chamfered approximately to the major diameter of the thread at the pipe end of the flange at an angle approximately 45 deg with the axis of the thread. The chamfer shall be concentric with the thread and shall be included in the measurement of the thread length.

6.5 Thread Length

The length of the thread shall include the chamfer.

6.6 Thread Gaging

The gaging notch of the thread gage shall come flush with the bottom of the chamfer in all threaded flanges, and shall be considered the intersection of the chamfer cone and the pitch cone of the thread. This depth of chamfer is approximately equal to one-half the pitch of the thread. The maximum allowable thread variation is one turn large or small from the gaging notch.

6.7 Threaded Flange Assembly

External pipe threads used with higher pressure flanges shall be longer than normal to bring the end of the pipe close to the face of the flange when parts are assembled by power equipment. The additional length and number of turns are shown in Annex A of ASME B16.5 for ASME B1.20.1 threads.

6.8 Flanged Bolt Holes

Bolt holes are in multiples of four. Bolt holes shall be equally spaced and pairs of bolt holes shall straddle fitting or valve centerlines.

6.9 Spot and Back Facing

Flanges and flanged fittings covered by this Standard shall have bearing surfaces for bolting that shall be parallel to the flange face within 1 deg. Any spot or back facing shall not reduce the flange thickness C below the dimension required by para. 6.1. The spot facing diameter shall be in accordance with MSS-SP-9. When cutting into the hub of flanges or flanged fittings with back facing tools, the intersection shall have a radius of not less than 1.5 mm (0.06 in.).

7 FITTING DIMENSIONS

7.1 Center-to-Face Dimensions

7.1.1 Side Outlet Fittings. Side outlet elbows and side outlet tees shall have all openings on intersecting centerlines.

7.1.2 Elbows

(a) The center-to-face dimensions for straight size 90-deg elbows, 90-deg-long radius elbows, 45-deg elbows, and side outlet 90-deg elbows are shown in Tables 3 and 5 (Tables I-3 and I-5).

(b) Reducing 90-deg elbows and reducing side outlet 90-deg elbows shall have the same center-to-face dimensions as straight size fittings shown in Tables 3 and 5 (Tables I-3 and I-5), corresponding to the size of the largest opening.

(c) Special degree elbows ranging from 1 deg to 45 deg, inclusively, shall have the same center-to-face dimensions given for 45-deg elbows and those over 45 deg and up to 90 deg, inclusively, shall have the same center-to-face dimensions given for 90-deg elbows. The angle designation of an elbow is its deflection from straight line flow and is the angle between the flange faces.

7.1.3 Tees, Crosses, and Laterals

(a) The center-to-face dimensions for straight size tees, with or without side outlet, crosses, and laterals are shown in Tables 3 and 5 (Tables I-3 and I-5).

(b) Reducing tees, with or without side outlet, reducing crosses, and reducing laterals shall have the same center-to-face dimensions as straight size fittings shown in Tables 3 and 5 (Tables I-3 and I-5), corresponding to the size of the largest opening. Tees, crosses, and laterals, reducing on the run only, shall have the same center-to-face dimensions as straight size fittings shown in Tables 3 and 5 (Tables I-3 and I-5), corresponding to the size of the largest opening.

(c) Tees reducing on both runs are generally known as bullhead tees and have the same center-to-face dimensions as straight size fittings corresponding to the size of the outlet.

7.1.4 True Ys. Center-to-face dimensions for straight size true Ys are shown in Tables 3 and 5 (Tables I-3 and I-5). Reducing sizes are considered special and should be made to suit conditions.

7.1.5 Reducers and Eccentric Reducers. The face-to-face dimensions for all combinations of reducers and eccentric reducers shall be the same as given in Tables 3 and 5 (Tables I-3 and I-5) for the larger opening.

7.1.6 Interchangeability. Class 150 flanged fittings in NPS 1 and larger sizes have a bolting pattern that is dimensionally interchangeable with ASME B16.1, Class 125 Cast Iron Flanged Fittings; ASME B16.5, Class 150 Steel Flanged Fittings; and ASME B16.42, Class 150 Ductile Iron Flanged Fittings. Class 300 flanged fittings in NPS 1 and larger have a bolting pattern that is dimensionally interchangeable with ASME B16.1, Class 250 Cast Iron Flanged Fittings; ASME B16.5, Class 300 Steel Flanged Fittings; and ASME B16.42, Class 300 Ductile Iron Flanged Fittings.

7.2 Wall Thickness

For inspection purposes, the minimum wall thickness t , of flanged fittings at the time of manufacture, shall be as shown in Tables 3 and 5 (Tables I-3 and I-5), except as provided in para. 9.1. Additional metal thickness needed to withstand assembly stresses, shapes other than circular, and stress concentrations shall be determined by the manufacturer. In particular, 45-deg laterals, true Ys, and crosses may require additional reinforcement to compensate for inherent weaknesses in these shapes.

8 BOLTING AND GASKETS

8.1 Bolting

For carbon steel and nonferrous bolts smaller than $\frac{3}{4}$ in., ASME B18.2.1, Square Heads; ASME B18.2.1, Heavy Hex Heads; or ASME B18.2.2, Heavy Hex Nuts are recommended. For carbon steel and nonferrous bolts $\frac{3}{4}$ in. and larger, ASME B18.2.1, Standard Heads; ASME B18.2.1, Hex Heads; ASME B18.2.2, Hex Nuts; or ASME B18.2.2, Heavy Hex Nuts are recommended.

It is recommended that all bolting be threaded in accordance with ASME B1.1, Unified Screw Threads, Coarse Thread Series, Class 2A and Class 2B.

8.2 Gaskets

Full-faced gaskets extending to the flange edge as given in ASME B16.21, are recommended for flat-faced surfaces such as shown in Tables 2 and 4 (Tables I-2 and

I-4). Metallic gaskets are not recommended to be used with flat-faced flanges.

9 TOLERANCES¹

9.1 Wall Thickness

Fittings with local areas having a less than minimum wall thickness will be acceptable, provided that

(a) the area of minimum thickness can be enclosed by a circle whose diameter is no greater than $0.35\sqrt{dt}$ where d is the inside diameter and t is the minimum wall thickness, as shown in Tables 3 and 5 (Tables I-3 and I-5)

(b) measured thickness is not less than $0.9t$

(c) enclosure circles are separated from each other by an edge-to-edge distance of not less than $1.75\sqrt{dt}$

9.2 Center-to-Face

The following tolerances shall be permitted on all center-to-contact surface dimensions of fittings:

NPS	Tolerance
≤ 10	± 0.8 (0.03 in.)
≥ 12	± 1.5 (0.06 in.)

Tolerances for surface-to-contact dimensions shall be twice those given above. The largest opening in the fitting governs the tolerance to be applied to all openings.

9.3 Facings

Outside diameter, 6.4 mm (0.25 in.) raised face, 0.5 mm (0.02 in.).

9.4 Flange Thickness

NPS	Tolerance, mm (in.)
≤ 12	+3.0 (0.12) -0.0 (zero)

9.5 Counterbore, Threaded Flanges

NPS	Tolerance, mm (in.)
≤ 10	+0.8 (0.03) -0.0 (zero)
≥ 12	+1.5 (0.06) -0.0 (zero)

9.6 Drilling and Facing

(a) Bolt circle diameter ± 1.5 mm (0.06 in.)

(b) Center-to-center of adjacent bolt holes ± 0.8 mm (0.03 in.)

10 PRESSURE TESTING

10.1 Flange Test

Flanges are not required to be pressure-tested.

10.2 Flanged Fitting Test

10.2.1 Shell Pressure Test. Each flanged fitting shall be given a shell pressure test.

10.2.2 Test Conditions. The shell pressure test for flanged fittings shall not be at a pressure less than 1.5 times the 38°C (100°F) pressure rating rounded off to the next higher 0.5 bar (10 psi) increment.

10.2.3 Test Fluid. The pressure test shall be made using water, which may contain a corrosion inhibitor or kerosene, as the test fluid. Other suitable test fluids may

be used, provided their viscosity is not greater than that of water. The test fluid temperature shall not exceed 50°C (125°F).

10.2.4 Test Duration. The minimum test duration shall be as follows:

Fitting Size	Duration, sec
NPS ≤ 2	60
$2\frac{1}{2} \leq \text{NPS} \leq 8$	120
NPS ≥ 10	180

10.2.5 Acceptance. No visible leakage is permitted through the pressure boundary wall.

MANDATORY APPENDIX I

DIMENSIONS OF FITTINGS IN U.S. CUSTOMARY UNITS

This Appendix provides tables for standard inch dimensions. (See Tables I-1 through I-6.)

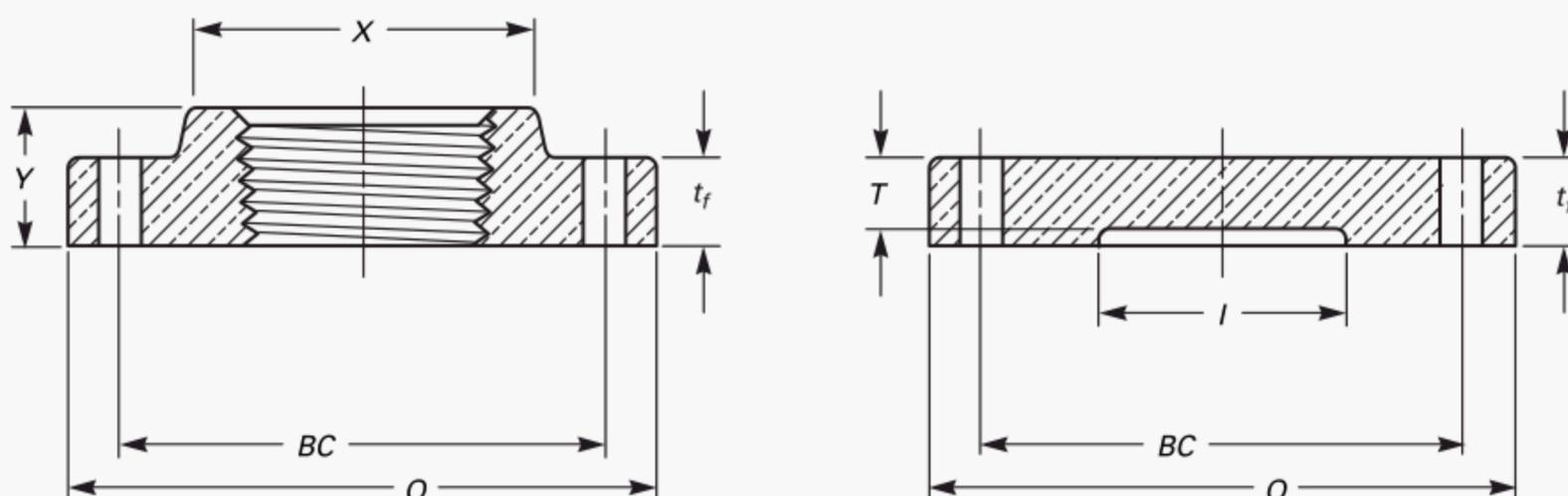
**Table I-1 Pressure–Temperature Ratings for ASTM B 61 Alloy C92200 and
ASTM B 62 Alloy C83600**

Service Temperature, °F	Working Pressure, psig			
	Class 150		Class 300	
	ASTM B 62 C83600	ASTM B 61 C92200	ASTM B 62 C83600	ASTM B 61 C92200
–20 to 150	225	225	500	500
175	220	220	480	490
200	210	215	465	475
225	205	210	445	465
250	195	205	425	450
275	190	200	410	440
300	180	195	390	425
350	165	180	350	400
400	...	170	...	375
406	150	...	...	...
450	135 [Note (1)]	160	280 [Note(1)]	350
500	...	150	...	325
550	...	140	...	300
Test Pressure	350	350	750	750

NOTE:

- (1) Some codes (e.g., ASME Boiler and Pressure Vessel Code, Section I; ASME B31.1; and ASME B31.5) limit the rating temperature of the indicated material to 406°F.

Table I-2 Dimensions of Class 150 Threaded Companion and Blind Flanges for Alloys C83600 and C92200



NPS	Diameter of Flange, O	Minimum Thickness of Flange, t_f [Note (1)]	Bolt Circle, BC	Number of Bolts [Note (2)]	Diameter of Bolts	Diameter of Bolt Hole	Minimum Diameter of Hub, X	Minimum Length Overall, Y	Maximum Diameter of Counter-bore, I	Minimum Thickness at Recess, T
1/2	3.50	0.31	2.38	4	1/2	5/8	1.19	0.59	0.50	0.25
3/4	3.88	0.34	2.75	4	1/2	5/8	1.25	0.62	0.75	0.28
1	4.25	0.38	3.12	4	1/2	5/8	1.94	0.69	1.00	0.31
1 1/4	4.62	0.41	3.50	4	1/2	5/8	2.31	0.81	1.25	0.34
1 1/2	5.00	0.44	3.88	4	1/2	5/8	2.56	0.88	1.50	0.38
2	6.00	0.50	4.75	4	5/8	3/4	3.06	1.00	2.00	0.44
2 1/2	7.00	0.56	5.50	4	5/8	3/4	3.56	1.12	2.50	0.50
3	7.50	0.62	6.00	4	5/8	3/4	4.25	1.19	3.00	0.56
3 1/2	8.50	0.69	7.00	8	5/8	3/4	4.81	1.25	3.50	0.62
4	9.00	0.69	7.50	8	5/8	3/4	5.31	1.31	4.00	0.62
5	10.00	0.75	8.50	8	3/4	7/8	6.44	1.44	5.00	0.69
6	11.00	0.81	9.50	8	3/4	7/8	7.56	1.56	6.00	0.75
8	13.50	0.94	11.75	8	3/4	7/8	9.69	1.75	8.00	0.88
10	16.00	1.00	14.25	12	7/8	1	12.00	1.94	10.00	0.94
12	19.00	1.06	17.00	12	7/8	1	14.38	2.19	12.00	1.00

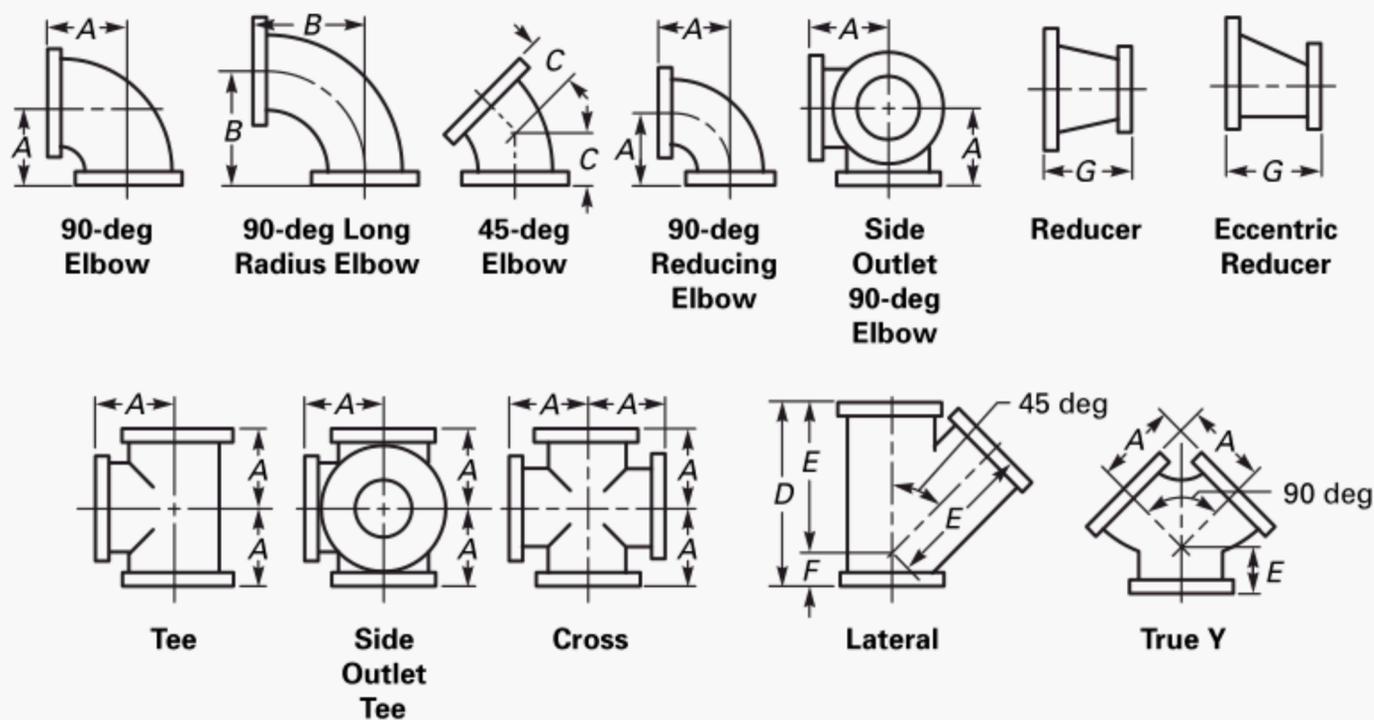
GENERAL NOTES:

- (a) Dimensions are in inches.
 (b) For flange facing, see para. 6.2.
 (c) Flange diameters and drilling templates correspond to those prescribed in ASME B16.1, B16.5, and B16.42.

NOTES:

- (1) For flange spot facing and thickness, see para. 6.9.
 (2) For flanges integral with fittings or valves, see para. 6.8.

Table I-3 Dimensions of Class 150 Elbows, Tees, Crosses, Laterals, True Ys (Straight Sizes), and Reducers



NPS	Center-to-Face, A [Notes (1)–(7)]	Face-to-Face, A+A	Center-to-Face, B [Note (1)]	Center-to-Face, C [Note (1)]	Face-to-Face, D [Notes (4), (5)]	Center-to-Face, E [Notes (4), (5)]	Center-to-Face, F [Notes (4), (5)]	Face-to-Face, G [Note (8)]	Wall Thickness, t [Note (9)]	Minimum Port Diameter, l
1/2	3.00	6.00	...	1.62	...	...	...	...	0.09	0.50
3/4	3.25	6.50	...	1.75	...	...	...	...	0.11	0.75
1	3.50	7.00	5.00	1.75	7.50	5.75	1.75	...	0.12	1.00
1 1/4	3.75	7.50	5.50	2.00	8.00	6.25	1.75	...	0.14	1.25
1 1/2	4.00	8.00	6.00	2.25	9.00	7.00	2.00	...	0.16	1.50
2	4.50	9.00	6.50	2.50	10.50	8.00	2.50	5.00	0.19	2.00
2 1/2	5.00	10.00	7.00	3.00	12.00	9.50	2.50	5.50	0.20	2.50
3	5.50	11.00	7.75	3.00	13.00	10.00	3.00	6.00	0.22	3.00
3 1/2	6.00	12.00	8.50	3.50	14.50	11.50	3.00	6.50	0.25	3.50
4	6.50	13.00	9.00	4.00	15.00	12.00	3.00	7.00	0.27	4.00
5	7.50	15.00	10.25	4.50	17.00	13.50	3.50	8.00	0.30	5.00
6	8.00	16.00	11.50	5.00	18.00	14.50	3.50	9.00	0.33	6.00
8	9.00	18.00	14.00	5.50	22.00	17.50	4.50	11.00	0.41	8.00
10	11.00	22.00	16.50	6.50	25.50	20.50	5.00	12.00	0.48	10.00
12	12.00	24.00	19.00	7.50	30.00	24.50	5.50	14.00	0.56	12.00

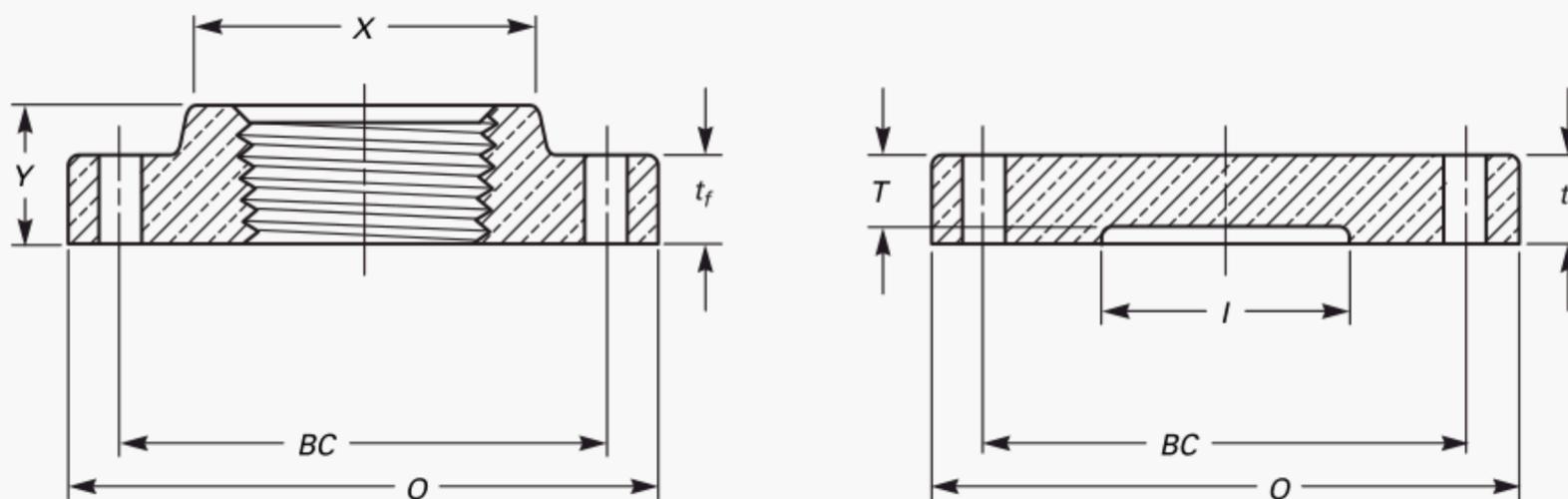
GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For flange and bolt hole dimensions, see Table I-2 and para. 6.8.
- (c) For center-to-face tolerance, see para. 9.2.

NOTES:

- (1) For intersecting centerlines of side outlet fittings, see para. 7.1.1.
- (2) For center-to-face dimensions of reducing elbows, see para. 7.1.2(b).
- (3) For center-to-face dimensions of special degree elbows, see para. 7.1.2(c).
- (4) For reinforcements of crosses and laterals, see para. 7.2.
- (5) For center-to-face dimensions of reducing tees, crosses, and laterals, see para 7.1.3(a).
- (6) For center-to-face dimensions of tees reducing on both runs, see para 7.1.3(b).
- (7) For center-to-face dimensions of reducing side outlet tees having two different size reductions on the outlets, see para. 7.1.3(a).
- (8) For face-to-face dimensions of reducers and eccentric reducers, see para. 7.1.5.
- (9) For wall thickness tolerance, see para. 9.1.

Table I-4 Dimensions of Class 300 Threaded Companion and Blind Flanges for Alloys C83600 and C92200



NPS	Diameter of Flange, <i>O</i>	Minimum Thickness of Flange, <i>t_f</i> [Note (1)]	Bolt Circle, <i>BC</i>	Number of Bolts [Note (2)]	Diameter of Bolts	Diameter of Bolt Hole	Minimum Diameter of Hub, <i>X</i>	Minimum Length Overall, <i>Y</i>	Maximum Diameter of Counter-bore, <i>I</i>	Minimum Thickness at Recess, <i>T</i>
1/2	3.75	0.50	2.62	4	1/2	5/8	1.19	0.59	0.50	0.44
3/4	4.62	0.53	3.25	4	5/8	3/4	1.50	0.62	0.75	0.47
1	4.88	0.59	3.50	4	5/8	3/4	1.94	0.69	1.00	0.53
1 1/4	5.25	0.62	3.88	4	5/8	3/4	2.31	0.81	1.25	0.56
1 1/2	6.12	0.69	4.50	4	3/4	7/8	2.56	0.88	1.50	0.62
2	6.50	0.75	5.00	8	5/8	3/4	3.06	1.00	2.00	0.69
2 1/2	7.50	0.81	5.88	8	3/4	7/8	3.56	1.12	2.50	0.75
3	8.25	0.91	6.62	8	3/4	7/8	4.25	1.19	3.00	0.84
3 1/2	9.00	0.97	7.25	8	3/4	7/8	4.81	1.25	3.50	0.91
4	10.00	1.06	7.88	8	3/4	7/8	5.31	1.31	4.00	1.00
5	11.00	1.12	9.25	8	3/4	7/8	6.44	1.44	5.00	1.06
6	12.50	1.19	10.62	12	3/4	7/8	7.56	1.56	6.00	1.12
8	15.00	1.38	13.00	12	7/8	1	9.69	1.75	8.00	1.31

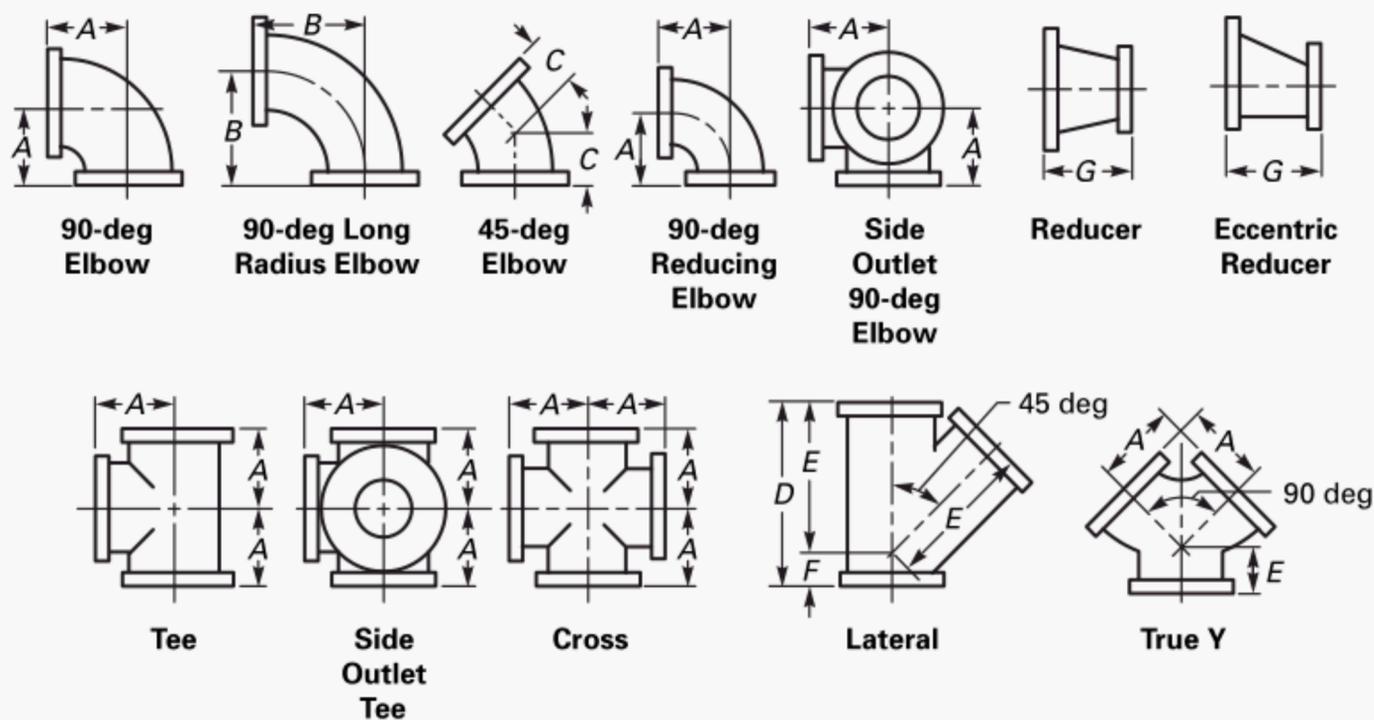
GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For flange facing, see para. 6.2.
- (c) Flange diameters and drilling templates correspond to those prescribed in ASME B16.1, B16.5, and B16.42.

NOTES:

- (1) For flange spot facing and thickness, see para. 6.9.
- (2) For flanges integral with fittings or valves, see para. 6.8.

Table I-5 Dimensions of Class 300 Elbows, Tees, Crosses, Laterals, True Ys (Straight Sizes), and Reducers



NPS	Center-to-Face, A [Notes (1)–(7)]	Face-to-Face, A+A	Center-to-Face, B [Note (1)]	Center-to-Face, C [Note (1)]	Face-to-Face, D [Notes (4), (5)]	Center-to-Face, E [Notes (4), (5)]	Center-to-Face, F [Notes (4), (5)]	Face-to-Face, G [Note (8)]	Wall Thickness, t [Note (9)]	Minimum Port Diameter, l
1/2	3.00	6.00	...	1.75	...	...	...	...	0.12	0.50
3/4	3.50	7.00	...	2.25	...	...	...	...	0.16	0.75
1	4.00	8.00	5.00	2.25	8.50	6.50	2.00	...	0.17	1.00
1 1/4	4.25	8.50	5.50	2.50	9.50	7.25	2.25	...	0.19	1.25
1 1/2	4.50	9.00	6.00	2.75	11.00	8.50	2.50	...	0.20	1.50
2	5.00	10.00	6.50	3.00	11.50	9.00	2.50	5.00	0.25	2.00
2 1/2	5.50	11.00	7.00	3.50	13.00	10.50	2.50	5.50	0.28	2.50
3	6.00	12.00	7.75	3.50	14.00	11.00	3.00	6.00	0.33	3.00
3 1/2	6.50	13.00	8.50	4.00	15.50	12.50	3.00	6.50	0.36	3.50
4	7.00	14.00	9.00	4.50	16.50	13.50	3.00	7.00	0.41	4.00
5	8.00	16.00	10.25	5.00	18.50	15.00	3.50	8.00	0.48	5.00
6	8.50	17.00	11.50	5.50	21.50	17.50	4.00	9.00	0.56	6.00
8	10.00	20.00	14.00	6.00	25.50	20.50	5.00	11.00	0.72	8.00

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For flange and bolt hole dimensions, see Table I-4 and para. 6.8.
- (c) For center-to-face tolerance, see para. 9.2.

NOTES:

- (1) For intersecting centerlines of side outlet fittings, see para 7.1.1.
- (2) For center-to-face dimensions of reducing elbows, see para. 7.1.2(b).
- (3) For center-to-face dimensions of special degree elbows, see para. 7.1.2(c).
- (4) For reinforcement of crosses and laterals, see para. 7.2.
- (5) For center-to-face dimensions of reducing tees, crosses, and laterals, see para. 7.1.3(a).
- (6) For center-to-face dimensions of tees reducing on both runs, see para. 7.1.3(b).
- (7) For center-to-face dimensions on reducing side outlet tees having two different size reductions on the outlets, see para. 7.1.3(a).
- (8) For face-to-face dimensions of reducers and eccentric reducers, see para. 7.1.5.
- (9) For wall thickness tolerance, see para. 9.1.

Table I-6 Pressure–Temperature Ratings for ASTM B 148, Alloy C95200

Service Temperature, °F	Working Pressure, psig					
	Class 150	Class 300	Class 600	Class 900	Class 1500	Class 2500
–20 to 100	195	515	1,030	1,545	2,575	4,290
150	165	430	855	1,285	2,140	3,570
200	155	400	800	1,205	2,005	3,340
250	145	385	770	1,150	1,920	3,200
300	140	370	740	1,110	1,850	3,085
350	140	365	735	1,100	1,835	3,060
400	140	365	725	1,090	1,820	3,030
450	140	360	725	1,085	1,805	3,010
500	140	360	720	1,080	1,800	3,000
Test Pressure	300	775	1,550	2,325	3,875	6,450

MANDATORY APPENDIX II REFERENCES

The following is a list of standards and specifications referenced in this Standard.

ASME B1.1-2003, Unified Inch Screw Threads (UN and UNR Thread Form)¹

ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch)¹

ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800¹

ASME B16.5-2003, Pipe Flanges and Flanged, NPS ½ Through NPS 24 Metric/Inch Standard¹

ASME B16.21-1992, Nonmetallic Flat Gaskets for Pipe Flanges¹

ASME B18.2.1-1996 (A99), Square and Hex Bolts and Screws¹

ASME B18.2.2-1987 (R1999), Square and Hex Nuts¹

ASME B31.1-2004, Power Piping¹

ASME B31.5-2001, Refrigeration Piping¹

ASME BPV-1-2004, Power Boilers¹

ASME PCC-1-2000, Guidelines for Pressure Boundary Bolted Flange Joint Assembly¹

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2300, Fairfield, NJ 07007-2300

ASTM A 193/A 193M-04c, Standard Specification for Alloy-Steel and Stainless Bolting Materials for High-Temperature Service

ASTM A 307-04, Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners

ASTM B 61-02, Standard Specification for Steam or Valve Bronze Castings

ASTM B 62-02, Standard Specification for Composition Bronze or Ounce Metal Castings

ASTM B 98/98M-03, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes

ASTM B 148-97 (R2003), Standard Specification for Aluminum-Bronze Sand Castings

ASTM B 150/B 150M-03, Standard Specification for Aluminum-Bronze Rod, Bar and Shapes

ASTM B 164-03, Standard Specification for Nickel-Copper Alloy Rod and Bar

Publisher: ASTM International (ASTM), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959

ISO 9000: 2000, Quality Management System — Fundamentals and Vocabulary

ISO 9000: 2000, Quality Management System — Requirements

Publisher: International Organization for Standardization (ISO), 1 ch. de la Voie-Creuse, Case Postale 56, CH-1211 Genève 20, Switzerland/Suisse

MSS SP-6-2001, Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings

MSS SP-9-2001, Spot Facing for Bronze, Iron and Steel Flanges

MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-80-2003, Bronze Gate, Globe, Angle and Check Valves

Publisher: Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc. (MSS), 127 Park Street, N.E., Vienna, VA 22180-4602

¹ May also be obtained from the American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

NONMANDATORY APPENDIX A QUALITY SYSTEM PROGRAM

The products manufactured in accordance with this Standard shall be produced under a quality system program following the principles of an appropriate standard from the ISO 9000 series.¹ A determination of the need for registration and/or certification of the product

¹ The series is also available from the American National Standards Institute (ANSI) and the American Society for Quality (ASQ) as American National Standards that are identified by a prefix "Q" replacing the prefix "ISO." Each standard of the series is listed in Mandatory Appendix II.

manufacturer's quality system program by an independent organization shall be the responsibility of the manufacturer. Detailed documentation demonstrating program compliance shall be available to the purchaser at the manufacturer's facility. A written, summarized description of the program used by the product manufacturer shall be available to the purchaser upon request. The product manufacturer is defined as the entity whose name or trademark appears on the product in accordance with the marking or identification requirements of this Standard.

ASME B16.24 INTERPRETATIONS

Replies to Technical Inquiries July 1, 2001 Through July 31, 2006

FOREWORD

This publication includes all of the written replies issued between the indicated dates by the Secretary, speaking for the ASME B16 Committee, Standardization of Valves, Flanges, Fittings, and Gaskets, to inquiries concerning interpretations of technical aspects of B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

These replies are taken verbatim from the original letters except for a few typographical corrections and some minor editorial corrections made for the purpose of improved clarity. In some few instances, a review of the interpretation follows immediately after the original reply.

These interpretations were prepared in accordance with the accredited ASME procedures. ASME procedures provide for reconsideration of these interpretations when or if additional information is available which the inquirer believes might affect the interpretation. Further, persons aggrieved by this interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Interpretation: 24-1

Subject: End Flange Facings

Date Issued: July 24, 2003

File: 03-1067

Question: Is it acceptable to add a raised face per ASME B16.5, while maintaining the ASME B16.24-2001 flange thickness dimensions "C" and still remain in compliance with ASME B16.24-2001?

Reply: Yes, it is acceptable to add a raised face per ASME B16.5, while maintaining the ASME B16.24-2001 flange thickness dimension "C," and the raised face height shall be in addition to the "C" dimension. See last sentence in para. 6.2.

AMERICAN NATIONAL STANDARDS FOR PIPING, PIPE FLANGES, FITTINGS, AND VALVES

Scheme for the Identification of Piping Systems.....	A13.1-1996
Pipe Threads, General Purpose (Inch)	B1.20.1-1983(R1992)
Dryseal Pipe Threads (Inch)	B1.20.3-1976(R1998)
Cast Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.....	B16.1-1998
Malleable Iron Threaded Fittings: Classes 150 and 300.....	B16.3-1998
Gray Iron Threaded Fittings: Classes 125 and 250	B16.4-1998
Pipe Flanges and Flanged Fittings (NPS 1/2 Through NPS 24)	B16.5-1996
Factory-Made Wrought Butt welding Fittings.....	B16.9-2001
Face-to-Face and End-to-End Dimensions of Valves	B16.10-2000
Forged Fittings, Socket-Welding and Threaded	B16.11-2001
Cast Iron Threaded Drainage Fittings	B16.12-1998
Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads	B16.14-1991
Cast Bronze Threaded Fittings: Classes 125 and 250.....	B16.15-1985(R1994)
Cast Copper Alloy Solder Joint Pressure Fittings	B16.18-1984(R1994)
Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.....	B16.20-1998
Nonmetallic Flat Gaskets for Pipe Flanges.....	B16.21-1992
Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.....	B16.22-1995
Cast Copper Alloy Solder Joint Drainage Fittings — DWV.....	B16.23-1992
Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.....	B16.24-2006
Butt welding Ends.....	B16.25-1997
Cast Copper Alloy Fittings for Flared Copper Tubes.....	B16.26-1988
Wrought Steel Butt welding Short Radius Elbows and Returns.....	B16.28-1994
Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings — DWV.....	B16.29-1994
Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes 1/2 Through 2).....	B16.33-1990
Valves — Flanged, Threaded, and Welding End.....	B16.34-1996
Orifice Flanges.....	B16.36-1996
Large Metallic Valves for Gas Distribution (Manually Operated, NPS 2 1/2 to 12, 125 psig Maximum).....	B16.38-1985(R1994)
Malleable Iron Threaded Pipe Unions	B16.39-1998
Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems	B16.40-1985(R1994)
Functional Qualification Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants.....	B16.41-1983(R1989)
Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300	B16.42-1998
Manually Operated Metallic Gas Valves for Use in House Piping Systems	B16.44-1995
Cast Iron Fittings for Solvent® Drainage Systems.....	B16.45-1998
Large Diameter Steel Flanges (NPS 26 Through NPS 60).....	B16.47-1996
Steel Line Blanks.....	B16.48-1997
Factory-Made Wrought Steel Butt welding Induction Bends for Transportation and Distribution Systems	B16.49-2000
Power Piping	B31.1-1998
Fuel Gas Piping (not an ANSI standard).....	B31.2-1968
Process Piping	B31.3-1999
Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.....	B31.4-1998
Refrigeration Piping and Heat Exchanger Components	B31.5-2000
Gas Transmission and Distribution Piping Systems	B31.8-1999
Building Services Piping.....	B31.9-1996
Slurry Transportation Piping Systems.....	B31.11-1989(R1998)
Manual for Determining the Remaining Strength of Corroded Pipelines	B31G-1991
Welded and Seamless Wrought Steel Pipe	B36.10M-1996
Stainless Steel Pipe	B36.19M-1985(R1994)
Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard	N278.1-1975(R1992)

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