

ASME B16.1-1998
(Revision of ASME/ANSI B16.1-1989)

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

Classes 25, 125, and 250

AN AMERICAN NATIONAL STANDARD



The American Society of
Mechanical Engineers



The American Society of
Mechanical Engineers

A N A M E R I C A N N A T I O N A L S T A N D A R D

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

Classes 25, 125, and 250

ASME B16.1-1998
(Revision of ASME/ANSI B16.1-1989)

Date of Issuance: March 19, 1999

The 1998 edition of this Standard is being issued with an automatic addenda subscription service. The use of addenda allows revisions made in response to public review comments or committee actions to be published on a regular yearly basis; 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 2003.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. The interpretations will be included with the above addenda service.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable Letters Patent, nor assumes any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations issued in accordance with governing ASME procedures and policies which precludes the issuance of interpretations by individual volunteers.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

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

Copyright © 1999 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All Rights Reserved
Printed in U.S.A.

FOREWORD

(This Foreword is not part of ASME B16.1-1998.)

In 1894, the American Society of Mechanical Engineers (ASME) adopted a standard flange template ("ASME Standard") for low-pressure service. A "Manufacturers Standard" for pressures up to 250 psi followed in 1901. Around 1910, a group of fittings manufacturers formed an organization that was the forerunner of the present Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) and undertook the design of a line of flanged fittings. A document covering this work was published in 1912.

During the years 1912-1914, a Joint Committee of the ASME and the Manufacturers Committee formulated compromise standard dimensions for pipe flanges and flanged fittings for use under saturated steam pressures of 125 psi and 250 psi pressure ranges. The Joint Committee's report was accepted at a conference attended by representatives of ASME, the Manufacturers Committee, the U.S. government, and the National Association of Master Steam and Hot Water Fitters. ASME published this report as the "American Standard for Pipe Flanges, Fittings and Their Bolting" in 1914. In 1918, work was started on standards for 50 lb steam flanges and for 800 lb, 1200 lb, and 3000 lb hydraulic flanges, which were subsequently approved by this group.

In 1921, the American Engineering Standards Committee, later known as the American Standards Association (ASA), United States of America Standards Institute (USAS), and more recently, the American National Standards Institute (ANSI), organized Sectional Committee B16 to unify and further develop national standards for pipe flanges and fittings (and later for valves and gaskets). Cosponsors of the B16 Committee were ASME, MSS, and the Heating and Piping Contractors Association [now the Mechanical Contractors Association of America (MCAA)]. Work already in progress on flanges and flanged fittings was assigned to Subcommittee 1 (now Subcommittee A). Following approval by the Subcommittee, the B16 Committee, the cosponsors, and ASA, the standards were published in 1928.

In later work, Subcommittee 1 developed the 25 lb Flange and Flanged Fitting Standard (approved in 1931 as ASA B16b2), which replaced the 50 lb standard that had been originally approved in 1918. Work on the 800 lb Hydraulic Flange Standard was published as ASA B16b1 in 1931. Revision of thicknesses, tolerances, and service pressure ratings of the 125 lb and 250 lb flanges and flanged fittings led to approval and publication of ASA B16a-1939.

An American War Standard entitled "Pressure Ratings for Cast Iron Flanges and Flanged Fittings, 125 lb" (ASA B16a1) was published in 1943. A complete review of the 125 lb and 250 lb standards resulted in new editions of each: ASA B16.1-1948 and ASA B16.2-1948. In 1960, editions of B16.1 and B16.2 were issued in which ratings were presented in graphic form and special requirements were added for testing flanges.

A review of all cast iron flange and flanged fittings standards initiated in 1962 resulted in the withdrawal of B16.16, "300 lb Refrigerant Flanges and Flanged Fittings" and the combining of the remaining standards into a single document, with B16.1 and B16.2 coming together as USAS B16.1-1967. In this edition, the presentation of ratings was restored to tabular form.

The increasing use of higher grades of cast iron necessitated the establishment of a second set of ratings for the smaller sizes. A revised edition published as ANSI B16.1-1975 incorporated these new ratings along with metric (SI) equivalents for dimensions and minor corrections to the 1967 edition text.

In 1982, American National Standards Committee B16 was recognized as an ASME Committee operating under procedures accredited by ANSI. Following approval by the ASME B16 Subcommittee A and B16 Committee, ANSI approved ASME/ANSI B16.1-1989 on March 8, 1989. Changes included revised marking requirements, revised bolt length increments ($\frac{1}{2}$ in. rather than $\frac{1}{4}$ in.), elimination of metric equivalents, a correction of the Class 800 flange raised face height to 0.25 in. from the 0.06 in. shown previously, and editorial changes to the text.

In the 1998 edition of ASME B16.1, Reference Standards have been updated, a Quality System Program Annex has been added, Class 800 has been deleted, and several editorial revisions have been made. Following approval by ASME B16 Subcommittee B and B16 Main Committee, ANSI approved this American National Standard on November 20, 1998.

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

RATINGS OF ASME B16.1 VERSUS ANSI/AWWA A21.10

Attention is directed to an apparent conflict in ambient temperature pressure ratings for flanged fittings between ASME B16.1 and ANSI/AWWA A21.10, Gray Iron and Ductile Iron Fittings, 2 in. through 48 in. for Water and Other Liquids.

The scope of ANSI/AWWA A21.10 limits that standard to fittings for use with gray iron and ductile iron pipe for water and other liquids at rated working pressures of 150 psi and 250 psi. The ratings of these fittings were established on the basis of hydrostatic testing of fittings to bursting, and do provide a factor of safety of at least 3.0 at the rated working pressure and at ambient temperature.

ASME B16.1 covers both separate flanges and flanged fittings for more general service at ambient and elevated temperatures. The pressure ratings set forth are not based upon burst strength, but have evolved over an extended period of time of satisfactory performance in a wide range of general service conditions. The ratings encompass pressure combined with elevated temperature, stresses imposed by piping, thermal stresses due to temperature variations, and many other conditions causing stress in the flange or fitting.

ASME B16 COMMITTEE

Standardization of Valves, Flanges, Fittings, Gaskets, and Valve Actuators

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

OFFICERS

W. N. McLean, *Chair*
H. R. Sonderegger, *Vice Chair*
P. A. Reddington, *Secretary*

COMMITTEE PERSONNEL

W. L. Ballis, Consultant, London, Ohio
R. W. Barnes, Anric Enterprises, Etobicoke, Ontario, Canada
R. R. Brodin, Fisher Controls International, Inc., Marshalltown, Iowa
M. A. Clark, Nibco, Inc., Elkhart, Indiana
A. Cohen, A. Cohen and Associates, Albuquerque, New Mexico
C. E. Floren, Mueller Co., Decatur, Illinois
D. R. Frikken, Solutia, Inc., St. Louis, Missouri
R. Henrich, Minnegasco, Inc., Golden Valley, Minnesota
J. C. Inch, Mueller Refrigeration Products Co., Hartsville, Tennessee
G. A. Jolly, Vogt Valve Co., Louisville, Kentucky
W. G. Knecht, BW/IP International, Inc., Williamsport, Pennsylvania
R. Koester, The William Powell Co., Cincinnati, Ohio
W. N. McLean, Newco Valves, Palos Park, Illinois
M. L. Nayyar, Bechtel Power Corp., Gaithersburg, Maryland
P. A. Reddington, American Society of Mechanical Engineers, New York, New York
R. A. Schmidt, Trinity-Ladish Co., Russellville, Arkansas
H. R. Sonderegger, Grinnell Corp., Cranston, Rhode Island
W. M. Stephan, Flexitallic, Inc., Mount Laurel, New Jersey
T. F. Stroud, Ductile Iron Pipe Research Association, Birmingham, Alabama
M. D. Wasicek, ABS Americas, Houston, Texas
R. E. White, Richard E. White and Associates, South Bend, Indiana
D. A. Williams, Southern Company Services, Birmingham, Alabama
L. A. Willis, The Dow Chemical Co., Freeport, Texas
W. R. Worley, Union Carbide Corp., South Charleston, West Virginia

SUBCOMMITTEE B — THREADED FITTINGS (EXCEPT STEEL)

H. R. Sonderegger, *Chair*, Grinnell Corp., Cranston, Rhode Island
B. P. Feder, *Secretary*, American Society of Mechanical Engineers, New York, New York
K. Barron, Ward Manufacturing, Blossburg, Pennsylvania
M. A. Clark, Nibco, Inc., Elkhart, Indiana
A. Cohen, A. Cohen and Associates, Albuquerque, New Mexico
A. A. Knapp, Canadian Copper/Brass Development Association, North York, Ontario, Canada
R. L. Larkin, American Darling Valve, Birmingham, Alabama
P. I. McGrath, Jr., Consultant, Birmingham, Alabama
W. N. McLean, Newco Valves, Palos Park, Illinois
J. K. Schultz, Conine Manufacturing Co., Inc., Tyler, Texas

CONTENTS

Foreword	iii
Standards Committee Roster	v
1 Scope	1
2 Pressure-Temperature Ratings	1
3 Size	1
4 Marking	1
5 Materials	2
6 Fitting Dimensions and Tolerances	2
7 Bolt, Nut, and Gasket Dimensions	4
8 Hydrostatic Tests	4
9 Certifications	4
Figures	
1 Method of Designating Outlets of Reducing Fittings in Specifications	6
2 Class 25 Flange	7
3 Class 25 Flanged Fittings	8
4 Class 125 Flanges	10
5 Class 125 Flanged Fittings	12
6 Class 250 Flanges	17
7 Class 250 Flanged Fittings	20
8 Class 125 Tees: Anchorage Bases	25
9 Class 250 Tees: Anchorage Bases	28
10 Drain Tappings	30
11 Method of Designating Location of Tapped Holes for Drains When Specified	31
Tables	
1 Nonshock Gage Pressure-Temperature Ratings	5
2 Flanges, Bolt Holes, and Bolting Dimensions of Class 25 Cast Iron Flanges	7
3 Dimensions of Class 25 Cast Iron Flanged Fittings	9
4 Flanges, Bolt Holes, and Bolting Dimensions of Class 125 Cast Iron Flanges	11
5 Dimensions of Class 125 Cast Iron Flanged Fittings	14
6 Flanges, Bolt Holes, and Bolting Dimensions of Class 250 Cast Iron Flanges	18
7 Dimensions of Class 250 Cast Iron Flanged Fittings	22
8 Dimensions of Anchorage Bases for Straight and Reducing Class 125 Tees	26
9 Dimensions of Anchorage Bases for Straight and Reducing Class 250 Tees	29
10 Minimum Thread Length	30

Mandatory Annex

I	References	33
---	------------------	----

Nonmandatory Annex

A	Quality System Program	35
---	------------------------------	----

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

Classes 25, 125, and 250

1 SCOPE

1.1 General

This Standard for Classes 25, 125, and 250 Cast Iron Pipe Flanges and Flanged Fittings covers:

- (a) pressure-temperature ratings
- (b) sizes and method of designating openings of reducing fittings
- (c) marking
- (d) minimum requirements for materials
- (e) dimensions and tolerances
- (f) bolt, nut, and gasket dimensions
- (g) tests

1.2 References

Standards and specifications adopted by reference in this Standard are shown in Annex I, which is part of this Standard.

1.3 Quality Systems

Requirements relating to the product manufacturer's Quality System Programs are described in Annex A.

2 PRESSURE-TEMPERATURE RATINGS

2.1 General

Pressure ratings for various temperatures (including limitations) are shown in Table 1.

2.2 Ratings

Ratings are independent of the contained fluid and are the maximum nonshock pressures at the tabulated temperatures. Intermediate ratings may be obtained by linear interpolation between the temperatures shown.

2.3 Rating Temperature

Temperatures shown for the corresponding pressure rating shall be the material temperature of the pressure-retaining structure. It may be assumed that the material

temperature is the same as the fluid temperature. Use of a pressure rating at a material temperature other than that of the contained fluid is the responsibility of the user and subject to the requirements of any applicable code.

2.4 Low-Temperature Ratings

Pressure ratings for temperatures below -20°F should be determined in accordance with low-temperature properties of cast iron (ASTM A 126) as governed by applicable codes.

3 SIZE

3.1 Nominal Pipe Size

The sizes of the flanges and fittings shown in Figs. 2 through 9 and scheduled in Tables 2 through 9 are identified by the corresponding nominal pipe sizes. NPS as used in this document means the nominal pipe size.

3.2 Reducing Fittings

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

4 MARKING

4.1 Fittings

The manufacturer's name or trademark and numerals as shown below for each rating shall be cast on the exterior surface of all fittings.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

Rating Class	Size	Nominal
25	All	25
125	1 to 12	125
	14 to 24	100
	30 to 48	50
250	1 to 12	250
	14 to 24	200
	30 to 48	100

4.2 Flanges

The manufacturer's name or trademark shall be cast on all loose flanges. In addition, numerals 25 shall be cast on Class 25 flanges. Rating numerals for other classes shall be cast on loose flanges that are subject to the requirements of para. 4.3.

4.3 Material Class

In those sizes and classes where both Classes A and B iron can be used, the letter A or B shall be cast on both flanges and fittings adjacent to the rating numerals. Flanges and fittings with no A or B Class iron marking shall be considered as Class A iron for rating purposes.

5 MATERIALS**5.1 Castings**

The castings shall meet the requirements of ASTM A 126 as listed in para. 5.1.1.

5.1.1 The material requirements for flanges and flanged fittings shall be as follows:

Rating Class	Size	Class of Iron ASTM A 126
25	All	A
125	1 to 12	A or B
	14 and above	B
250	1 to 12	A or B
	14 and above	B

5.2 Bolting

The bolting used with these flanges and fittings shall be made of carbon steel that conforms to the

requirements of ASTM A 307 Grade B¹ and used with ring-type gaskets.

6 FITTING DIMENSIONS AND TOLERANCES**6.1 Wall Thickness**

It is recognized that some variations are absolutely unavoidable in the making of patterns and castings. Equipment shall be designed to produce wall thicknesses given in the tables. Wall thickness at no point shall be less than 87.5% of the thickness given in the tables.

6.2 Facing

6.2.1 Classes 25 and 125 cast iron flanges and flanged fittings shall be flat faced (i.e., without projection or raised face) and finished in accordance with MSS SP-6.

6.2.2 Class 250 flanges and flanged fittings shall have a raised face 0.06 in. high of the diameters given in Table 6 and finished in accordance with MSS SP-6. The raised face is included in the minimum flange thickness and center-to-face dimension.

6.3 Center-to-Face Dimensions

6.3.1 Side Outlet Fittings. Side outlet elbows, side outlet tees, and side outlet crosses shall have all openings on intersecting centerlines. Long-radius elbows with side outlet shall have the side outlet on the radial centerline of the elbow.

6.3.2 Elbows

(a) The center-to-face dimensions for straight-size 90 deg. elbows, 90 deg. long-radius elbows, 45 deg. elbows, side-outlet 90 deg. elbows, and double-branch elbows are shown in Tables 3, 5, and 7.

(b) Reducing 90 deg. elbows, reducing 90 deg. long-radius elbows, reducing side-outlet 90 deg. elbows, and reducing double-branch elbows shall have the same center-to-face dimensions as straight-size fittings shown in Tables 3, 5, and 7 corresponding to the size of the largest opening.

¹ For Classes 25 and 125 flanges: The carbon steel bolts prescribed for the flanges in this Standard are based on the use of a flat "ring" gasket that extends to the bolts.

Where cast iron to cast iron flanges or cast iron to steel flanges are used with full-face gaskets, higher strength bolts may properly be used.

Where cast iron flanges are bolted to steel flanges and flat ring gaskets are used, carbon steel bolts prescribed in this Standard shall be employed.

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

(c) For 90 deg. long-radius elbows with side outlet, the center-to-face dimensions of the side outlet shall be the same as dimension A in Tables 3, 5, and 7 for a straight-size 90 deg. elbow corresponding to the size of the largest opening.

(d) Special-degree elbows ranging from 1 deg. to 45 deg., inclusive, shall have the same center-to-face dimensions as those for 45 deg. elbows; those over 45 deg. and up to 90 deg., inclusive, shall have the same center-to-face dimensions as those for 90 deg. elbows. The angle designation of an elbow is the angle between the flange faces.

6.3.3 Tees, Crosses, and Laterals

(a) The center-to-face dimensions for straight-size tees and crosses, with or without side outlet, and laterals are shown in Tables 3, 5, and 7.

(b) Reducing tees and reducing crosses, with or without side outlet, and reducing laterals, NPS 16 and smaller, shall have the same center-to-face dimensions as straight-size fittings shown in Tables 3, 5, and 7 corresponding to the size of the largest opening. For NPS 18 and larger, if the outlet of a reducing tee; the branch of a reducing lateral; or the largest outlet of a reducing side outlet tee, reducing cross, and reducing side outlet cross is the same size or smaller than given in Tables 3, 5, and 7 (short body pattern), the center-to-face dimensions shown in these Tables shall be used. If a branch or any outlet is larger than shown in Tables 3, 5, and 7, the center-to-face dimensions shall be the same as for the straight-size fitting shown in Tables 3, 5, and 7 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, 5, and 7 corresponding to the size of the largest opening.

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

6.3.4 True Ys. Center-to-face dimensions for straight-size true Ys are shown in Tables 5 and 7. Reducing sizes are considered special and should be made to suit conditions.

6.3.5 Reducers and Eccentric Reducers. The face-to-face dimensions for all reductions of reducers and eccentric reducers shall be the same as given in Tables 5 and 7 for the largest opening.

6.4 Center-to-Face Tolerances

The following tolerances shall be permitted on all center-to-contact surface dimensions of fittings: Tolerances for contact surface-to-contact surface dimensions shall be twice those given below. The largest opening in the fitting governs the tolerance to be applied to all openings.

Tolerance	
Nominal Pipe Size	Plus or Minus, in.
10 and smaller	0.03
12 and larger	0.06

6.5 Threaded Flanges

6.5.1 General. Flanges shall have a Standard Taper Pipe Thread in accordance with ASME B1.20.1. The thread shall be concentric with the axis of the flange, and variations in alignment shall not exceed 0.06 in./ft. The gaging notch of working gage should come flush with the bottom of chamfer, and the maximum allowable thread variations are one turn large or one turn small from the gaging notch.

6.5.2 Class 125. Threads shall be countersunk a distance not less than one-half of the pitch of the thread at an angle approximately 45 deg. with the axis of the thread, for the purpose of easy entrance in making the joint and protection of the threads. Countersinking shall be concentric with the threads. The length of the threads shall be measured to include the countersink.

6.5.3 Class 250. Hub may be recessed. When not recessed, threads shall be countersunk a distance not less than one-half of the pitch of the thread at an angle approximately 45 deg. with the axis of the thread at the back of the flange. If hub is recessed, threads shall be 45 deg. countersunk to diameter of recess. The purpose is for easier entrance in making a joint and for the protection of the threads. Countersinking shall be concentric with the threads. The length of threads shall be measured to include the countersink.

6.6 Flange Bolt Holes

Flange bolt holes shall be in accordance with the dimensions shown in Tables 2, 4, and 6. Pairs of bolt holes shall straddle the centerline.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

6.7 Spot Facing

All flanges and flanged fittings covered by this Standard shall have bearing surfaces for bolting that are parallel to the flange face within 3 deg. Any back facing or spot facing required to accomplish parallelism shall not reduce the flange thickness Q below the dimensions given in Tables 2 through 7. Flange thickness at any point within the spot face area, as defined in MSS SP-9, shall not exceed the required minimum thickness by more than the following amounts.

Nominal Pipe Size	Excess Thickness, Max., in.
2 to 12	0.12
14 to 24	0.18
30 to 96	0.25

When required, all spot facing shall be done in accordance with MSS SP-9. Sharp corners shall be avoided in back facing.

6.8 Crosses and Lateral Reinforcement

Crosses and laterals (Y-branches) both straight and reducing shall be reinforced where necessary to compensate for the inherent weakness in the shape of these fittings.

6.9 Drain Tappings

Holes may be tapped in the wall of fittings if the metal thickness is sufficient to provide the effective length of thread as shown in Fig. 10 and as specified in Table 10. Where thread length is insufficient due to metal thickness or size of tapping is such that reinforcement of opening is necessary, an integral boss should be added. In no case shall the effective length of thread A be less than that shown in Table 10. These lengths are equal to the effective thread lengths as shown in ASME B1.20.1.

The method of designating the locations of the tapped holes for drains is shown in Fig. 11. Each possible location is designated by a letter so that desired locations for the various types of fittings may be definitely specified without the use of further sketches or descrip-

tion. For further detail in applying tappings, see MSS SP-45.

7 BOLT, NUT, AND GASKET DIMENSIONS**7.1 Bolting**

Carbon steel bolts smaller than 0.75 in. shall have (ASME B18.2.1) square heads or (ASME B18.2.1) heavy hex heads, and shall have (ASME B18.2.2) heavy hex nuts.

Carbon steel bolts 0.75 in. and larger shall have (ASME B18.2.1) square heads or (ASME B18.2.1) hex heads and shall have (ASME B18.2.2) hex nuts or (ASME B18.2.2) heavy hex nuts or (ASME B18.2.2) square nuts. For bolt sizes 1.5 in. and larger, stud bolts with a nut on each end are recommended.

All bolts or (stud bolts) and all nuts shall be threaded in accordance with the Unified Screw Threads, standard coarse thread series (ASME B1.1) with Class 2A for bolts and Class 2B for nuts.

7.2 Gaskets¹

Flat ring gaskets shall be in accordance with dimensions given in ASME B16.21 for nonmetallic gaskets for pipe flanges.

8 HYDROSTATIC TESTS

Tests are not required unless specified by the user.

(a) *Fittings.* Fittings shall be capable of withstanding, without showing leaks, the hydrostatic test pressures listed in Table 1 for the material and maximum working pressure of the item tested. These test pressures are 1.5 times the cold working pressure rate rounded to the next higher 10 psi in Table 1.

(b) *Flanges.* Flanges integral with or attached to equipment may be hydrostatically tested by the purchaser at his responsibility at pressures higher than specified herein.

9 CERTIFICATIONS

The manufacturer shall be able to certify that products are in conformance with the requirements of this Standard when required on the purchase order.

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 1 NONSHOCK GAGE PRESSURE-TEMPERATURE RATINGS

Temperature, °F	Class 25 [Note (1)] ASTM A 126		Class 125 ASTM A 126				Class 250 [Note (1)] ASTM A 126			
	Class A		Class A	Class B			Class A	Class B		
	NPS 4-36	NPS 42-96	NPS 1-12	NPS 1-12	NPS 14-24	NPS 30-48	NPS 1-12	NPS 1-12	NPS 14-24	NPS 30-48
-20 to 150	45	25	175	200	150	150	400	500	300	300
200	40	25	165	190	135	115	370	460	280	250
225	35	25	155	180	130	100	355	440	270	225
250	30	25	150	175	125	85	340	415	260	200
275	25	25	145	170	120	65	325	395	250	175
300	...	...	140	165	110	50	310	375	240	150
325	...	...	130	155	105	...	295	355	230	125
353 [Note (2)]	...	...	125	150	100	...	280	335	220	100
375	...	...	...	145	...	...	265	315	210	...
406 [Note (3)]	...	...	...	140	...	...	250	290	200	...
425	...	...	...	130	...	...	...	270	...	...
450	...	...	...	125	...	...	...	250	...	...
Hydrostatic Shell Test Pressures [Note (4)]										
100	70	40	270	300	230	230	600	750	450	450

GENERAL NOTES:

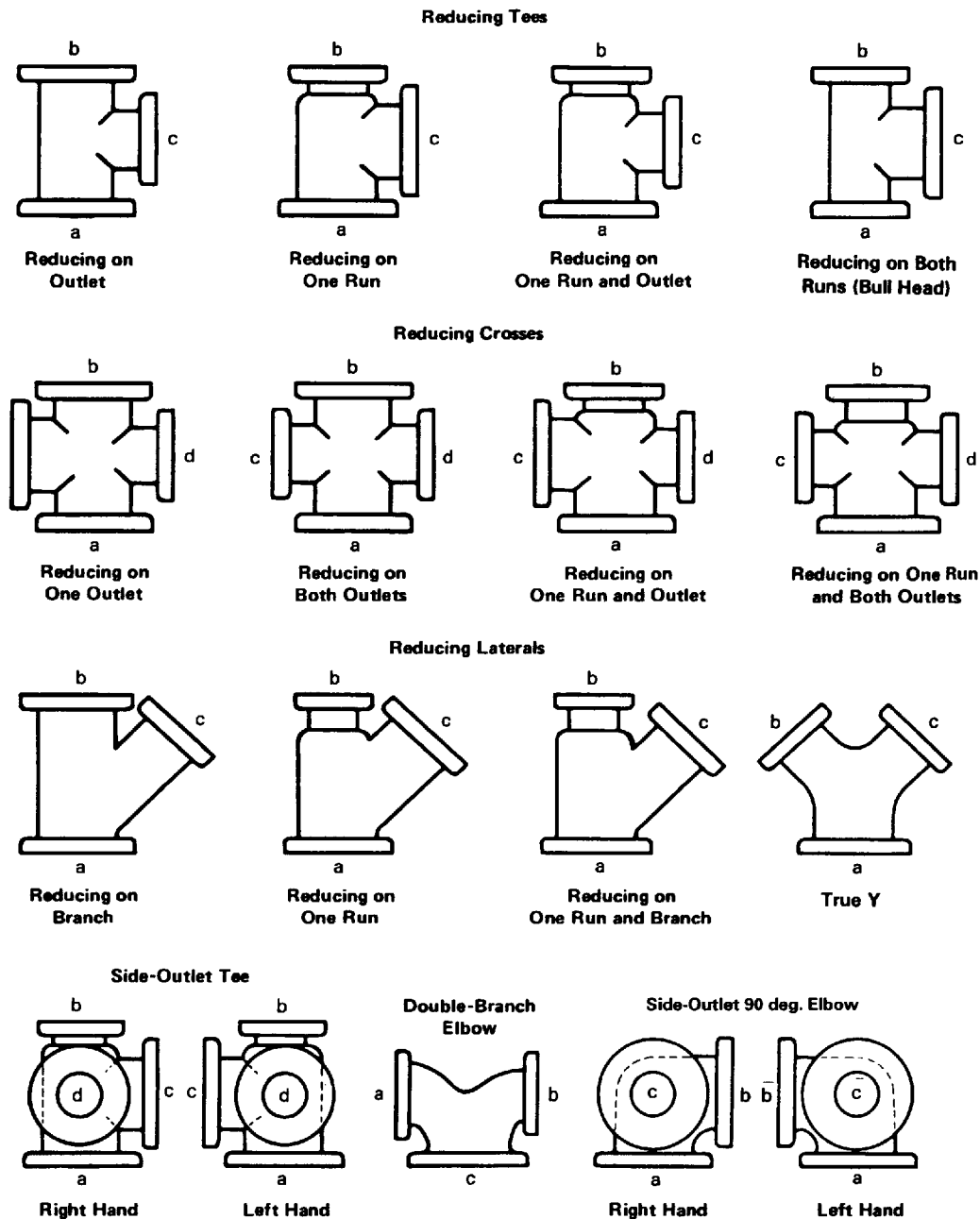
- (a) Pressure is in lb/sq in. gage.
 (b) NPS is nominal pipe size.

NOTES:**(1) Limitations:**

- (a) Class 25. When Class 25 cast iron flanges and flanged fittings are used for gaseous service, the maximum pressure shall be limited to 25 psig. Tabulated pressure-temperature ratings above 25 psig for Class 25 cast iron flanges and flanged fittings are applicable for nonshock hydraulic service only.
 (b) Class 250. When used for liquid service, the tabulated pressure-temperature ratings in NPS 14 and larger are applicable to Class 250 flanges only and not to Class 250 fittings.
 (2) 353°F (max.) to reflect the temperature of saturated steam at 125 psig.
 (3) 406°F (max.) to reflect the temperature of saturated steam at 250 psig.
 (4) Hydrostatic tests are not required unless specified by the user.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS



GENERAL NOTE:

The largest opening establishes the basic size of a reducing fitting. The largest opening is named first, except for bull-head tees, which are reducing on both runs, and double-branch elbows where both branches are reducing; the outlet is the largest opening and named last in both cases.

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.

FIG. 1 METHOD OF DESIGNATING OUTLETS OF REDUCING FITTINGS IN SPECIFICATIONS

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

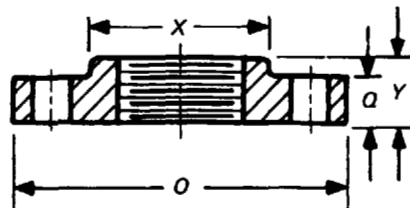


FIG. 2 CLASS 25 FLANGE

TABLE 2 FLANGES, BOLT HOLES, AND BOLTING DIMENSIONS OF CLASS 25 CAST IRON FLANGES

Nominal Pipe Size	Flanges		Hub		Bolt Holes		Bolting [Note (6)]		
	Diameter O	Thickness, Min. Q [Notes (1) and (2)]	Diameter, Min. X	Length, Min. Y	Diameter of Bolt Circle [Note (3)]	Diameter of Bolt Holes [Notes (3)–(5)]	Number of Bolts	Diameter of Bolts [Note (3)]	Length of Bolts
4	9.00	0.75	5.31	1.31	7.50	0.75	8	0.62	2.50
5	10.00	0.75	6.44	1.44	8.50	0.75	8	0.62	2.50
6	11.00	0.75	7.56	1.56	9.50	0.75	8	0.62	2.50
8	13.50	0.75	9.69	1.75	11.75	0.75	8	0.62	2.50
10	16.00	0.88	11.94	1.94	14.25	0.75	12	0.62	3.00
12	19.00	1.00	14.06	2.19	17.00	0.75	12	0.62	3.00
14	21.00	1.12	15.37	2.25	18.75	0.88	12	0.75	3.50
16	23.50	1.12	17.50	2.50	21.25	0.88	16	0.75	3.50
18	25.00	1.25	19.62	2.69	22.75	0.88	16	0.75	4.00
20	27.50	1.25	21.75	2.88	25.00	0.88	20	0.75	4.00
24	32.00	1.38	26.00	3.25	29.50	0.88	20	0.75	4.00
30	38.75	1.50	...	...	36.00	1.00	28	0.88	4.50
36	46.00	1.62	...	...	42.75	1.00	32	0.88	5.00
42	53.00	1.75	...	...	49.50	1.12	36	1.00	5.50
48	59.50	2.00	...	...	56.00	1.12	44	1.00	6.00
54	66.25	2.25	...	...	62.75	1.12	44	1.00	6.50
60	73.00	2.25	...	...	69.25	1.25	52	1.12	6.50
72	86.50	2.50	...	...	82.50	1.25	60	1.12	7.00
84	99.75	2.75	...	...	95.50	1.38	64	1.25	7.50
96	113.25	3.00	...	...	108.50	1.38	68	1.25	8.00

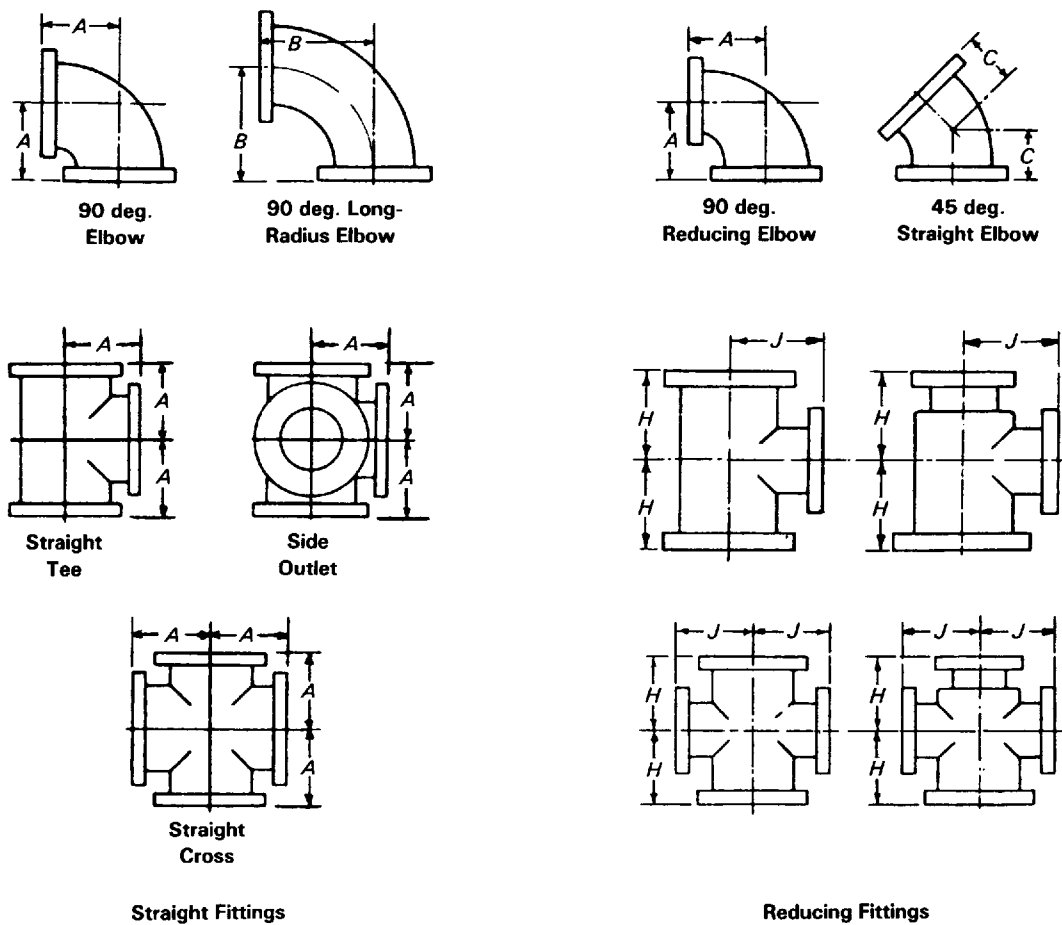
GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) For facing, see para. 6.2.1.
- (2) Threaded companion flanges should not be thinner than the Class 125 thickness on NPS 24 and smaller. Other types of flanges may have thicknesses as given above.
- (3) The flange diameter, bolt circle, and number of bolts are the same in Class 25 as in Class 125. Bolt hole diameters of Class 25 shall not be modified when mated with Class 125 flanges or with steel flanges.
- (4) For spot facing, see para. 6.7.
- (5) For flange bolt holes, see para. 6.6.
- (6) For bolts and nuts, see para. 7.1.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS



(For dimensions, see Table 3 on next page.)

FIG. 3 CLASS 25 FLANGED FITTINGS

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 3 DIMENSIONS OF CLASS 25 CAST IRON FLANGED FITTINGS¹⁻⁷

Nominal Pipe Size	Diameter of Flange	General			Straight Size [Note (4)]			Reducing Tees and Crosses (Short-Body Pattern) [Notes (13)–(15)]		
		Thickness of Flange, Min.	Wall Thickness of Body [Note (8)]	Inside Diameter of Fitting	Center- to-Face Elbow, Tee, and Cross A [Notes (9)–(11)]	Center- to- Face Long- Radius Elbow B	Center-to- Face 45 deg. Elbow C [Note (12)]	NPS Size of Outlet and Smaller [Notes (16) and (17)]	Center- to- Face Run H [Note (4)]	Center- to- Face Outlet J [Note (4)]
4	9.00	0.75	0.42	4	6.5	9.00	4.0	All reducing fittings NPS 16 and smaller have the same center-to-face dimensions as straight-size fittings.		
5	10.00	0.75	0.44	5	7.5	10.25	4.5			
6	11.00	0.75	0.44	6	8.0	11.50	5.0			
8	13.50	0.75	0.46	8	9.0	14.00	5.5			
10	16.00	0.88	0.50	10	11.0	16.50	6.5			
12	19.00	1.00	0.54	12	12.0	19.00	7.5			
14	21.00	1.12	0.57	14	14.0	21.50	7.5			
16	23.50	1.12	0.60	16	15.0	24.00	8.0			
18	25.00	1.25	0.64	18	16.5	26.50	8.5		12.0	13.0
20	27.50	1.25	0.67	20	18.0	29.00	9.5		14.0	17.0
24	32.00	1.38	0.76	24	22.0	34.00	11.0	16.0	15.0	19.0
30	38.75	1.50	0.88	30	25.0	41.50	15.0	20.0	18.0	23.0
36	46.00	1.62	0.99	36	28.0	49.00	18.0	24.0	20.0	26.0
42	53.00	1.75	1.10	42	31.0	56.50	21.0	24.0	23.0	30.0
48	59.50	2.00	1.26	48	34.0	64.00	24.0	30.0	26.0	34.0
54	66.25	2.25	1.35	54	39.0	71.50	27.0	36.0	29.0	37.0
60	73.00	2.25	1.39	60	44.0	79.00	30.0	40.0	33.0	41.0
72	86.50	2.50	1.62	72	53.0	94.00	36.0	48.0	40.0	48.0

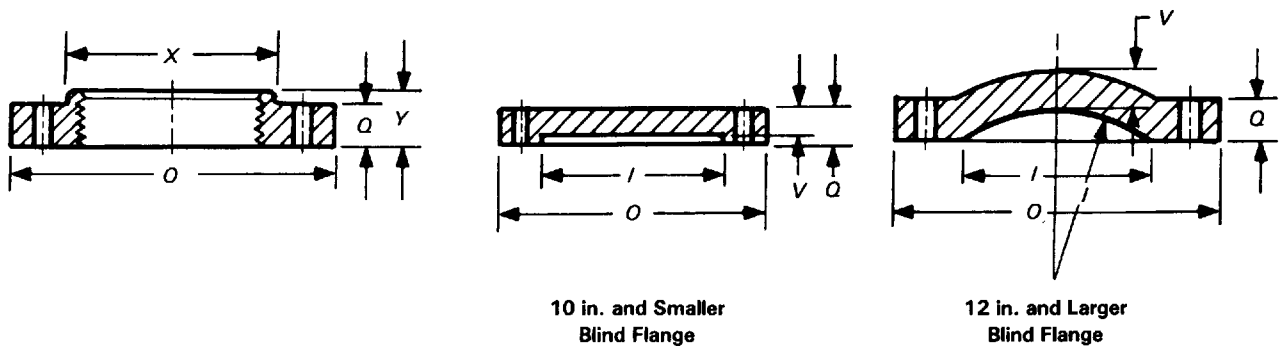
GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) For facing, see para. 6.2.1.
- (2) For flange bolt holes, refer to Table 2; see also para. 6.6.
- (3) For spot facing, see para. 6.7.
- (4) For center-to-face tolerances, see para. 6.4.
- (5) For intersecting centerlines of side outlets, see para. 6.3.1.
- (6) The flange diameter, bolt circle, and number of bolts are the same in Class 25 as in Class 125. Bolt hole diameters of Class 25 shall not be modified when mated with Class 125 flanges or with steel flanges.
- (7) The center-to-face dimensions of fittings are the same as the Class 125.
- (8) For wall thickness tolerance, see para. 6.1.
- (9) For center-to-face dimensions of reducing elbows and side-outlet elbows, see paras. 6.3.2(b) and (c).
- (10) Tees and crosses, reducing on run only, carry same dimensions center-to-face and face-to-face as a straight-size fitting of the larger opening.
- (11) For reinforcement of crosses, see para. 6.8.
- (12) For center-to-face dimensions of special degree elbows, see para. 6.3.2(d).
- (13) Fittings reducing on the run only carry same dimensions center-to-face and face-to-face as straight-size fittings, corresponding to the size of the larger opening. Tees increasing on outlet, known as bull-head tees, will have same center-to-face and face-to-face dimensions as a straight fitting of the size of the outlet. For example, an NPS 12 × NPS 12 × NPS 18 tee will be governed by the dimensions of the NPS 18 long-body tee, given in Table 3, namely NPS 16½ center-to-face of all openings and NPS 33 face-to-face.
- (14) Side-outlet tees, with outlet at 90 deg. or any other angle, straight or reducing, carry same dimensions center-to-face and face-to-face as regular tees having same reductions.
- (15) In a side-outlet tee, the larger of the two side outlets governs the center-to-face dimension J.
- (16) Tees, side-outlet tees, and crosses, NPS 16 and smaller, reducing on the outlet, have the same dimensions center-to-face and face-to-face as straight-size fittings, corresponding to the size of the larger opening. NPS 18 and larger, reducing on the outlet, are made in two lengths, depending on the size of the outlet as given in Table 3.
- (17) Long-body patterns are used when outlets are larger than given above and, therefore, have the same dimensions as straight-size fittings.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS



(For dimensions, see Table 4 on next page.)

FIG. 4 CLASS 125 FLANGES

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 4 FLANGES, BOLT HOLES, AND BOLTING DIMENSIONS OF CLASS 125 CAST IRON FLANGES

Nominal Pipe Size	Flanges		Hub		Blind Flanges		Bolt Holes		Bolting			
	Diam- eter of Flange O	Thick- ness of Flange, Min. Q [Note (1)]	Diam- eter of Hub, Min. X	Length of Hub and Threads, Min. Y [Note (2)]	Diam- eter of Port I [Note (3)]	Wall Thick- ness V [Note (4)]	Diam- eter of Bolt Circle [Notes (5) and (6)]	Diameter of Bolt Holes [Notes (5) and (6)]	Number of Bolts	Diam- eter of Bolts	Length of Bolts [Notes (7) and (8)]	Length of Bolt- Stud With Two Nuts [Note (7)]
1	4.25	0.44	1.94	0.69	1.00	0.38	3.12	0.62	4	0.50	2.00	...
1¼	4.62	0.50	2.31	0.81	1.25	0.44	3.50	0.62	4	0.50	2.00	...
1½	5.00	0.56	2.56	0.88	1.50	0.50	3.88	0.62	4	0.50	2.00	...
2	6.00	0.62	3.06	1.00	2.00	0.56	4.75	0.75	4	0.62	2.50	...
2½	7.00	0.69	3.56	1.12	2.50	0.63	5.50	0.75	4	0.62	2.50	...
3	7.50	0.75	4.25	1.19	3.00	0.69	6.00	0.75	4	0.62	2.50	...
3½	8.50	0.81	4.81	1.25	3.50	0.75	7.00	0.75	8	0.62	3.00	...
4	9.00	0.94	5.31	1.31	4.00	0.88	7.50	0.75	8	0.62	3.00	...
5	10.00	0.94	6.44	1.44	5.00	0.88	8.50	0.88	8	0.75	3.00	...
6	11.00	1.00	7.56	1.56	6.00	0.94	9.50	0.88	8	0.75	3.50	...
8	13.50	1.12	9.69	1.75	8.00	1.06	11.75	0.88	8	0.75	3.50	...
10	16.00	1.19	11.94	1.94	10.00	1.12	14.25	1.00	12	0.88	4.00	...
12	19.00	1.25	14.06	2.19	12.00	0.81	17.00	1.00	12	0.88	4.00	...
14	21.00	1.38	15.38	2.25	14.00	0.88	18.75	1.12	12	1.00	4.50	...
16	23.50	1.44	17.50	2.50	16.00	1.00	21.25	1.12	16	1.00	4.50	...
18	25.00	1.56	19.62	2.69	18.00	1.06	22.75	1.25	16	1.12	5.00	...
20	27.50	1.69	21.75	2.88	20.00	1.12	25.00	1.25	20	1.12	5.00	...
24	32.00	1.88	26.00	3.25	24.00	1.25	29.50	1.38	20	1.25	5.50	...
30	38.75	2.12	...	...	30.00	1.44	36.00	1.38	28	1.25	6.50	...
36	46.00	2.38	...	...	36.00	1.62	42.75	1.62	32	1.50	7.00	9.00
42	53.00	2.62	...	...	42.00	1.81	49.50	1.62	36	1.50	7.50	9.50
48	59.50	2.75	...	...	48.00	2.00	56.00	1.62	44	1.50	8.00	9.50
54	66.25	3.00	...	...	...	...	62.75	2.00	44	1.75	8.50	10.50
[Note (9)] 60	73.00	3.12	...	...	...	...	69.25	2.00	52	1.75	9.00	11.00
[Note (9)] 72	86.50	3.50	...	...	...	...	82.50	2.00	60	1.75	9.50	11.50
[Note (9)] 84	99.75	3.88	...	...	...	...	95.50	2.25	64	2.00	10.50	13.00
[Note (9)] 96	113.25	4.25	...	...	...	...	108.50	2.50	68	2.25	11.50	14.00
[Note (9)]												

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) For facing, see para. 6.2.1.
- (2) For thread of threaded flanges, see paras. 6.5.1 and 6.5.2.
- (3) All blind flanges NPS 12 and larger must be dished with inside radius equal to the port diameter.
- (4) For wall thickness tolerance, see para. 6.1.
- (5) For flange bolt holes, see para. 6.6.
- (6) For spot facing, see para. 6.7.
- (7) For bolts and nuts, see para. 7.1.
- (8) Bolt lengths to be compensated for when bolting steel to cast iron flanges.
- (9) These sizes are included for convenience. Pressure-temperature ratings are the user's responsibility.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

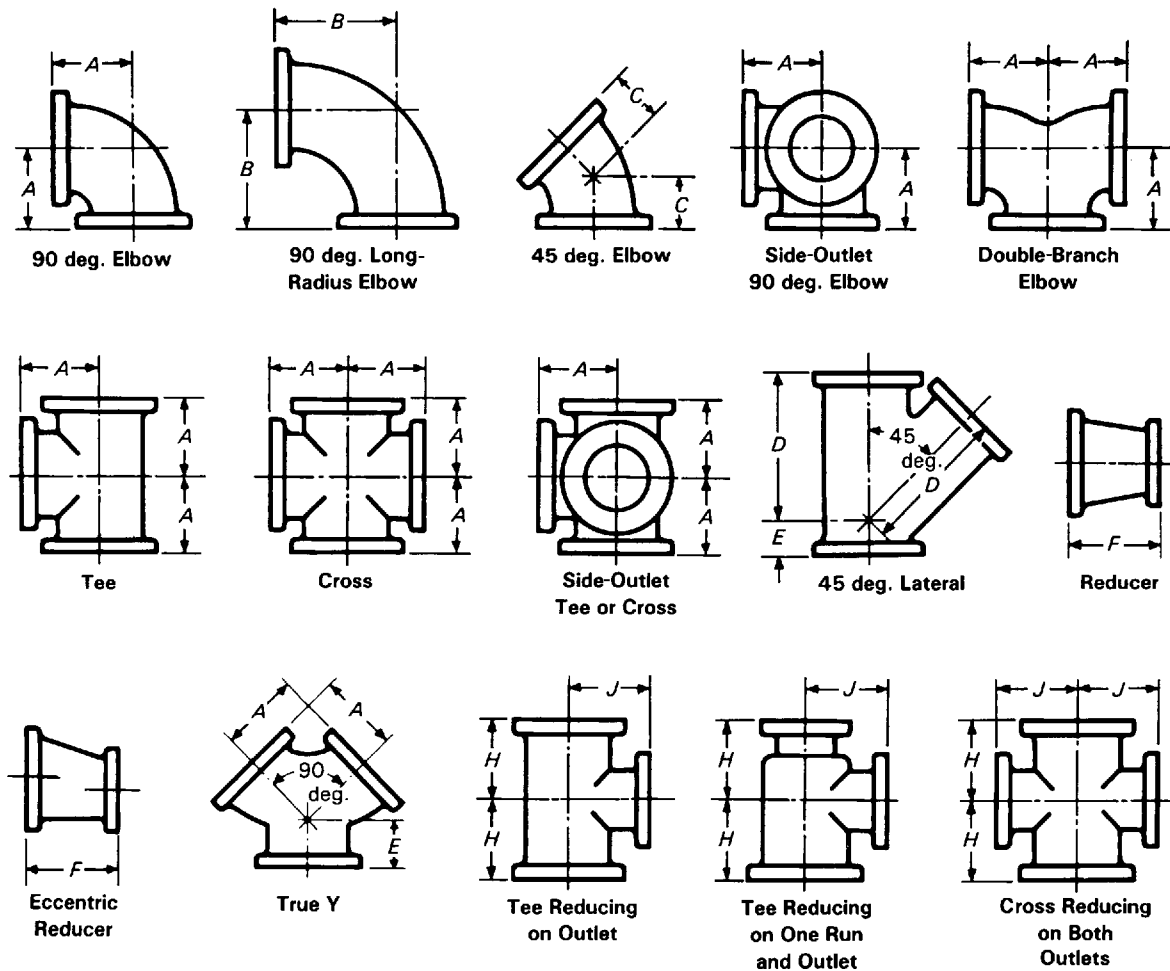
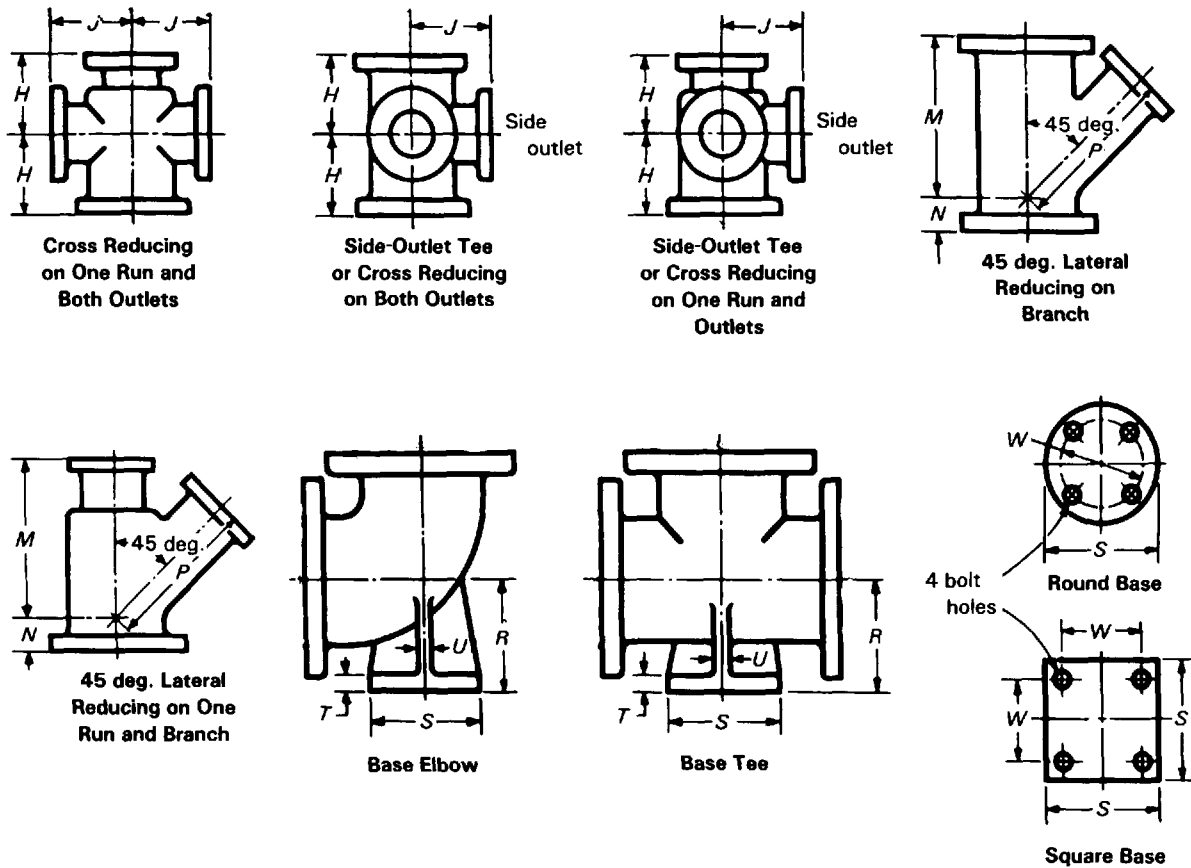


FIG. 5 CLASS 125 FLANGED FITTINGS

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998



(For dimensions, see Table 5 on next page.)

FIG. 5 CLASS 125 FLANGED FITTINGS (CONT'D)

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

TABLE 5 DIMENSIONS OF CLASS 125 CAST IRON FLANGED FITTINGS

Nom- inal Pipe Size	Straight Fittings [Notes (5) and (6)]										Reducing Fittings (Short-Body Patterns) [Notes (11) and (12)]			
	Center- to-Face 90 deg.					Center- to-Face 90 deg.					Tees and Crosses [Notes (9), (13), and (14)]			
	Elbow, Tees, Crosses, True Y, and Double- Branch Elbow					Long- Radius Elbow					NPS Size of Outlet and Smaller			
	General					Center- to-Face 45 deg. Elbow					Center- to-Face Outlet Run			
	Diam- eter of Flange Min.	Thick- ness of Flange	Thick- ness of Fittings	Wall Thickness	[Note (4)]	A [Notes (6)-(9)]	B [Notes (6)-(8)]	C [Note (8)]	D [Note (9)]	E [Note (9)]	F [Note (10)]	H [Notes (6) and (10)]	J [Notes (6) and (10)]	
1	4.25	0.44	1.00	0.31	0.31	3.50	5.00	1.75	5.75	1.75	...	...	...	
1 1/4	4.62	0.50	1.25	0.31	0.31	3.75	5.50	2.00	6.25	1.75	...	...	...	
1 1/2	5.00	0.56	1.50	0.31	0.31	4.00	6.00	2.25	7.00	2.00	...	...	...	
2	6.00	0.62	2.00	0.31	0.31	4.50	6.50	2.50	8.00	2.50	5.0	...	...	
2 1/2	7.00	0.69	2.50	0.31	0.31	5.00	7.00	3.00	9.50	2.50	5.5	...	...	
3	7.50	0.75	3.00	0.38	0.38	5.50	7.75	3.00	10.00	3.00	6.0	...	...	
3 1/2	8.50	0.81	3.50	0.44	0.44	6.00	8.50	3.50	11.50	3.00	6.5	...	...	
4	9.00	0.94	4.00	0.50	0.50	6.50	9.00	4.00	12.00	3.00	7.0	...	...	
5	10.00	0.94	5.00	0.50	0.50	7.50	10.25	4.50	13.50	3.50	8.0	...	...	
6	11.00	1.00	6.00	0.56	0.56	8.00	11.50	5.00	14.50	3.50	9.0	...	...	
8	13.50	1.12	8.00	0.62	0.62	9.00	14.00	5.50	17.50	4.50	11.0	...	...	
10	16.00	1.19	10.00	0.75	0.75	11.00	16.50	6.50	20.50	5.00	12.0	...	...	
12	19.00	1.25	12.00	0.81	0.81	12.00	19.00	7.50	24.50	5.50	14.0	...	...	
14	21.00	1.38	14.00	0.88	0.88	14.00	21.50	7.50	27.00	6.00	16.0	...	...	
16	23.50	1.44	16.00	1.00	1.00	15.00	24.00	8.00	30.00	6.50	18.0	...	...	
18	25.00	1.56	18.00	1.06	1.06	16.50	26.50	8.50	32.00	7.00	19.0	...	...	
20	27.50	1.69	20.00	1.12	1.12	18.00	29.00	9.50	35.00	8.00	20.0	...	...	
24	32.00	1.88	24.00	1.25	1.25	22.00	34.00	11.00	40.50	9.00	24.0	...	...	
30	38.75	2.12	30.00	1.44	1.44	25.00	41.50	15.00	49.00	10.00	30.0	...	...	
36	46.00	2.38	36.00	1.62	1.62	28.00	49.00	18.00	...	...	36.0	...	...	
42	53.00	2.62	42.00	1.81	1.81	31.00	56.50	21.00	...	...	42.0	...	...	
48	59.50	2.75	48.00	2.00	2.00	34.00	64.00	24.00	...	...	48.0	...	...	

(continued)

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 5 DIMENSIONS OF CLASS 125 CAST IRON FLANGED FITTINGS (CONT'D)

Reducing Fittings (Short-Body Patterns) [Notes (11) and (12)]					Base Elbows and Tees [Notes (15)–(17)]						
Nominal Pipe Size	Laterals [Note (9)]				Diameter of Round Base or Width of Square Base S [Notes (18) and (19)]	Thickness of Base T	Thickness of Ribs U	NPS Size of Supporting Pipe for Base	Base Drilling		
	NPS Size of Branch and Smaller	Center- to- Face Run M	Center- to- Face Run N	Center- to- Face Branch P					Bolt Circle or Bolt Spacing W	Diameter of Holes	
1					3.50	0.44	0.38	3/4	2.75	0.62	
1 1/4					3.62	0.44	0.38	3/4	2.75	0.62	
1 1/2					3.75	0.44	0.50	1	3.12	0.62	
2					4.12	0.50	0.50	1 1/4	3.50	0.62	
2 1/2					4.50	0.50	0.50	1 1/4	3.50	0.62	
3					4.88	0.56	0.50	1 1/2	3.88	0.62	
3 1/2					5.25	0.56	0.50	1 1/2	3.88	0.62	
4	All reducing laterals NPS 16 and smaller shall have the same center- to-face dimensions as straight-size fittings, corresponding to the size of the largest opening.				5.50	0.62	0.50	2	4.25	0.75	
5					6.25	0.69	0.62	2 1/2	5.50	0.75	
6					7.00	0.69	0.62	2 1/2	5.50	0.75	
8					8.75	0.94	0.88	4	7.50	0.75	
10				9.75	9.00	0.94	0.88	4	7.50	0.75	
12				11.25	11.00	1.00	1.00	6	9.50	0.88	
14				12.50	11.00	1.00	1.00	6	9.50	0.88	
16				13.75	11.00	1.00	1.00	6	9.50	0.88	
18	8	25.0	1.0	27.5	15.00	1.12	1.12	8	11.75	0.88	
20	10	27.0	1.0	29.5	16.00	1.12	1.12	8	11.75	0.88	
24	12	31.5	0.5	34.5	18.50	1.12	1.12	8	11.75	0.88	
30	14	39.0	0.0	42.0	...	...	...	...	...	...	

(continued)

(continued)

TABLE 5 (CONT'D)

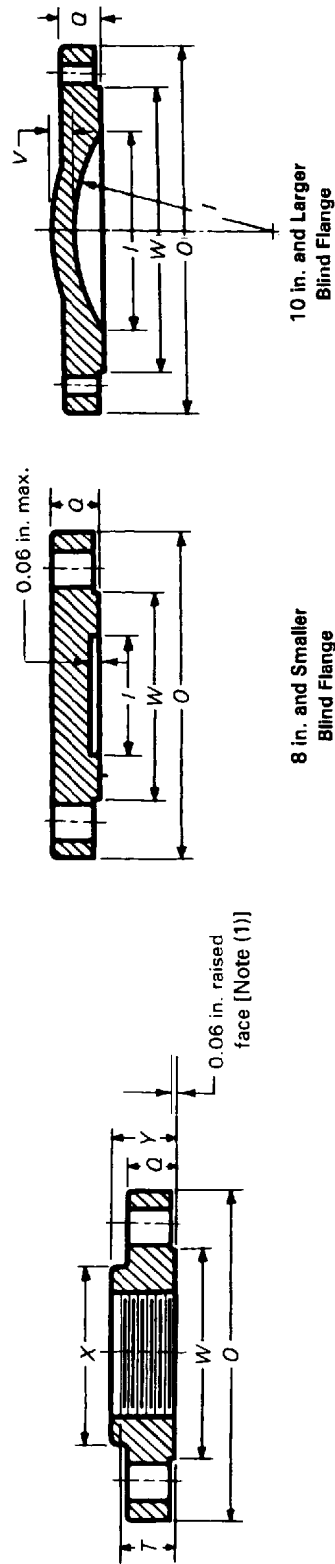
GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) For facing, see para. 6.2.1.
- (2) For flange bolt holes, refer to Table 4 and para. 6.6.
- (3) For spot facing, see para. 6.7.
- (4) For wall thickness tolerances, see para. 6.1.
- (5) For center-to-face tolerances, see para. 6.4.
- (6) For intersecting centerlines of side-outlet fittings, see para. 6.3.1.
- (7) For center-to-face dimensions of reducing elbows and side-outlet elbows, see paras. 6.3.2(b) and (c).
- (8) For center-to-face dimensions of special degree elbows, see para. 6.3.2(d).
- (9) For reinforcement of crosses and laterals, see para. 6.8.
- (10) For face-to-face dimensions of reducers and eccentric reducers, see para. 6.3.5.
- (11) For center-to-face dimensions of tees and crosses having outlets and laterals having branches larger than given above, see para. 6.3.3(b).
- (12) For center-to-face dimensions of tees, crosses, and laterals reducing on run only, see para. 6.3.3(b).
- (13) For center-to-face dimensions of tees reducing on both runs, known as bull-head tees, see para. 6.3.3(b).
- (14) For center-to-face dimensions of reducing side-outlet tees and crosses having two different size reductions on the outlets, see para. 6.3.3(b).
- (15) Bases are furnished only when specified by the purchaser.
- (16) For tees, sizes larger than 24 in., anchorage fittings are recommended. See Table 8.
- (17) The base dimension applies to all straight and reducing sizes.
- (18) For reducing fittings, the size and center-to-face dimensions of base are determined by the size of the largest opening of the fitting. In the case of reducing base elbows, orders shall specify whether the base shall be opposite the larger or smaller opening.
- (19) Bolt hole template shown for round base is the same as for the flange of the supporting pipe size, except using only four holes in all cases so placed as to straddle centerlines. The bases of these fittings are intended for support in compression and are not to be used for anchors or supports in tension or shear.

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998



NOTE:
(1) Diameter of raised face has tolerance of ± 0.03 in.

NOTE:
(1) Diameter of raised face has tolerance of ± 0.03 in.

FIG. 6 CLASS 250 FLANGES

(For dimensions, see Table 6 on next page.)

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

TABLE 6 FLANGES, BOLT HOLES, AND BOLTING DIMENSIONS OF CLASS 250 CAST IRON FLANGES

Nominal Pipe Size	Flanges		Blind Flanges [Note (2)]			Hubs		Bolt Holes			Bolting [Note (6)]			Length of Stud Bolts [Note (8)]
	Diam- eter of Flange O	Thick- ness of Flange, Min. Q	Diameter of Raised Face W [Note (1)]	Diam- eter of Port /	Wall Thick- ness V [Note (3)]	Diam- eter of Hub, Min. X	Length Through Hub, Min. Y	Length of Threads, Min. T [Note (4)]	Diam- eter of Bolt Circle [Note (5)]	Diam- eter of Bolts [Note (7)]	Number of Bolts [Note (7)]	Length of Bolts [Note (8)]		
1	4.88	0.69	2.69	1.00	...	2.06	0.88	0.68	3.50	0.75	4	0.62	2.50	...
1¼	5.25	0.75	3.06	1.25	...	2.50	1.00	0.81	3.88	0.75	4	0.62	2.50	...
1½	6.12	0.81	3.56	1.50	...	2.75	1.12	0.87	4.50	0.88	4	0.75	3.00	...
2	6.50	0.88	4.19	2.00	...	3.31	1.25	1.00	5.00	0.75	8	0.62	3.00	...
2½	7.50	1.00	4.94	2.50	...	3.94	1.43	1.13	5.88	0.88	8	0.75	3.50	...
3	8.25	1.12	5.69	3.00	...	4.62	1.56	1.19	6.62	0.88	8	0.75	3.50	...
3½	9.00	1.19	6.31	3.50	...	5.25	1.62	1.25	7.25	0.88	8	0.75	3.50	...
4	10.00	1.25	6.94	4.00	...	5.75	1.75	1.31	7.88	0.88	8	0.75	4.00	...
5	11.00	1.38	8.31	5.00	...	7.00	1.88	1.44	9.25	0.88	8	0.75	4.00	...
6	12.50	1.44	9.69	6.00	...	8.12	1.94	1.56	10.62	0.88	12	0.75	4.00	...
8	15.00	1.62	11.94	8.00	...	10.25	2.19	1.75	13.00	1.00	12	0.88	4.50	...
10	17.50	1.88	14.06	10.00	0.94	12.62	2.38	1.94	15.25	1.12	16	1.00	5.50	...
12	20.50	2.00	16.44	12.00	1.00	14.75	2.56	2.19	17.75	1.25	16	1.12	5.50	...
14	23.00	2.12	18.94	13.25	1.12	16.25	2.69	2.25	20.25	1.25	20	1.12	6.00	...
16	25.50	2.25	21.06	15.25	1.25	18.38	2.88	2.50	22.50	1.38	20	1.25	6.50	...
18	28.00	2.38	23.31	17.00	1.38	...	...	...	24.75	1.38	24	1.25	6.50	...
20	30.50	2.50	25.56	19.00	1.50	...	...	...	27.00	1.38	24	1.25	7.00	...
24	36.00	2.75	30.31	23.00	1.62	...	...	...	32.00	1.62	24	1.50	7.50	9.50
30	43.00	3.00	37.19	29.00	2.00	...	...	...	39.25	2.00	28	1.75	8.50	10.50
36	50.00	3.38	43.69	...	...	...	...	...	46.00	2.25	32	2.00	9.50	12.00
[Note (9)]														
42	57.00	3.69	50.44	...	...	...	...	...	52.75	2.25	36	2.00	10.00	12.50
[Note (9)]														
48	65.00	4.00	58.44	...	...	...	...	...	60.75	2.25	40	2.00	11.00	13.00
[Note (9)]														

(continued)

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 6 (CONT'D)

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) For facings, see para. 6.2.2.
- (2) All blind flanges for NPS 10 and larger must be dished with inside radius equal to the port diameter.
- (3) For wall thickness tolerance, see para. 6.1.
- (4) For thread of threaded flanges, see paras. 6.5.1 and 6.5.3.
- (5) For flange bolt holes, see para. 6.6.
- (6) For bolts and nuts, see para. 7.1.
- (7) For spot facing, see para. 6.7.
- (8) When bolting to steel flanges, longer bolts or studs shall be used.
- (9) Fittings in these sizes are not produced and used in sufficient quantities to warrant standardization; however, the flange dimensions are included for convenience where special fittings larger than NPS 30 are required. When these fittings are made, the body structure should be designed to be the equivalent of the flanges in service pressure ratings.

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

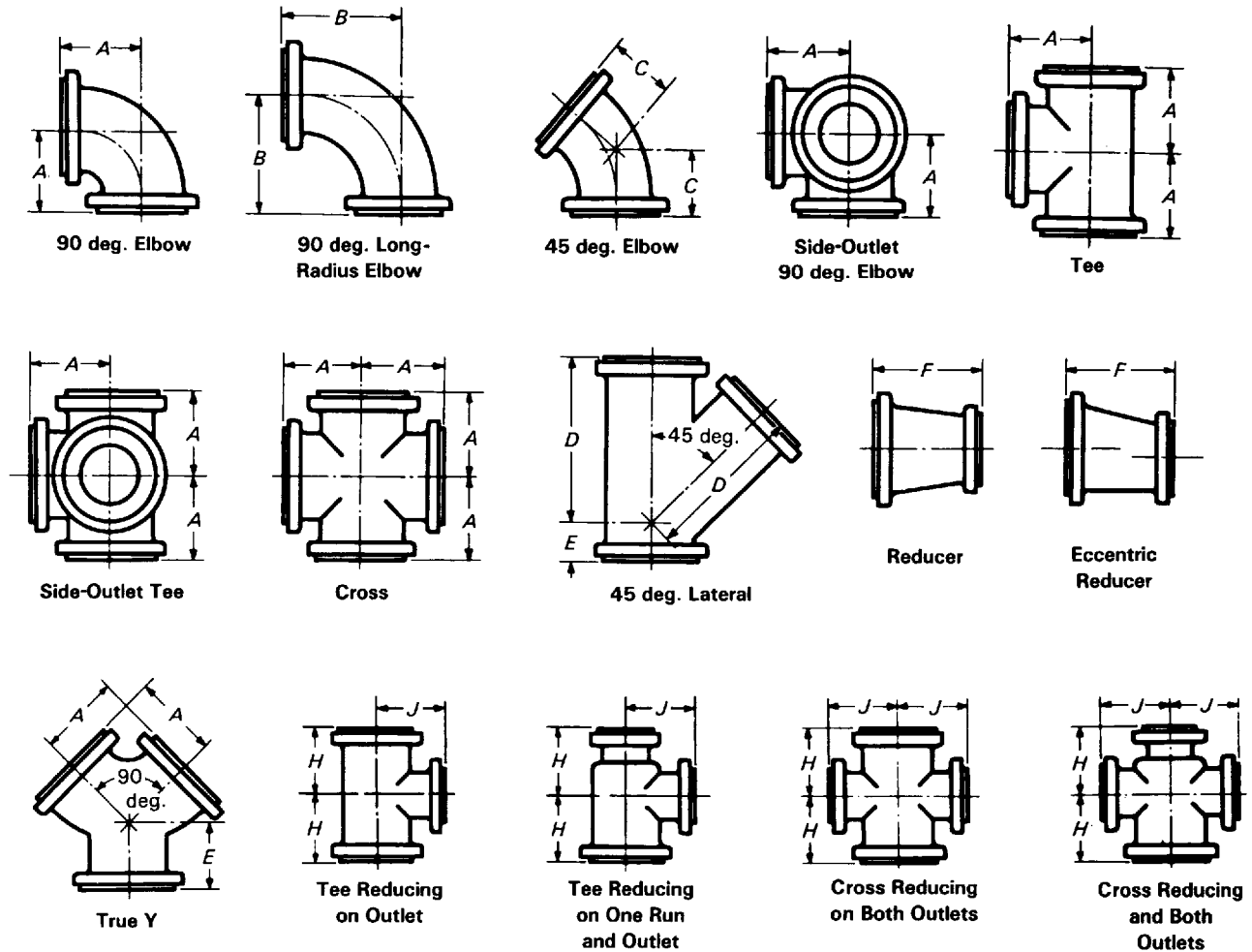
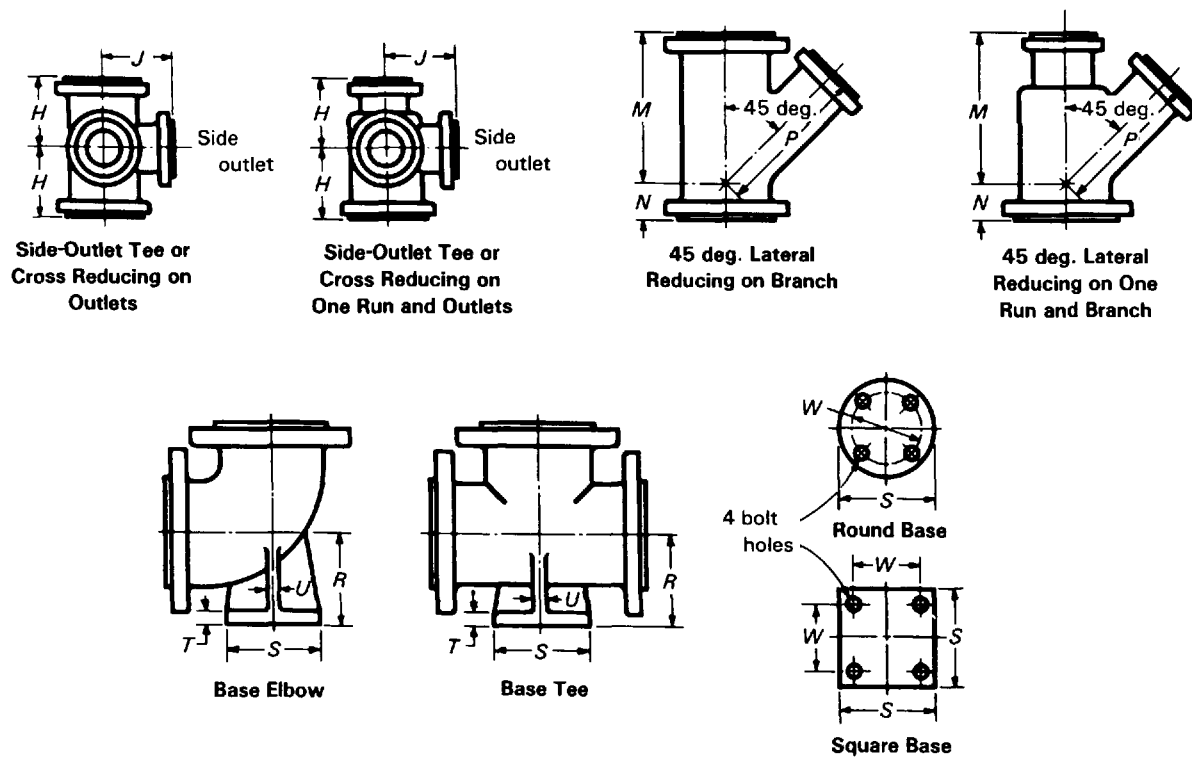


FIG. 7 CLASS 250 FLANGED FITTINGS

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998



(For dimensions, see Table 7 on next page.)

FIG. 7 CLASS 250 FLANGED FITTINGS (CONT'D)

ASME B16.1-1998

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

TABLE 7 DIMENSIONS OF CLASS 250 CAST IRON FLANGED FITTINGS

Nomi- nal Pipe Size	Flanges [Notes (1)-(3)]			General Fittings [Notes (5) and (6)]			Straight Fittings [Notes (5) and (6)]					Reducing (Short Body) Tees and Crosses [Notes (10), (13), and (14)]				
	Diam- eter of Flange, Thick- ness of Min.	Diam- eter of Raised Face [Note (4)]	Thick- ness of Face [Note (4)]	Inside Diam- eter of Fittings [Note (7)]	Body Wall Thick- ness [Note (7)]	Center- to-Face 90 deg. Elbow, Tees, Crosses, and True Y [Notes (8)-(10)]	Center- to-Face 90 deg. Long- Radius Elbow [Notes (6), (8), and (9)]	Center- to-Face 45 deg. Elbow [Notes (6), (8), and (9)]	Center-to- Face Lateral [Notes (10) and (11)]	Face-to- Face and Lateral [Notes (10) and (11)]	Face-to- Face Reducer F [Note (12)]	NPS Size of Outlet and Smaller [Notes (6) and (12)]	Center- to-Face Run H [Notes (8) and (9)]	Center-to- Face Outlet or Side J [Notes (8) and (9)]		
1	4.88	0.69	2.69	1.00	0.44	4.00	5.00	2.00	6.50	2.00	...	...	...	...	...	...
1 1/4	5.25	0.75	3.06	1.25	0.44	4.25	5.50	2.50	7.25	2.25	...	...	...	...	...	...
1 1/2	6.12	0.81	3.56	1.50	0.44	4.50	6.00	2.75	8.50	2.50	...	...	...	...	...	...
2	6.50	0.88	4.19	2.00	0.44	5.00	6.50	3.00	9.00	2.50	5.0	...	...	...	...	...
2 1/2	7.50	1.00	4.94	2.50	0.50	5.50	7.00	3.50	10.50	2.50	5.5	...	...	...	...	...
3	8.25	1.12	5.69	3.00	0.56	6.00	7.75	3.50	11.00	3.00	6.0	...	...	...	...	...
3 1/2	9.00	1.19	6.31	3.50	0.56	6.50	8.50	4.00	12.50	3.00	6.5	...	...	...	...	...
4	10.00	1.25	6.94	4.00	0.62	7.00	9.00	4.50	13.50	3.00	7.0	...	...	...	...	...
5	11.00	1.38	8.31	5.00	0.69	8.00	10.25	5.00	15.00	3.50	8.0	...	...	...	...	...
6	12.50	1.44	9.69	6.00	0.75	8.50	11.50	5.50	17.50	4.00	9.0	...	...	...	...	...
8	15.00	1.62	11.94	8.00	0.81	10.00	14.00	6.00	20.50	5.00	11.0	...	...	...	...	...
10	17.50	1.88	14.06	10.00	0.94	11.50	16.50	7.00	24.00	5.50	12.0	...	...	...	...	...
12	20.50	2.00	16.44	12.00	1.00	13.00	19.00	8.00	27.50	6.00	14.0	...	...	...	...	...
14	23.00	2.12	18.94	13.25	1.12	15.00	21.50	8.50	31.00	6.50	16.0	...	...	...	...	...
16	25.50	2.25	21.06	15.25	1.25	16.50	24.00	9.50	34.50	7.50	18.0	...	...	...	...	...
18	28.00	2.38	23.31	17.00	1.38	18.00	26.50	10.00	37.50	8.00	19.0	12	14.0	17.0	...	...
20	30.50	2.50	25.56	19.00	1.50	19.50	29.00	10.50	40.50	8.50	20.0	14	15.5	18.5	...	...
24	36.00	2.75	30.31	23.00	1.62	22.50	34.00	12.00	47.50	10.00	24.0	16	17.0	21.5	...	...
30	43.00	3.00	37.19	29.00	2.00	27.50	41.50	15.00	...	...	30.0	20	20.5	25.5	...	...

(continued)

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 7 DIMENSIONS OF CLASS 250 CAST IRON FLANGED FITTINGS (CONT'D)

Nominal Pipe Size	Reducing (Short Body) [Notes (11) and (15)]				Base, Elbows, and Tees [Notes (16)-(18)]					
	Laterals [Note (10)]				Diameter of Round Base or Width of Square Base S [Note (19)]	Thickness of Base T	Thickness of Ribs U	NPS Size of Supporting Pipe for Base	Base Drilling [Note (20)]	
	NPS Size of Branch and Smaller	Center- to- Face Run M	Center- to- Face Run N	Center- to- Face Branch P					Bolt Circle or Bolt Spacing W	Diameter of Holes
2					4.50	0.75	0.50	1 1/4	3.88	0.75
2 1/2					4.75	0.75	0.50	1 1/4	3.88	0.75
3					5.25	0.81	0.62	1 1/2	4.50	0.88
3 1/2					5.62	0.81	0.62	1 1/2	4.50	0.88
4					6.00	0.88	0.62	2	5.00	0.75
5	All reducing laterals NPS 16 and smaller shall have the same center- to-face dimensions as straight-size fittings, corresponding to the size of the largest opening.				6.75	1.00	0.75	2 1/2	5.88	0.88
6					7.50	1.00	0.75	2 1/2	5.88	0.88
8					9.00	1.25	0.88	4	7.88	0.88
10					10.50	1.25	0.88	4	7.88	0.88
12					12.00	1.44	1.00	6	10.62	0.88
14					13.50	1.44	1.00	6	10.62	0.88
16					14.75	1.44	1.12	6	10.62	0.88
18	8	31	3	32.5	16.25	1.62	1.12	8	13.00	1.00
20	10	34	3	36	17.88	1.62	1.25	8	13.00	1.00
24	12	41	3	43	20.75	1.88	1.25	10	15.25	1.12

(continued)

TABLE 7 (CONT'D)

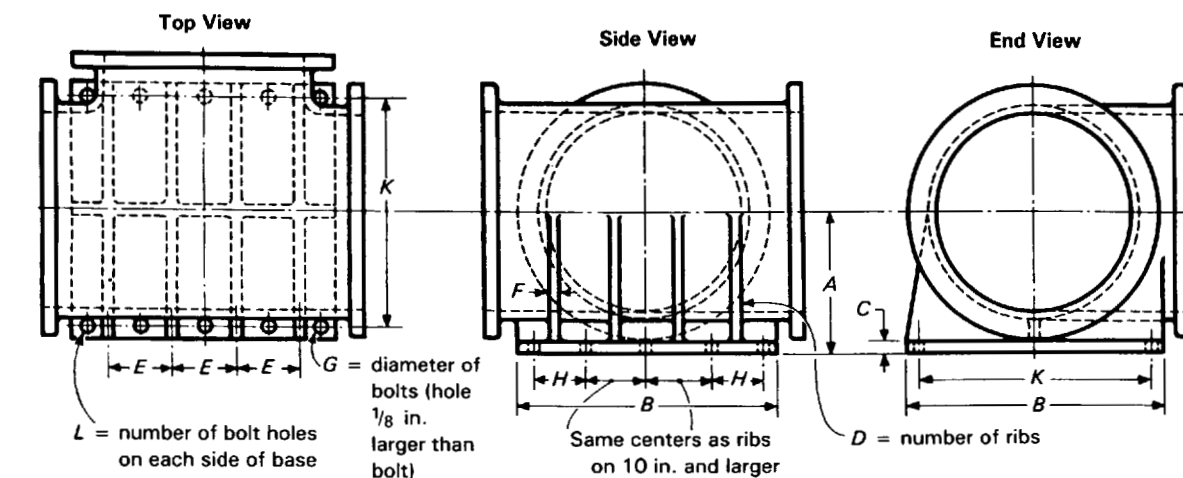
GENERAL NOTE: Dimensions are in inches.

NOTES:

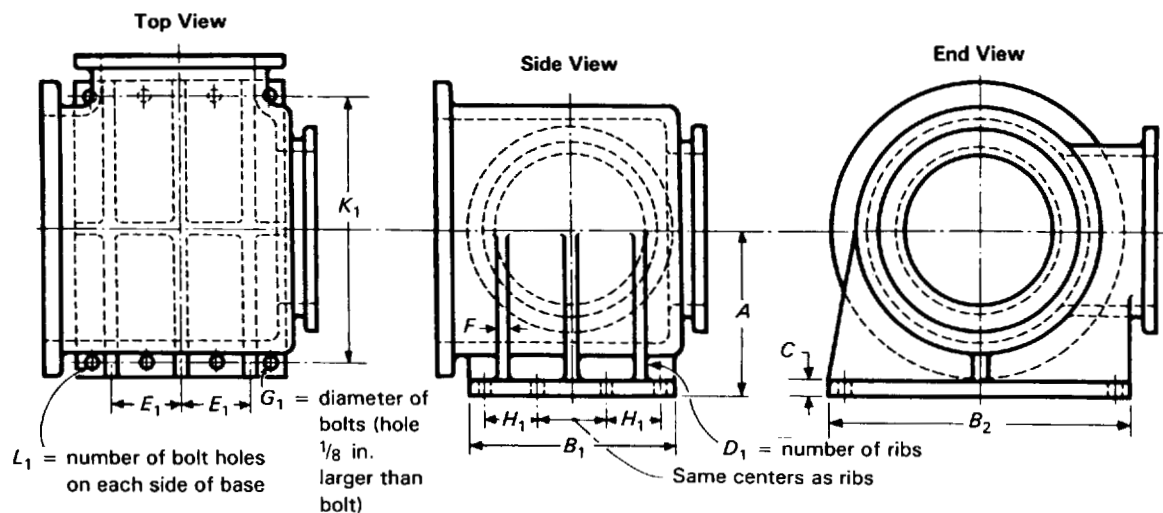
- (1) For facing, see para. 6.2.2.
- (2) For flange bolt holes, refer to Table 6 and para. 6.6.
- (3) For spot facing, see para. 6.7.
- (4) Tolerance of the diameter of the raised face is equal to ± 0.03 in.
- (5) For center-to-face tolerances, see para. 6.4.
- (6) For intersecting centerlines of side-outlet fittings, see para. 6.3.1.
- (7) For wall thickness tolerances, see para. 6.1.
- (8) For center-to-face dimensions of reducing elbows and side-outlet elbows, see paras. 6.3.2(b) and (c).
- (9) For center-to-face dimensions of special degree elbows, see para. 6.3.2(d).
- (10) For reinforcement of crosses and laterals, see para. 6.8.
- (11) For center-to-face dimensions of tees and crosses having outlets and laterals having branches larger than given above, see para. 6.3.3(b).
- (12) For face-to-face dimensions of reducers and eccentric reducers, see para. 6.3.5.
- (13) For center-to-face dimensions of tees reducing on both runs, known as bull-head tees, see para. 6.3.3(c).
- (14) For center-to-face dimensions of reducing side-outlet tees and crosses having two different size reductions on the outlet, see para. 6.3.3(b).
- (15) For center-to-face dimensions of tees, crosses, and laterals reducing on run only, see para. 6.3.3(b).
- (16) Bases are furnished only when specified by purchaser.
- (17) The base dimensions apply to all straight and reducing sizes.
- (18) For tees, sizes larger than NPS 24, anchorage fittings are recommended. See Table 9.
- (19) For reducing fittings, the size and center-to-face dimensions of base are determined by the size of the largest opening of the fitting. In the case of reducing base elbows, orders shall specify whether the base shall be opposite the larger or smaller opening.
- (20) Bolt hole template shown for round base is the same as for the flange of the supporting pipe size, except using only four holes in all cases so placed as to straddle centerlines. The bases of these fittings are intended for support in compression and are not to be used for anchors or supports in tension or shear.

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998



Straight Sizes



Reducing Sizes, Short Body Pattern

(For dimensions, see Table 8 on next page.)

FIG. 8 CLASS 125 TEES
Anchorage Bases

**TABLE 8 DIMENSIONS OF
ANCHORAGE BASES FOR STRAIGHT AND REDUCING CLASS 125 TEES^{1, 2}**

Nominal Pipe Size	Common to Both Straight Sizes and Reducing Sizes				Straight Sizes					
	Center- to- Base- A	Thickness of Base C [Note (3)]	Diameter of Bolts G	Thickness of Ribs F	Width and Length of Square Base B	Trans- verse Bolt Centers K	Number of Bolt Holes on Each Side of Base L	Number of Ribs D	Centers of Ribs and Inside Bolt Holes E	Longi- tudinal Centers From End Bolt to Second End H
2½	4.50	0.69	0.62	0.44	7.00	4.50	2	1	...	4.50
3	4.88	0.75	0.62	0.44	7.50	5.00	2	1	...	5.00
3½	5.25	0.81	0.62	0.44	8.50	6.00	2	1	...	6.00
4	5.50	0.94	0.62	0.50	9.00	6.50	3	2	4.25	3.25
5	6.25	0.94	0.88	0.50	10.00	7.50	3	2	5.00	3.25
6	7.00	1.00	0.88	0.56	11.00	8.75	3	2	6.00	4.38
8	8.38	1.12	1.00	0.62	13.50	11.00	3	2	8.00	5.50
10	9.25	1.19	1.12	0.75	16.00	13.38	4	3	4.88	4.25
12	11.25	1.25	1.12	0.81	19.00	15.50	4	3	5.75	4.88
14	12.50	1.38	1.25	0.88	21.00	17.75	4	3	6.75	5.50
16	13.75	1.44	1.38	1.00	23.50	19.75	4	3	7.75	6.00
18	15.00	1.56	1.38	1.06	25.00	21.75	4	3	8.50	6.62
20	16.00	1.69	1.50	1.12	27.50	24.00	4	3	9.50	7.25
24	18.50	1.88	1.62	1.25	32.00	28.38	4	3	11.38	8.50
30	22.00	2.12	1.75	1.44	38.75	34.50	5	4	9.38	7.88
36	25.50	2.38	1.88	1.62	46.00	40.75	5	4	11.25	9.12
42	29.25	2.62	2.00	1.81	53.00	46.75	5	4	13.00	10.38
48	32.75	2.75	2.25	2.00	59.50	53.25	5	4	14.88	11.75

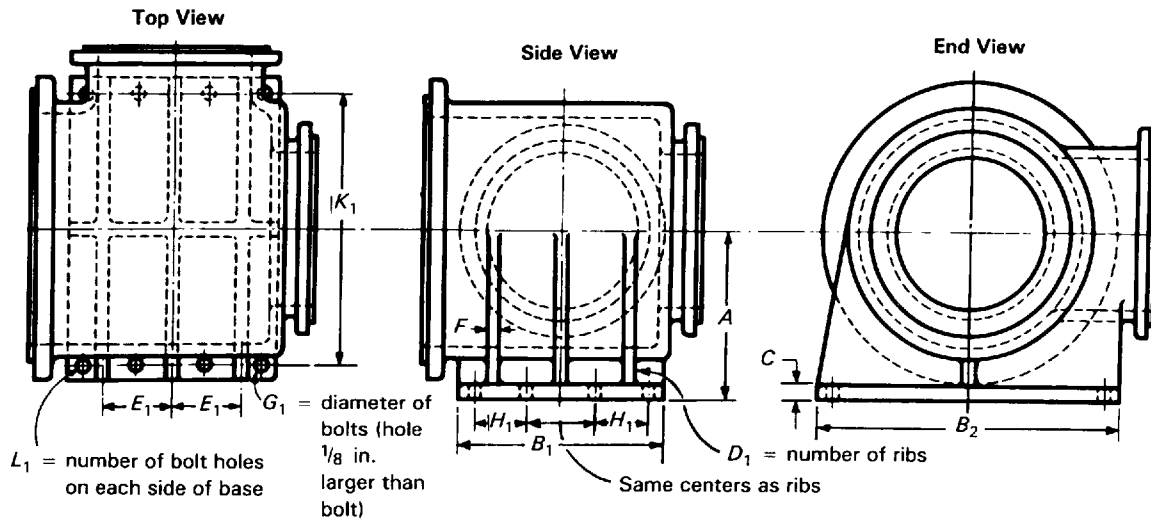
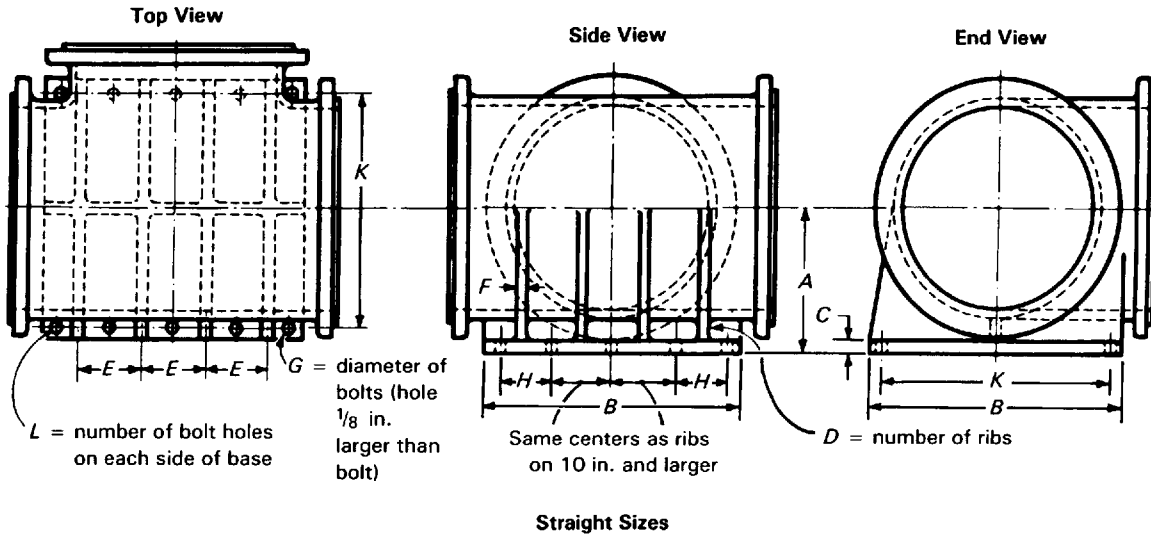
GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) Bases are furnished only when specified by the purchaser.
- (2) For tee dimensions, refer to Table 5.
- (3) For NPS 18 and larger, if the outlet is the same size or smaller than given for reducing tees, the base dimensions shown in this Table shall be used. If the outlet is larger than shown for reducing tees, the base dimensions shall be the same as for the straight-size tee, corresponding to the size of the largest opening.
- (4) Tees reducing on run only shall have the same base dimensions as straight-size tees, corresponding to the size of the largest opening.

**TABLE 8 DIMENSIONS OF
ANCHORAGE BASES FOR STRAIGHT AND REDUCING CLASS 125 TEES^{1, 2}**

Reducing Tees [Notes (3) and (4)] (Short-Body Pattern)									
NPS Outlet Sizes and Smaller	Length of Base B_1 [Note (3)]	Number of Ribs D_1	Centers of Ribs E_1	Diameter of Bolts G_1	Longitudinal Center From End Bolt to Second Bolt H_1	Trans- verse Bolt Centers K_1	Number of Bolt Holes on Each Side of Base L_1	Width of Base B_2	Nominal Pipe Size
									2½
									3
									3½
									4
									5
Reducing tee NPS 16 and smaller shall have the same base B dimensions as a straight-size tee, corresponding to the size of the largest opening.									6
									8
									10
									12
									14
									16
12	19.00	3	5.25	1.25	5.12	21.50	4	24.75	18
14	21.00	3	6.00	1.25	5.38	23.75	4	26.75	20
16	23.50	3	7.00	1.38	6.25	28.00	4	31.62	24
20	27.50	3	9.00	1.50	7.25	34.25	4	39.00	30
24	32.00	3	10.75	1.50	8.38	41.50	4	46.25	36
24	36.50	4	8.50	1.62	7.50	48.50	5	54.75	42
30	41.75	4	9.75	1.62	8.25	53.75	5	60.00	48



(For dimensions, see Table 9 on next page.)

**FIG. 9 CLASS 250 TEES
Anchorage Bases**

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998

TABLE 9 DIMENSIONS OF ANCHORAGE BASES FOR STRAIGHT AND REDUCING CLASS 250 TEES^{1, 2}

Common on Both Straight Sizes and Reducing Sizes					Straight Sizes				Reducing Sizes (Short-Body Pattern) [Notes (3) and (4)]							
Nomi- nal Pipe Size	Center- to- Base A	Thickness of Base C	Diam- eter of Bolts G	Thick- ness of Ribs F	Width and Length of Square Base B	Trans- verse Bolt Centers K	Number of Bolt Holes on Each Side of Base L	Number of Ribs D	Centers of Ribs E	Longitudi- nal Center From End Bolt to Second Bolt H	NPS Outlet Sizes and Smaller [Note (2)]	Length of Base B ₁ Centers [Note (3)]	Longitudi- nal Center			
													From End Bolt to Second Bolt H ₁	Bolt to Second Bolt H ₁	Trans- verse Bolt Centers K ₁	
2½	4.75	0.75	0.62	0.56	7.50	5.75	2	1	...	5.75						
3	5.25	0.81	0.62	0.56	8.25	6.50	2	1	...	6.50						
3½	5.62	0.94	0.62	0.56	9.00	7.25	2	1	...	7.25						
4	6.00	0.94	0.62	0.62	10.00	7.75	3	2	4	3.78						
5	6.75	1.00	0.88	0.69	11.00	8.75	3	2	5	4.38						
6	7.50	1.06	0.88	0.75	12.50	10.25	3	2	6	5.12						
8	9.00	1.12	1.00	0.81	15.00	12.50	3	2	8	6.25						
10	10.50	1.25	1.12	0.94	17.50	14.75	4	3	5	4.88						
12	12.00	1.25	1.25	1.00	20.50	17.50	4	3	6	5.75						
14	13.50	1.38	1.25	1.12	23.00	20.00	4	3	7	6.50						
Reducing tee NPS 16 and smaller shall have the same base B dimensions as a straight-size tee, corresponding to the size of the largest opening.																
16	14.75	1.56	1.38	1.25	25.50	22.00	4	3	8	7.00						
18	16.25	1.69	1.38	1.38	28.00	24.25	4	3	9	7.38	12	20.5	6.50	5.25	24.5	28.25
20	17.88	1.88	1.50	1.50	30.50	26.75	4	3	10	8.38	14	23.0	7.00	6.00	26.5	30.25
24	20.75	2.06	1.62	1.62	36.00	31.75	4	3	12	9.88	16	25.5	8.12	6.69	32.0	36.25
30	24.75	2.31	1.75	2.00	43.00	38.00	5	4	10	9.00	20	30.5	6.62	6.12	38.0	43.00

Reducing tee NPS 16 and smaller shall have the same base B dimensions as a straight-size tee, corresponding to the size of the largest opening.

GENERAL NOTE: Dimensions are in inches.

NOTES:

(1) Bases are furnished only when specified by the purchaser.

(2) For tee dimensions, refer to Table 7.

(3) For NPS 18 and larger, if the outlet is the same size or smaller than given for reducing tees, the base dimensions as shown in this Table for reducing tees shall be used. If the outlet is larger than shown for reducing tees, the base dimensions shall be the same as for the straight-size tees, corresponding to the size of the largest opening.

(4) Tees reducing on run only shall have the same base dimensions as straight-size tees, corresponding to the size of the largest opening.

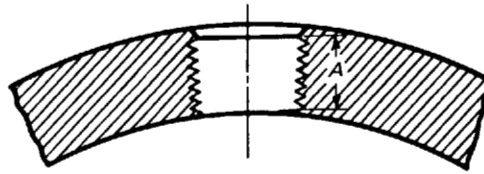


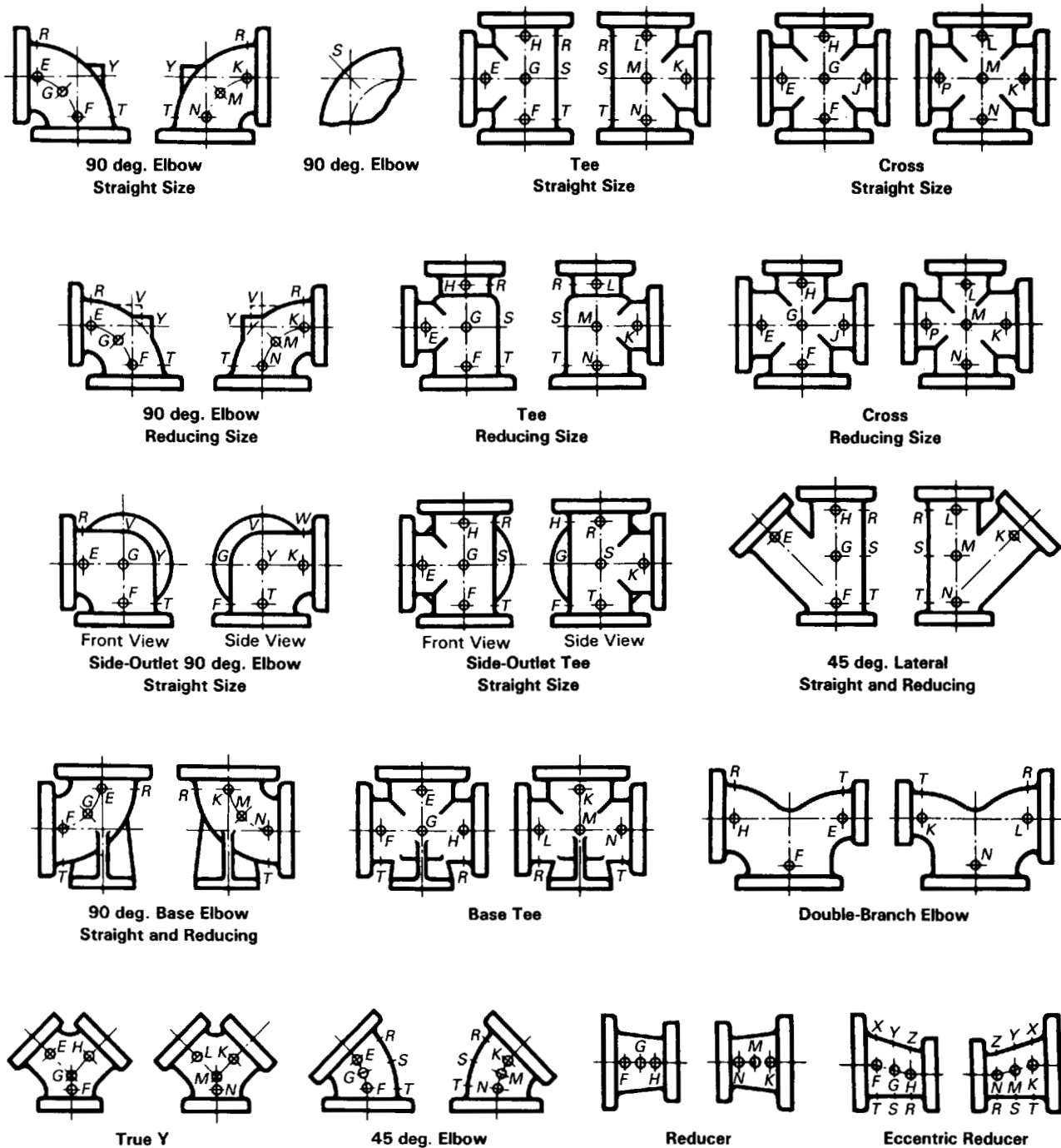
FIG. 10 DRAIN TAPPINGS

TABLE 10 MINIMUM THREAD LENGTH

Size of Tapping	Length of Thread <i>A</i> , in.
$\frac{3}{8}$	0.41
$\frac{1}{2}$	0.53
$\frac{3}{4}$	0.55
1	0.68
$1\frac{1}{4}$	0.71
$1\frac{1}{2}$	0.72
2	0.76

CAST IRON PIPE FLANGES AND FLANGED FITTINGS

ASME B16.1-1998



GENERAL NOTE:

The above sketches show two views of the same fitting and represent fittings with symmetrical shapes, with the exception of the side-outlet elbow and the side-outlet tee (straight sizes).

FIG. 11 METHOD OF DESIGNATING
LOCATION OF TAPPED HOLES FOR DRAINS WHEN SPECIFIED

ANNEX I REFERENCES

(This Annex is part of ASME B16.1-1998.)

The following is a list of publications referenced in this Standard.

ASME B1.1-1989, Unified Inch Screw Threads (UN and UNR Thread Form)¹

ASME B1.20.1-1983 (R1992), Pipe Threads, General Purpose (Inch)¹

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

ASME B18.2.1-1996, Square and Hex Bolts and Screws (Inch Series)¹

ASME B18.2.2-1987 (R1993), Square and Hex Nuts (Inch Series)¹

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

ASTM A 126-95, Specification for Gray Iron Castings
for Valves, Flanges, and Pipe Fittings

ASTM A 307-94, Specification for Carbon Steel Bolts
and Studs, 60,000 psi Tensile Strength

American Society for Testing and Materials (ASTM),
100 Barr Harbor Drive, West Conshohocken, PA
19428

ISO 9000-1: 1994, Quality management and quality
assurance standards, Part 1: Guidelines for selection
and use

ISO 9000-2: 1997, Quality management and quality
assurance standards, Part 2: Generic guidelines for
the application of ISO 9001, ISO 9002, and ISO 9003

ISO 9000-3: 1991, Quality management and quality
assurance standards, Part 3: Guidelines for the appli-
cation of ISO 9001 to the development, supply, and
maintenance of software

ISO 9001: 1994, Quality systems: Model for quality
assurance in design, development, production, instal-
lation, and servicing

ISO 9002: 1994, Quality systems: Model for quality
assurance in production and servicing

ISO 9003: 1994, Quality systems: Model for quality
assurance in final inspection and test

International Organization for Standardization (ISO), 1
rue de Varembe, Case Postale 56, CH-1121, Genève
20, Switzerland/Suisse

MSS SP-6-1996, Standard Finishes for Contact Faces
of Pipe Flanges and Connecting-End Flanges of
Valves and Fittings

MSS SP-9-1997, Spot Facing for Bronze, Iron, and
Steel Flanges

MSS SP-45-1992, Bypass and Drain Connections

Manufacturers Standardization Society of the Valve and
Fittings Industry (MSS), 127 Park Street, NE, Vienna,
VA 22180

¹ May also be obtained from American National Standards Institute
(ANSI), 11 West 42nd Street, New York, NY 10036.

ANNEX A

QUALITY SYSTEM PROGRAM

(This Annex is a nonmandatory part of ASME B16.1-1998 and is provided for informational purposes only.)

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 manufacturer's quality system program by an independent organization shall be the responsibility of the manufacturer. The detailed documentation demonstrating program compliance shall be available to the purchaser at the manufacturer's facility. A written summary description of the program utilized 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.

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 under Annex I.