

STEEL PIPE FLANGE DIMENSIONAL REFERENCE

STEEL PIPE FLANGES FOR WATERWORKS SERVICE

AWWA C207-18

Sizes 4 in. through 144 in. (100 mm through 3,600 mm)

CLASS B

CLASS D

CLASS E

CLASS F

BLIND FLANGES

STEEL HUB FLANGES

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Technical data navigation

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REFERENCE NOTE

Source dimensional values and footnotes are retained. Confirm the applicable material, grade, schedule and project specification before ordering.

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4. *Purchaser*: The person, company, or organization that purchases any materials or work to be performed.

5. *Transient pressure*: The purchaser-determined unsteady-state maximum pressure induced on a system resulting from a rapid change in flow velocity. Transient pressure as defined herein represents the total pressure level achieved during the transient event and is not an incremental pressure increase above the working pressure.

6. *Working pressure*: The maximum pressure under which a system or a zone within the system operates in a steady state or in a static condition, whichever is greater.

SECTION 4: REQUIREMENTS

Sec. 4.1 Materials

4.1.1 *Materials*. Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for water systems as applicable.

4.1.2 *Permeation*. The selection of materials is critical for water service and distribution piping in locations where there is likelihood the pipe will be exposed to significant concentrations of pollutants composed of low-molecular-weight petroleum products or organic solvents or their vapors. Documented research has shown that pipe materials (such as polyethylene and polyvinyl chloride) and elastomers, such as those used in jointing gaskets and packing glands, are subject to permeation by low-molecular-weight organic solvents or petroleum products. If a water pipe must pass through such a contaminated area or an area subject to contamination, consult with the manufacturer regarding permeation of pipe walls, jointing materials, and so on *before* selecting materials for use in that area.

4.1.3 *Manufacturing methods*. Flanges shall be made from seamless forgings, cut from plate as a single piece, welded bar rings, or segmented and welded plates.

4.1.3.1 *Flange materials*. Steel plate, bar, and forgings used in the manufacture of flanges shall meet the following requirements:

1. Specified minimum tensile strength = 50,000 psi (345 MPa).
2. Specified minimum yield strength = 32,000 psi (221 MPa).
3. Elongation, 2-in. (50-mm) gauge length (minimum) = 18 percent, or 8-in. (200-mm) gauge length (minimum) = 14 percent.
4. Carbon (maximum) = 0.35 percent.

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5. Phosphorus (maximum) = 0.04 percent.

6. Sulfur (maximum) = 0.05 percent.

4.1.3.2 *Mill test reports.* The manufacturer shall provide mill test reports showing conformance to the physical and chemical requirements on request.

4.1.4 *Bolting materials.* Bolts and studs shall be ASTM A193/A193M Grade B7 with ASTM A194/A194M Grade 2H heavy hex nuts or ASTM A563 heavy hex nuts for 1 in. and smaller. Bolting shall have product marking in accordance with ASTM A193/A193M and ASTM A962/A962M.

4.1.4.1. Washers, when used, shall meet the requirements of ASTM F436.

4.1.4.2. Minimum bolt lengths shall be determined by adding the sum of the mating flange maximum thicknesses, the gasket, washers, and the depth of the nut plus ¼-in. (6.4-mm) minimum. If studs with two nuts are used, they shall be the same length as the bolts determined previously, plus the depth of a second nut and washer, plus an additional ⅛ in. (3.2 mm). If studs with only one nut are used to mate to a flange with tapped holes, the studs shall be the same length as the bolts determined previously.

4.1.5 *Gaskets.* This standard is predicated on gaskets of the type, thickness, and material shown in Table 1 for the class of flange, working pressure limit, and diameter listed.

Table 1 Flange gasket materials, type, and thickness

AWWA Flange Class	Working Pressure Limit*		Nominal Pipe Diameter		Material Options†	Type	Minimum Thickness	
	<i>psi</i>	<i>(kPa)</i>	<i>in.</i>	<i>(mm)</i>			<i>in.</i>	<i>(mm)</i>
B	86	(593)	4–24	(100–600)	Elastomeric	Full Face‡	⅛	(1.59)
B	86	(593)	4–24	100–600	CFG, PTFE	Ring	⅛	(1.59)
B	86	(593)	26–144	(650–3,600)	CFG, PTFE	Ring	⅛	(3.18)
D	175	(1,207)	4–12	(100–300)	Elastomeric	Full Face‡	⅛	(1.59)
D	175	(1,207)	4–12	(100–300)	CFG, PTFE	Ring	⅛	(1.59)
D	150	(1,034)	14–24	(350–600)	Elastomeric	Full Face‡	⅛	(1.59)
D	150	(1,034)	14–24	(350–600)	CFG, PTFE	Ring	⅛	(1.59)
D	150	(1,034)	26–144	(650–3,600)	CFG, PTFE	Ring	⅛	(3.18)
E	275	(1,896)	4–24	(100–600)	CFG, PTFE	Ring†	⅛	(1.59)
E	275	(1,896)	26–144	(650–3,600)	CFG, PTFE	Ring†	⅛	(3.18)
F	300	(2,068)	4–24	(100–600)	CFG, PTFE	Ring†	⅛	(1.59)
F	300	(2,068)	26–48	(650–1,200)	CFG, PTFE	Ring†	⅛	(3.18)

CFG: compressed fiber gaskets, PTFE: polytetrafluoroethylene

* Maximum pressure (test or transient) is provided in Tables 2 through 5.

† Electrical isolation gaskets may be made of other materials that comply with this standard.

‡ Care must be taken with elastomeric gaskets to prevent overcompressing the gasket.

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Elastomer (rubber) gaskets shall be hardness (Shore A) 70 to 85, suitable for water service temperature up to 200°F (93.3°C) with gasket seating stress of 200 psi (1,379 kPa) minimum. If assembly seating stress recommendations are unavailable, elastomeric gaskets shall be rated for a minimum of 175 psi (1,206 kPa) internal working pressure by the manufacturer.

Compressed fiber gaskets (CFG) shall be a blend of synthetic fibers, fillers, and elastomeric binders suitable for potable water service. Gaskets that are PTFE (polytetrafluoroethylene) based are also acceptable. Gasket seating stress shall be no greater than 4,800 psi (33 MPa).

Ring gasket dimensions shall be as follows:

Inside diameter (ID) = flange ID.

Outside diameter (OD) = bolt-circle diameter minus the bolt-hole diameter.

Gaskets used for electrical isolation shall be made so that the gasket will electrically isolate the joint and consist of materials that are suitable for potable water service. The gasket shall be pressure rated by the gasket manufacturer to a pressure no less than the applicable pressure class and shall meet the required seating stress to which it will be subjected.

Sec. 4.2 Fabrication

4.2.1 *Tolerances.* The dimensions listed in Tables 2 through 5 shall apply prior to attachment and are subject to the following tolerances:

4.2.1.1 Inside diameter of flange: $+\frac{1}{16}$ in. (1.6 mm), -0 .

4.2.1.2 Outside diameter of flange: $\pm\frac{1}{8}$ in. (3.2 mm).

4.2.1.3 Thickness of flanges 18 in. (450 mm) and smaller: $+\frac{1}{8}$ in. (3.2 mm), -0 .

4.2.1.4 Thickness of flanges 20 in. (500 mm) and larger: $+\frac{3}{16}$ in. (4.8 mm), -0 .

4.2.1.5 Bolt-circle diameter: $\pm\frac{1}{16}$ in. (1.6 mm).

4.2.1.6 Bolt-hole spacing: $\pm\frac{1}{32}$ in. (0.79 mm).

4.2.2 *Facing.* Flanges of all classes and types shall be flat faced—that is, without projection or raised face. Either a serrated concentric or serrated spiral finish having 24–55 grooves/in. (0.94–2.17 grooves/mm) shall be used. The cutting tool employed shall have a radius of 0.06 in. (1.52 mm) or larger. The resultant surface finish shall have a 125- to 500- μ in. (3.2- to 12.7- μ m) roughness average (Ra), as defined in ASME B46.1.

4.2.2.1 Flange faces shall be free of lining and coating materials, except that a removable corrosion inhibitor is permitted until installation. The gasket seating surface shall not have protrusions.

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4.2.3 *Drilling.* For flanges up to 84 in. (2,100 mm) in diameter, bolt holes shall be drilled $\frac{1}{8}$ in. (3.2 mm) larger in diameter than the nominal diameter of the bolt. For flanges larger than 84 in. (2,100 mm) in diameter, bolt holes shall be drilled $\frac{3}{16}$ -in. (4.8-mm) larger than the nominal bolt diameter. Bolt holes may be oversized by an additional $\frac{1}{8}$ in. (3.2 mm) to accommodate insulators or to facilitate alignment with the mating flange. If bolt holes are oversized, washers shall be used.

4.2.4 *Segmentation of flanges.* Flanges shall be constructed by welding segments together when the OD of a flange exceeds the width of available plate material (approximately 78-in. [1,950-mm] ID and larger). The maximum number of segments in a single flange shall be four and segments shall be of approximately equal size.

4.2.4.1 Welding of the segments shall be performed in accordance with Sec. 4.3.2 of this standard.

4.2.4.2 100 percent radiographic or ultrasonic testing of all welds is required and shall be performed in accordance with the governing welding code as described in Sec. 4.3.2.

4.2.4.3 If any specimen tested in accordance with the approved procedure fails to meet the requirements, it shall be repaired using the approved repair procedure and radiographically or ultrasonically tested for conformance. If the retest fails to conform to the requirements, the flange shall be rejected.

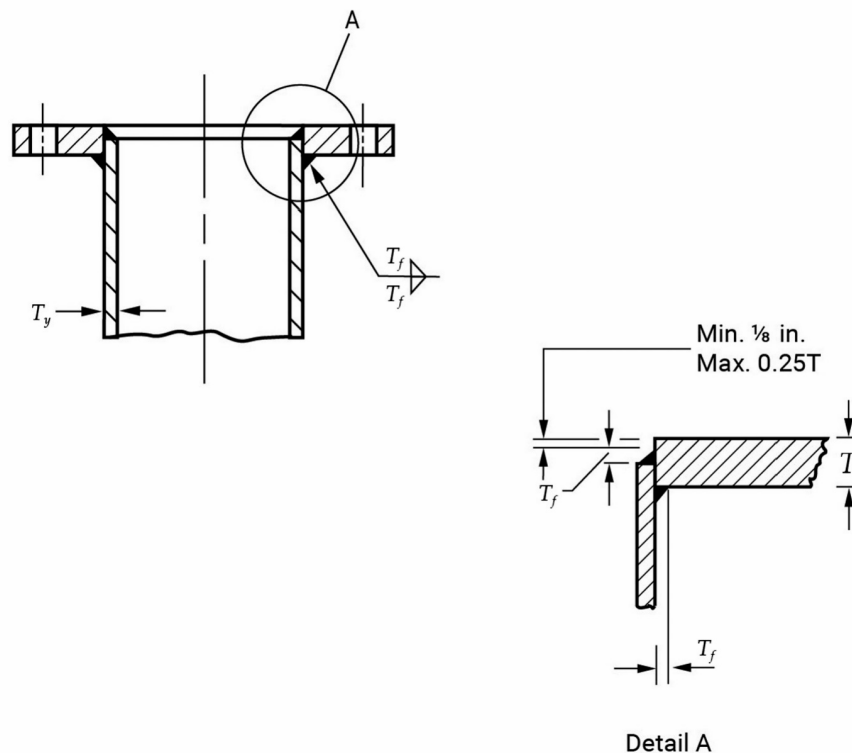
4.2.4.4 Segmented flanges shall be stress relieved in accordance with the governing weld procedure after welding and before machining.

4.2.5 *Blind flanges.* Blind-flange thicknesses shall be as set forth in Table 5. For blind flanges over 48-in. (1,200-mm) nominal diameter, it is recommended that a combination of a ring flange and a flanged and dished head, suitable for the pressure and design conditions, be used. Blind-flange drilling and machine facing shall match the mating flange.

Sec. 4.3 Attachment of Flanges

4.3.1 *Welding.* Flanges shall be attached to pipe, fittings, or other appurtenances by means of two fillet welds as shown in Figure 1. For pipe cylinder thicknesses, T_p , $\frac{1}{4}$ in. (6.4 mm) or less, the fillet size, T_f , shall be equal to T_p . For pipe cylinder thicknesses greater than $\frac{1}{4}$ in. (6.4 mm), the fillet weld size, T_f , may be reduced to the calculated thickness of the attached steel pipe cylinder for pressure in accordance with AWWA Manual M11 or $\frac{1}{4}$ in. (6.4 mm), whichever is greater, with consideration given to the minimum single-pass fillet weld size and

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- NOTES:
- T_f – Fillet weld size (see Sec. 4.3.1)
 - T – Flange thickness as defined in Tables 2 through 4
 - T_y – Pipe cylinder thickness (see Sec. 4.3.1)

Figure 1 Attachment of flange

hydrogen-assisted cracking. When the weld root opening is greater than $\frac{1}{16}$ in. (1.6 mm), increase the weld size according to the root opening. Root openings shall not exceed $\frac{3}{16}$ in. (4.8 mm). Whenever attachment by this means is not practical, the flanges may be attached by welds shown in Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

4.3.2 Welding procedure and qualification. All welds performed in the attachment of flanges, welding of segments of flanges, and the repair of welding defects shall conform to a written procedure developed by the manufacturer.

The procedure used shall be based on a current applicable welding code, such as AWS D1.1/D1.1M or ASME Boiler and Pressure Vessel Code, Section IX.

4.3.2.1 Welder and welding operator qualification. Welders and welding operators shall be qualified under Section IX of the ASME Boiler and Pressure Vessel Code, applicable parts of AWS D1.1/D1.1M, or other approved procedure.

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4.3.3 *Draft or layback tolerance.* After welding of the flange has been completed, a draft or layback of the flange face may occur as shown in Figure 2. Total draft or layback shall not exceed 1 degree for a single flange or 1½ degrees between two mating flanges. Negative draft or layback as shown in Figure 3 shall not be permitted.

4.3.4 *Welding technique.* Care shall be taken during the welding process to avoid warping the flange face, particularly when attaching Class B flanges.

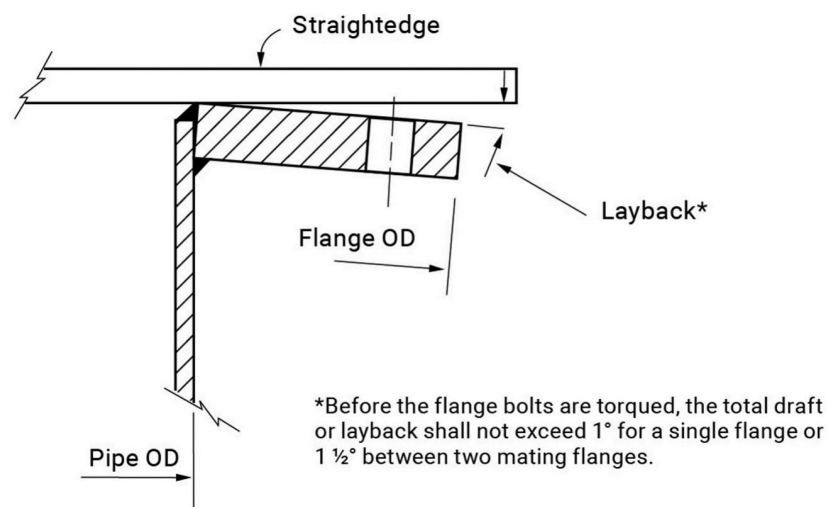


Figure 2 Draft or layback measurement

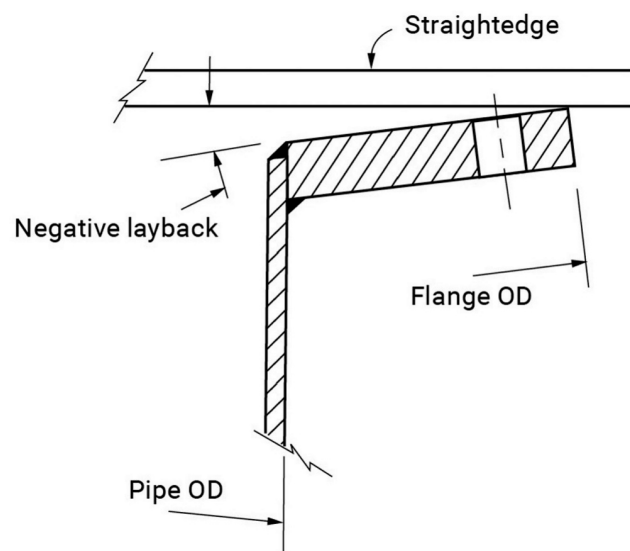


Figure 3 Negative draft or layback

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4.3.5 *Bolt-hole alignment.* Bolt holes shall straddle the centerline, except where special mating conditions exist.

Sec. 4.4 Protective Coating

If specified by the purchaser, the flanges or flanged joints shall be given a protective coating conforming to ANSI/AWWA C203, ANSI/AWWA C209, ANSI/AWWA C210, ANSI/AWWA C213, ANSI/AWWA C216, ANSI/AWWA C217, ANSI/AWWA C218, ANSI/AWWA C222, or some combination of these coatings.

SECTION 5: VERIFICATION

Sec. 5.1 Inspection by the Purchaser

5.1.1 *Optional inspection.* At the purchaser's option, flange dimensions and attachment to pipe by welding may be inspected by the purchaser. This inspection shall not relieve the manufacturer of the responsibility to provide material and perform work in accordance with this standard.

5.1.2 *Access and facilities.* The purchaser shall have access at all reasonable times to those parts of the manufacturer's plant involved in the manufacture of the material ordered while the work contracted is being performed. The manufacturer shall provide the purchaser with the facilities necessary to determine that the material is being provided in accordance with this standard. Inspections shall be made at the place of manufacture or other mutually agreeable location prior to shipment.

5.1.3 *Rejection.* The purchaser may reject any flanges that do not conform to the requirements of this standard and the purchaser's specifications.

SECTION 6: DELIVERY

Sec. 6.1 Marking

Flanges shall be impression stamped with the size and name or trademark of the manufacturer and with the AWWA class as defined in Tables 2 through 5.

Sec. 6.2 Affidavit of Compliance

The purchaser may require an affidavit from the manufacturer that the material provided complies with applicable requirements of this standard.

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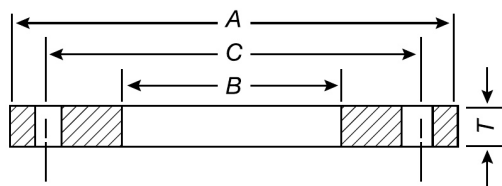


Table 2 AWWA standard steel-ring flanges, Class B* (86 psi) and Class D† (175–150 psi)
 Maximum pressure (test or transient) allowed up to 129 psi for Class B, 262.5 psi for Class D up to 12 in., and 225 psi for Class D sizes larger than 12 in.

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [‡]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [§] <i>in.</i>	Thickness of Flange <i>in.</i>	
						Class B (<i>T</i>)	Class D (<i>T</i>)
4	9.00	4.57	8	7.50	0.625	0.625	0.625
5	10.00	5.66	8	8.50	0.750	0.625	0.625
6	11.00	6.72	8	9.50	0.750	0.688	0.688
8	13.50	8.72	8	11.75	0.750	0.688	0.688
10	16.00	10.88	12	14.25	0.875	0.688	0.688
12	19.00	12.88	12	17.00	0.875	0.688	0.812
14	21.00	14.19	12	18.75	1.000	0.688	0.938
16	23.50	16.19	16	21.25	1.000	0.688	1.000
18	25.00	18.19	16	22.75	1.125	0.688	1.062
20	27.50	20.19	20	25.00	1.125	0.688	1.125
22	29.50	22.19	20	27.25	1.250	0.750	1.188
24	32.00	24.19	20	29.50	1.250	0.750	1.250
26	34.25		24	31.75	1.250	0.812	1.312
28	36.50		28	34.00	1.250	0.875	1.312
30	38.75		28	36.00	1.250	0.875	1.375
32	41.75		28	38.50	1.500	0.938	1.500
34	43.75		32	40.50	1.500	0.938	1.500
36	46.00		32	42.75	1.500	1.000	1.625
38	48.75		32	45.25	1.500	1.000	1.625
40	50.75		36	47.25	1.500	1.000	1.625
42	53.00		36	49.50	1.500	1.125	1.750
44	55.25		40	51.75	1.500	1.125	1.750
46	57.25		40	53.75	1.500	1.125	1.750
48	59.50		44	56.00	1.500	1.250	1.875
50	61.75		44	58.25	1.750	1.250	2.000
52	64.00		44	60.50	1.750	1.250	2.000
54	66.25		44	62.75	1.750	1.375	2.125
60	73.00		52	69.25	1.750	1.500	2.250
66	80.00		52	76.00	1.750	1.625	2.500

(table continues)

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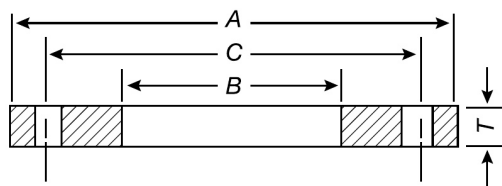
Table 2 AWWA standard steel-ring flanges, Class B* (86 psi) and Class D† (175–150 psi) (continued)

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [‡]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [§] <i>in.</i>	Thickness of Flange <i>in.</i>	
						Class B (<i>T</i>)	Class D (<i>T</i>)
72	86.50		60	82.50	1.750	1.750	2.625
78	93.00		64	89.00	2.000	2.000	2.750
84	99.75		64	95.50	2.000	2.000	2.875
90	106.50		68	102.00	2.250	2.250	3.000
96	113.25		68	108.50	2.250	2.250	3.250
102	120.00		72	114.50	2.500	2.500	3.250
108	126.75		72	120.75	2.500	2.500	3.375
114	133.50		76	126.75	2.750	2.750	3.500
120	140.25		76	132.75	2.750	2.750	3.500
126	147.00		80	139.25	3.000	3.000	3.750
132	153.75		80	145.75	3.000	3.000	3.875
144	167.25		84	158.25	3.250	3.250	4.125

NOTES:

- Ring flanges may be overbored or counterbored to accommodate larger outside-diameter (OD) pipe than shown as nominal. This is done to allow a clear inside diameter (ID) after cement–mortar lining. Wrench clearance between the pipe OD and bolt circle, as well as sufficient gasket seating area, must be maintained.
- Metric conversion—nominal pipe size: $\text{in.} \times 25 = \text{mm}$; dimensions: $\text{in.} \times 25.4 = \text{mm}$; $\text{psi} \times 6.895 = \text{kPa}$.
 - * Working pressure limit at water service temperature is 86 psi. These flanges have the same OD and drilling pattern as Class 125 cast-iron flanges (ASME B16.1). In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi drilling for steel flanges.
 - † Working pressure limit at water service temperature: sizes 4–12 in. inclusive, 175 psi; sizes larger than 12 in., 150 psi. These flanges have the same diameter and drilling as Class 125 cast-iron flanges (ASME B16.1). In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi standard for steel flanges.
 - ‡ The purchaser shall specify the ID of the flange, dimension *B*, for nominal pipe sizes 26 in. and larger. The diameter of the flange bore shall not exceed the pipe OD by more than 0.25 in.
 - § Bolt holes shall be drilled 1/8-in. larger in diameter than the nominal diameter of the bolt except as stated in Sec. 4.2.3.

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**Table 3 AWWA standard steel-ring flanges, Class E* (275 psi)**

Maximum pressure (test or transient) allowed up to 412.5 psi

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [†]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [‡] <i>in.</i>	Thickness of Flange (<i>T</i>) <i>in.</i>
4	9.00	4.57	8	7.50	0.625	1.125
5	10.00	5.66	8	8.50	0.750	1.188
6	11.00	6.72	8	9.50	0.750	1.313
8	13.50	8.72	8	11.75	0.750	1.500
10	16.00	10.88	12	14.25	0.875	1.563
12	19.00	12.88	12	17.00	0.875	1.750
14	21.00	14.19	12	18.75	1.000	1.875
16	23.50	16.19	16	21.25	1.000	2.000
18	25.00	18.19	16	22.75	1.125	2.125
20	27.50	20.19	20	25.00	1.125	2.375
22	29.50	22.19	20	27.25	1.250	2.500
24	32.00	24.19	20	29.50	1.250	2.625
26	34.25		24	31.75	1.250	2.750
28	36.50		28	34.00	1.250	2.750
30	38.75		28	36.00	1.250	2.875
32	41.75		28	38.50	1.500	3.000
34	43.75		32	40.50	1.500	3.000
36	46.00		32	42.75	1.500	3.125
38	48.75		32	45.25	1.500	3.125
40	50.75		36	47.25	1.500	3.250
42	53.00		36	49.50	1.500	3.375
44	55.25		40	51.75	1.500	3.375
46	57.25		40	53.75	1.500	3.438
48	59.50		44	56.00	1.500	3.500
50	61.75		44	58.25	1.750	3.500
52	64.00		44	60.50	1.750	3.625
54	66.25		44	62.75	1.750	3.750
60	73.00		52	69.25	1.750	3.875
66	80.00		52	76.00	1.750	4.250
72	86.50		60	82.50	1.750	4.375

(table continues)

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Table 3 AWWA standard steel-ring flanges, Class E* (275 psi) (continued)

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [†]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [‡] <i>in.</i>	Thickness of Flange (<i>T</i>) <i>in.</i>
78	93.00		64	89.00	2.000	4.750
84	99.75		64	95.50	2.000	4.750
90	106.50		68	102.00	2.250	5.125
96	113.25		68	108.50	2.250	5.125
102	120.00		72	114.50	2.500	5.500
108	126.75		72	120.75	2.500	5.500
114	133.50		76	126.75	2.750	5.875
120	140.25		76	132.75	2.750	5.875
126	147.00		80	139.25	3.000	6.250
132	153.75		80	145.75	3.000	6.250
144	167.25		84	158.25	3.250	6.750

NOTES:

1. Ring flanges may be overbored or counterbored to accommodate larger outside-diameter pipe than shown as nominal. This is done to allow a clear inside diameter after cement–mortar lining. Wrench clearance between the pipe OD and bolt circle, as well as sufficient gasket seating area, must be maintained.

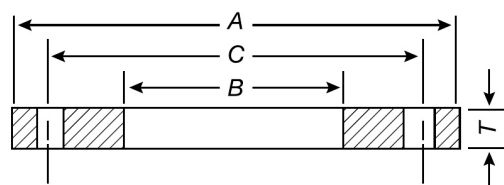
2. Metric conversion—nominal pipe size: in. × 25 = mm; dimensions: in. × 25.4 = mm; psi × 6.895 = kPa.

* Working pressure limit at water service temperature is 275 psi. These flanges have the same OD and drilling pattern as ASME B16.1 Class 125 cast-iron flanges. In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi standard for steel flanges.

[†] The purchaser shall specify the ID of the flange, dimension *B*, for nominal pipe sizes 26 in. and larger. The diameter of the flange bore shall not exceed the pipe OD by more than 0.25 in.

[‡] Bolt holes shall be drilled 1/8 in. larger in diameter than the nominal diameter of the bolt except as stated in Sec. 4.2.3.

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**Table 4 AWWA standard steel-ring flanges, Class F* (300 psi)**

Maximum pressure (test or transient) allowed up to 450 psi

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [†]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [‡] <i>in.</i>	Thickness of Flange (<i>T</i>) <i>in.</i>
4	10.00	4.57	8	7.88	0.750	1.13
5	11.00	5.66	8	9.25	0.750	1.21
6	12.50	6.73	12	10.62	0.750	1.31
8	15.00	8.73	12	13.00	0.875	1.31
10	17.50	10.88	16	15.25	1.000	1.50
12	20.50	12.88	16	17.75	1.125	1.63
14	23.00	14.19	20	20.25	1.125	1.94
16	25.50	16.19	20	22.50	1.250	2.14
18	28.00	18.19	24	24.75	1.250	2.25
20	30.50	20.19	24	27.00	1.250	2.33
22	33.00	22.19	24	29.25	1.250	2.50
24	36.00	24.19	24	32.00	1.500	2.69
26	38.25	—	28	34.50	1.750	3.00
28	40.75	—	28	37.00	1.750	3.13
30	43.00	—	28	39.25	1.750	3.15
32	45.25	—	28	41.50	1.750	3.25
34	47.50	—	28	43.50	1.750	3.38
36	50.00	—	32	46.00	2.000	3.46
38	52.25	—	32	48.00	2.000	3.50
40	54.25	—	36	50.25	2.000	3.63
42	57.00	—	36	52.75	2.000	3.81
44	59.25	—	36	55.00	2.000	4.00
46	61.50	—	40	57.25	2.000	4.13
48	65.00	—	40	60.75	2.000	4.50

NOTES:

- Ring flanges may be overbored or counterbored to accommodate larger outside-diameter (OD) pipe than shown as nominal. This is done to allow a clear inside diameter (ID) after cement–mortar lining. Wrench clearance between the pipe OD and bolt circle, as well as sufficient gasket seating area, must be maintained.
 - Metric conversion—nominal pipe size: in. $\times$ 25 = mm; dimensions: in. $\times$ 25.4 = mm; psi $\times$ 6.895 = kPa.
- * Working pressure limit at water service temperature is 300 psi. These flanges have the same OD and drilling pattern as ASME B16.1 Class 250 cast-iron pipe and flanged fittings and ASME B16.5 Class 300 for steel flanges.
- [†] The purchaser shall specify the ID of the flange, dimension *B*, for nominal pipe sizes 26 in. and larger. The diameter of the flange bore shall not exceed the pipe OD by more than 0.25 in.
- [‡] Bolt holes shall be drilled $\frac{1}{8}$ in. larger in diameter than the nominal diameter of the bolt except as stated in Sec. 4.2.3.

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Table 5 AWWA blind-flange thickness

Nominal Pipe Size <i>in.</i>	Minimum Thickness*			
	Class B [†] (86 psi) Max P [‡] = 129 psi <i>in.</i>	Class D [§] <i>in.</i>	Class E ^{**} (275 psi) Max P = 412.5 psi <i>in.</i>	Class F ^{††} (300 psi) Max P = 450 psi <i>in.</i>
4	0.625	0.625	1.125	1.130
5	0.625	0.650	1.188	1.210
6	0.688	0.693	1.313	1.310
8	0.688	0.812	1.500	1.310
10	0.688	0.953	1.563	1.500
12	0.719	1.117	1.750	1.630
14	0.791	1.133	1.875	1.940
16	0.892	1.265	2.000	2.140
18	0.950	1.331	2.125	2.250
20	1.040	1.448	2.375	2.330
22	1.132	1.568	2.500	2.500
24	1.216	1.661	2.625	2.690
26	1.307	1.786	2.750	3.000
28	1.398	1.906	2.750	3.130
30	1.477	2.008	2.875	3.166
32	1.581	2.150	3.000	3.332
34	1.661	2.252	3.050	3.475
36	1.751	2.370	3.209	3.671
38	1.853	2.506	3.394	3.815
40	1.933	2.609	3.533	3.982
42	2.023	2.729	3.695	4.171
44	2.114	2.849	3.857	4.338
46	2.194	2.952	3.997	4.505
48	2.285	3.072	4.159	4.781
50	2.377	3.196	4.327	N/A
52	2.468	3.315	4.489	N/A
54	2.559	3.435	4.651	N/A

(table continues)

STEEL PIPE FLANGES FOR WATERWORKS SERVICE

Table 5 AWWA blind-flange thickness (continued)

Nominal Pipe Size <i>in.</i>	Minimum Thickness*			
	Class B [†] (86 psi) Max P [‡] = 129 psi <i>in.</i>	Class D [§] <i>in.</i>	Class E ^{**} (275 psi) Max P = 412.5 psi <i>in.</i>	Class F ^{††} (300 psi) Max P = 450 psi <i>in.</i>
60	2.820	3.779	5.116	N/A
66	3.092	4.136	5.601	N/A
72	3.353	4.480	6.066	N/A

NOTES:

1. All flanges are flat faced.
2. Minimum thickness based on allowable stress of 16,000 psi.
3. Minimum thickness based on 7,000 psi allowable bolt stress for Classes B and D.
4. Minimum thickness based on 25,000 psi allowable bolt stress for Classes E and F.
5. For diameters over 48 in., see recommendation in Sec. 4.2.5.
6. Metric conversion—nominal pipe size: in. × 25 = mm; dimensions: in. × 25.4 = mm; psi × 6.895 = kPa.
- * Design method: ASME Boiler and Pressure Vessel Code, Sec. VIII, Div. 1, UG-34, Eq 2 (2010), or corresponding ring-flange thickness, whichever is greater.
- [†] Working pressure limit at water service temperature is 86 psi. These flanges have the same outside diameter (OD) and drilling pattern as Class 125 cast-iron flanges (ASME B16.1). In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi drilling for steel flanges.
- [‡] Max P = maximum pressure (test or transient).
- [§] Class D flanges have a working pressure limit at water service temperature of 175 psi (1,207 kPa) for nominal pipe sizes ≤12 in. (600 mm), and 150 psi (1,034 kPa) for nominal pipe sizes >12 in. (600 mm). Maximum pressure (test or transient) for nominal pipe sizes up to 12 in. is 260 psi and 225 psi for sizes larger than 12 in.
- ^{**} Working pressure limit at water service temperature is 275 psi. These flanges have the same OD and drilling pattern as ASME B16.1 Class 125 cast-iron flanges. In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi standard for steel flanges.
- ^{††} Working pressure limit at water service temperature is 300 psi. These flanges have the same OD and drilling pattern as ASME B16.1 Class 250 cast-iron pipe and flanged fittings and ASME B16.5 Class 300 for steel flanges.

APPENDIX B

Steel-Hub Flanges

This appendix is for information only and is not a part of ANSI/AWWA C207.

For additional information on hub flanges, refer to ASME B16.47 and ASME B16.5.

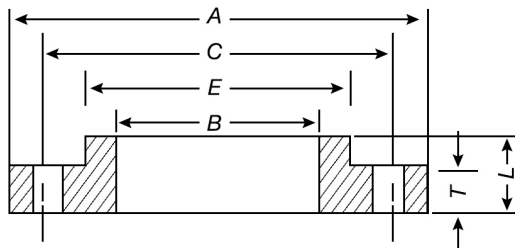


Table B.1 AWWA standard steel-hub flanges, Class D* (175–150 psi)

Maximum pressure (test or transient) allowed up to 260 psi for Class D up through 12 in., and 225 psi for Class D sizes larger than 12 in.

Nominal Pipe Size <i>in.</i>	OD of Flange (A) <i>in.</i>	ID of Flange (B) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (C) <i>in.</i>	Diameter of Bolts [†] <i>in.</i>	Flange Dimensions <i>in.</i>		
						(T)	(L)	(E)
4	9.00	4.57	8	7.50	0.625	0.500	0.875	5.312
5	10.00	5.66	8	8.50	0.750	0.562	1.250	6.312
6	11.00	6.72	8	9.50	0.750	0.562	1.250	7.562
8	13.50	8.72	8	11.75	0.750	0.562	1.250	9.688
10	16.00	10.88	12	14.25	0.875	0.688	1.250	12.000
12	19.00	12.88	12	17.00	0.875	0.688	1.250	14.375
14	21.00	14.19	12	18.75	1.000	0.750	1.250	15.750
16	23.50	16.19	16	21.25	1.000	0.750	1.250	18.000
18	25.00	18.19	16	22.75	1.125	0.750	1.250	19.875
20	27.50	20.19	20	25.00	1.125	0.750	1.250	22.000
22	29.50	22.19	20	27.25	1.250	1.000	1.750	24.250
24	32.00	24.19	20	29.50	1.250	1.000	1.750	26.125
26	34.25	26.19	24	31.75	1.250	1.000	1.750	28.500
28	36.50	28.19	28	34.00	1.250	1.000	1.750	30.500
30	38.75	30.19	28	36.00	1.250	1.000	1.750	32.500
32	41.75	32.19	28	38.50	1.500	1.125	1.750	34.750
34	43.75	34.19	32	40.50	1.500	1.125	1.750	36.750
36	46.00	36.19	32	42.75	1.500	1.125	1.750	38.750
38	48.75	38.19	32	45.25	1.500	1.125	1.750	40.750
40	50.75	40.19	36	47.25	1.500	1.125	1.750	43.000

(table continues)

Table B.1 AWWA standard steel-hub flanges, Class D* (175–150 psi) (continued)

Nominal Pipe Size <i>in.</i>	OD of Flange (A) <i>in.</i>	ID of Flange (B) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (C) <i>in.</i>	Diameter of Bolts [†] <i>in.</i>	Flange Dimensions <i>in.</i>		
						(T)	(L)	(E)
42	53.00	42.19	36	49.50	1.500	1.250	1.750	45.000
44	55.25	44.19	40	51.75	1.500	1.250	2.250	47.000
46	57.25	46.19	40	53.75	1.500	1.250	2.250	49.000
48	59.50	48.19	44	56.00	1.500	1.375	2.500	51.000
50	61.75	50.19	44	58.25	1.750	1.375	2.500	53.000
52	64.00	52.19	44	60.50	1.750	1.375	2.500	55.000
54	66.25	54.19	44	62.75	1.750	1.375	2.500	57.000
60	73.00	60.19	52	69.25	1.750	1.500	2.750	63.000
66	80.00	66.19	52	76.00	1.750	1.500	2.750	69.000
72	86.50	72.19	60	82.50	1.750	1.500	2.750	75.000
78	93.00	78.19	64	89.00	2.000	1.750	3.000	81.250
84	99.75	84.19	64	95.50	2.000	1.750	3.000	87.500
90	106.50	90.19	68	102.00	2.250	2.000	3.250	93.750
96	113.25	96.19	68	108.50	2.250	2.000	3.250	100.000

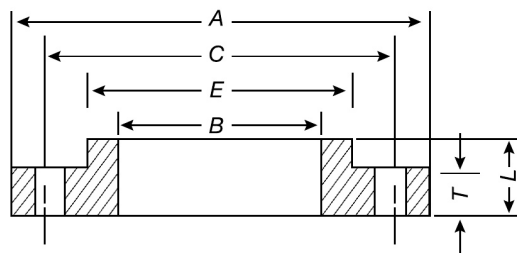
NOTES:

1. Hub flanges are to be used on pipe that has an outer diameter (OD) equal to the nominal pipe size in the first column and shall not be overbored. ID: inner diameter

2. Metric conversion—nominal pipe size: in. $\times$ 25 = mm; dimensions: in. $\times$ 25.4 = mm; psi $\times$ 6.895 = kPa.

* Working pressure limit at water service temperature: sizes 4–12 in. inclusive, 175 psi; sizes larger than 12 in., 150 psi. These flanges have the diameter OD and drilling as Class 125 cast-iron flanges (ASME B16.1). In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi standard for steel flanges.

[†] Bolt holes shall be drilled $\frac{1}{8}$ -in. larger in diameter than the nominal diameter of the bolt except as stated in Sec.4.2.3.

**Table B.2 AWWA standard steel-hub flanges, Class E* (275 psi)**

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [†]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [‡] <i>in.</i>	Flange Dimensions <i>in.</i>		
						(<i>T</i>) [§]	(<i>L</i>)	(<i>E</i>)
4	9.00	4.57	8	7.50	0.625	0.938	1.312	5.312
5	10.00	5.66	8	8.50	0.750	0.938	1.438	6.438
6	11.00	6.72	8	9.50	0.750	1.000	1.562	7.562
8	13.50	8.72	8	11.75	0.750	1.125	1.750	9.688
10	16.00	10.88	12	14.25	0.875	1.188	1.938	12.000
12	19.00	12.88	12	17.00	0.875	1.250	2.188	14.375
14	21.00	14.19	12	18.75	1.000	1.375	2.250	15.750
16	23.50	16.19	16	21.25	1.000	1.438	2.500	18.000
18	25.00	18.19	16	22.75	1.125	1.562	2.688	19.875
20	27.50	20.19	20	25.00	1.125	1.688	2.875	22.000
22	29.50	22.19	20	27.25	1.250	1.812	3.125	24.000
24	32.00	24.19	20	29.50	1.250	1.875	3.250	26.125
26	34.25	26.19	24	31.75	1.250	2.000	3.375	28.500
28	36.50	28.19	28	34.00	1.250	2.062	3.438	30.750
30	38.75	30.19	28	36.00	1.250	2.125	3.500	32.750
32	41.75	32.19	28	38.50	1.500	2.250	3.625	35.000
34	43.75	34.19	32	40.50	1.500	2.312	3.688	37.000
36	46.00	36.19	32	42.75	1.500	2.375	3.750	39.250
38	48.75	38.19	32	45.25	1.500	2.375	3.750	41.750
40	50.75	40.19	36	47.25	1.500	2.500	3.875	43.750
42	53.00	42.19	36	49.50	1.500	2.625	4.000	46.000
44	55.25	44.19	40	51.75	1.500	2.625	4.000	48.000
46	57.25	46.19	40	53.75	1.500	2.688	4.062	50.000
48	59.50	48.19	44	56.00	1.500	2.750	4.125	52.250
50	61.75	50.19	44	58.25	1.750	2.750	4.125	54.250
52	64.00	52.19	44	60.50	1.750	2.875	4.250	56.500
54	66.25	54.19	44	62.75	1.750	3.000	4.375	58.750
60	73.00	60.19	52	69.25	1.750	3.125	4.500	65.250

(table continues)

Table B.2 AWWA standard steel-hub flanges, Class E* (275 psi) (continued)

Nominal Pipe Size <i>in.</i>	OD of Flange (<i>A</i>) <i>in.</i>	ID of Flange (<i>B</i> [†]) <i>in.</i>	Number of Bolts	Diameter of Bolt Circle (<i>C</i>) <i>in.</i>	Diameter of Bolts [‡] <i>in.</i>	Flange Dimensions <i>in.</i>		
						(<i>T</i>) [§]	(<i>L</i>)	(<i>E</i>)
66	80.00	66.19	52	76.00	1.750	3.375	4.875	71.500
72	86.50	72.19	60	82.50	1.750	3.500	5.000	78.500
78	93.00	78.19	64	89.00	2.000	3.875	5.375	84.500
84	99.75	84.19	64	95.50	2.000	3.875	5.375	90.500
90	106.50	90.19	68	102.00	2.250	4.250	5.750	96.750
96	113.25	96.19	68	108.50	2.250	4.250	5.750	102.750

NOTES:

1. Hub flanges are to be used on pipe that has an outer diameter (OD) equal to the nominal pipe size in the first column and shall not be overbored. ID: inner diameter

2. Metric conversion—nominal pipe size: in. $\times$ 25 = mm; dimensions: in. $\times$ 25.4 = mm; psi $\times$ 6.895 = kPa.

* Water pressure rating at water service temperature is 275 psi. These flanges have the same diameter and drilling as ASME B16.1 Class 125 cast-iron flanges. In sizes 24 in. and smaller, they also match ASME B16.5 Class 150-psi standard for steel flanges.

[†] Welding neck flanges may be used if desired, at the purchaser's option.

[‡] Bolt holes shall be drilled $\frac{1}{8}$ in. larger in diameter than the nominal diameter of the bolt as stated in Sec. 4.2.3.

[§] The thickness *T* of a flange from which the raised face has been removed shall be no less than dimension *T* minus 0.06 in.

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