



Standard Practice for Selecting Bolting Lengths for Piping System Flanged Joints¹

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This standard has been approved for use by agencies of the U.S. Department of Defense.

^{ε1} NOTE—Editorial corrections were made to Section 2 in September 2018.

1. Scope

1.1 This practice covers bolt and stud bolt lengths, quantities, and thread series for pipe to pipe and pipe to valve flanged joints (Note 1) in the nominal pipe size ranges of 1/2 through 48-in. (12.7 through 1219-mm) diameter and pressure range of 125 through 2500 psi (0.8 through 17 236 kPa).

NOTE 1—This is applicable when flange of valve has the same thickness as mating flange.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASME Standards:²

B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)

B16.1 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250

B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B16.24 Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

2.2 MSS Standards:³

MSS-SP-44 Steel Pipe Flanges

3. Bolting Criteria

3.1 Bolt and stud bolt lengths are computed using the following (see Annex A1):

3.1.1 Includes maximum nut thickness in accordance with ASME B18.2.2.

3.1.2 Does not include washer thickness.

3.1.3 Does not include bolt or stud bolt point height.

3.1.4 Includes allowance for up to 1/8-in. (3.2-mm) thick gaskets, except butterfly valves.

3.1.5 Includes 1/4-in. (6.3-mm) raised face in addition to flange thickness listed in tables for flanges rated at 400 psi (2.8 kPa) and above.

3.1.6 Includes use of heavy hex nut and bolt design.

3.1.7 Includes plus tolerance for flange thickness in accordance with ASME B16.5.

3.2 All bolts and stud bolts have threads in accordance with ASME B1.1, Class 2A dimensioning and nuts Class 2B.

3.3 The material requirements for bolts, stud bolts, and nuts are obtained from the material specifications of individual system diagrams.

3.4 Alloy steel bolting 1-in. (25.4-mm) nominal diameter and smaller and all carbon steel bolting has threads of the UNC

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² Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

³ Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, <http://www.mss-hq.org>.

Series; alloy steel bolting above 1-in. nominal diameter has threads of the 8-UN Series.

3.5 For detailed descriptions of flange bolting assemblies, butterfly valve bolting assemblies, and tapped lug-type butterfly valve bolting assemblies, refer to Figs. 1–7.

4. List of Tables

4.1 The tables are arranged in the following sequence:

150-lb Steel Flanged Joints	Table 1
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400-lb Steel Flanged Joints	Table 3
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5. Keywords

5.1 bolting lengths; cover bolt; flange joint(s); marine technology; ships; stud bolts

TABLE 1 Bolting Lengths for 150-lb Steel Flanged Joints to ASME B16.5 and MSS-SP-44 (see Fig. 1 and Fig. 2)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Carbon Steel, in. ^A	Stud Bolt Length Carbon Steel, in. ^A
1/2	1/2	4	7/16	1/2-13 UNC-2A	1 3/4	2 1/4
3/4	1/2	4	1/2	1/2-13 UNC-2A	2	2 1/2
1	1/2	4	9/16	1/2-13 UNC-2A	2	2 1/2
1 1/4	1/2	4	5/8	1/2-13 UNC-2A	2 1/4	2 3/4
1 1/2	1/2	4	1 1/16	1/2-13 UNC-2A	2 1/4	2 3/4
2	5/8	4	3/4	5/8-11 UNC-2A	2 3/4	3 1/4
2 1/2	5/8	4	7/8	5/8-11 UNC-2A	3	3 1/2
3	5/8	4	1 5/16	5/8-11 UNC-2A	3	3 1/2
3 1/2	5/8	8	1 5/16	5/8-11 UNC-2A	3	3 1/2
4	5/8	8	1 5/16	5/8-11 UNC-2A	3	3 1/2
5	3/4	8	1 5/16	3 3/4-11 UNC-2A	3 1/4	3 3/4
6	3/4	8	1	3/4-10 UNC-2A	3 1/4	4
8	3/4	8	1 1/8	3/4-10 UNC-2A	3 1/2	4 1/4
10	7/8	12	1 3/16	7/8-9 UNC-2A	3 3/4	4 1/2
12	7/8	12	1 1/4	7/8-9 UNC-2A	4	4 3/4
14	1	12	1 3/8	1-8 UNC-2A	4 1/4	5 1/4
16	1	16	1 7/16	1-8 UNC-2A	4 1/2	5 1/4
18	1 1/8	16	1 9/16	1 1/8-7 UNC-2A	5 3/4	
20	1 1/8	20	1 11/16	1 1/8-7 UNC-2A	5 1/4	6 1/4
24	1 1/4	20	1 7/8	1 1/4-7 UNC-2A	5 3/4	6 3/4
26	1 1/4	24	2 1/16	1 1/16-7 UNC-2A	7 1/4	8 1/2
28	1 1/4	28	2 13/16	1 1/4-7 UNC-2A	7 1/2	8 3/4
30	1 1/4	28	2 15/16	1 1/4-7 UNC-2A	7 3/4	9
32	1 1/2	28	3 3/16	1 1/2-6 UNC-2A	8 3/4	10
34	1 1/2	32	3 1/4	1 1/2-6 UNC-2A	8 3/4	10
36	1 1/2	32	3 9/16	1 1/2-6 UNC-2A	9 1/2 10 3/4	
38	1 1/2	32	3 7/16	1 1/2-6 UNC-2A	9 1/4	10 1/2
40	1 1/2	36	3 9/16	1 1/2-6 UNC-2A	9 1/2	10 3/4
42	1 1/2	36	3 13/16	1 1/2-6 UNC-2A	10	11 1/4
44	1 1/2	40	4	1 1/2-6 UNC-2A	10 1/4	11 1/2
46	1 1/2	40	4 1/16	1 1/2-6 UNC-2A	10 1/2	11 3/4
48	1 1/2	44	4 1/4	1 1/2-6 UNC-2A	10 3/4	12 1/4

^A 1 in. = 25.4 mm.

TABLE 2 Bolting Lengths for 300-lb Steel Flanged Joints to ASME B16.5 (see Fig. 1 and Fig. 2)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Carbon Steel, in. ^A	Stud Bolt Length Carbon Steel, in. ^A
1/2	1/2	4	9/16	1/2-13 UNC-2A	2	2 1/2
3/4	5/8	4	5/8	5/8-11 UNC-2A	2 1/4	3
1	5/8	4	1 1/16	5/8-11 UNC-2A	2 1/2	3
1 1/4	5/8	4	3/4	5/8-11 UNC-2A	2 1/2	3 1/4
1 1/2	3/4	4	13/16	3/4-10 UNC-2A	3	3 1/2
2	5/8	8	7/8	5/8-11 UNC-2A	3	3 1/2
2 1/2	3/4	8	1	3/4-10 UNC-2A	3 1/4	4
3	3/4	8	1 1/8	3/4-10 UNC-2A	3 1/2	4 1/4
3 1/2	3/4	8	1 3/16	3/4-10 UNC-2A	3 3/4	4 1/4
4	3/4	8	1 1/4	3/4-10 UNC-2A	3 3/4	4 1/2
5	3/4	8	1 3/8	3/4-10 UNC-2A	4	4 3/4
6	3/4	12	1 7/16	3/4-10 UNC-2A	4 1/4	4 3/4
8	7/8	12	1 5/8	7/8-8 UNC-2A	4 3/4	5 1/2
10	1	16	1 7/8	1-8 UNC-2A	5 1/4	6 1/4
12	1 1/8	16	2	1 1/8-7 UNC-2A	5 3/4	6 3/4
14	1 1/8	20	2 1/8	1 1/8-7 UNC-2A	6	7
16	1 1/4	20	2 1/4	1 1/4-7 UNC-2A	6 1/4	7
18	1 1/4	24	2 3/8	1 1/4-7 UNC-2A	6 1/2	7 3/4
20	1 1/4	24	2 1/2	1 1/4-7 UNC-2A	7	8
24	1 1/2	24	2 3/4	1 1/2-6 UNC-2A	7 3/4	9

^A 1 in. = 25.4 mm.

TABLE 3 Bolting Lengths for 400-lb Steel Flanged Joints to ASME B16.5 (see Fig. 3 and Fig. 4)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Alloy Steel, in. ^A	Stud Bolt Length Alloy Steel, in. ^A
1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
3/4	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
1	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
1 1/4	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
1 1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
2 1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
3	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
3 1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
4	7/8	8	1 3/8	7/8-9 UNC-2A	not used	5 1/2
5	7/8	8	1 1/2	7/8-9 UNC-2A	not used	5 3/4
6	7/8	12	1 5/8	7/8-9 UNC-2A	not used	6
8	1	12	1 7/8	1-8 UNC-2A	not used	6 3/4
10	1 1/8	16	2 1/8	1 1/8-8 UN-2A	not used	7 1/2
12	1 1/4	16	2 1/4	1 1/4-8 UN-2A	not used	8
14	1 1/4	20	2 3/8	1 1/4-8 UN-2A	not used	8 1/4
16	1 3/8	20	2 1/2	1 3/8-8 UN-2A	not used	8 3/4
18	1 3/8	24	2 5/8	1 3/8-8 UN-2A	not used	9
20	1 1/2	24	2 3/4	1 1/2-8 UN-2A	not used	9 1/2
24	1 3/4	24	3	1 3/4-8 UN-2A	not used	10 1/2

^A 1 in. = 25.4 mm.

^B For dimensions of these pipe sizes, refer to Table 4.

TABLE 4 Bolting Lengths for 600-lb Steel Flanged Joints to ASME B16.5 (see Fig. 3 and Fig. 4)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Alloy Steel, in. ^A	Stud Bolt Length Alloy Steel, in. ^A
1/2	1/2	4	9/16	1/2-13 UNC-2A	not used	3
3/4	5/8	4	5/8	5/8-11 UNC-2A	not used	3 1/2
1	5/8	4	1 1/16	5/8-11 UNC-2A	not used	3 1/2
1 1/4	5/8	4	1 3/16	5/8-11 UNC-2A	not used	3 3/4
1 1/2	3/4	4	7/8	3/4-10 UNC-2A	not used	4 1/4
2	5/8	8	1	5/8-11 UNC-2A	not used	4 1/4
2 1/2	3/4	8	1 1/8	3/4-10 UNC-2A	not used	4 3/4
3	3/4	8	1 1/4	3/4-10 UNC-2A	not used	5
3 1/2	7/8	8	1 3/8	7/8-9 UNC-2A	not used	5 1/2
4	7/8	8	1 1/2	7/8-9 UNC-2A	not used	5 3/4
5	1	8	1 3/4	1-8 UNC-2A	not used	6 1/2
6	1	12	1 7/8	1-8 UNC-2A	not used	6 3/4
8	1 1/8	12	2 3/16	1 1/8-8 UN-2A	not used	7 1/2
10	1 1/4	16	2 1/2	1 1/4-8 UN-2A	not used	8 1/2
12	1 1/4	20	2 5/8	1 1/4-8 UN-2A	not used	8 3/4
14	1 3/8	20	2 3/4	1 3/8-8 UN-2A	not used	9 1/4
16	1 1/2	20	3	1 1/2-8 UN-2A	not used	10
18	1 5/8	20	3 1/4	1 5/8-8 UN-2A	not used	10 3/4
20	1 5/8	24	3 1/2	1 5/8-8 UN-2A	not used	11 1/4
24	1 7/8	24	4	1 7/8-8 UN-2A	not used	13

^A 1 in. = 25.4 mm.

TABLE 5 Bolting Lengths for 900-lb Steel Flanged Joints to ASME B16.5 (see Fig. 3 and Fig. 4)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Alloy Steel, in. ^A	Stud Bolt Length Alloy Steel, in. ^A
1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
3/4	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
1	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
1 1/4	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
1 1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
2 1/2	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
3	7/8	8	1 1/2	7/8-9 UNC-2A	not used	5 3/4
4	1 1/8	8	1 3/4	1 1/8-8 UN-2A	not used	6 3/4
5	1 1/4	8	2	1 1/4-8 UN-2A	not used	7 1/2
6	1 1/8	12	2 3/16	1 1/8-8 UN-2A	not used	7 1/2
8	1 3/8	12	2 1/2	1 3/8-8 UN-2A	not used	8 3/4
10	1 3/8	16	2 3/4	1 3/8-8 UN-2A	not used	9 1/4
12	1 3/8	20	3 1/8	1 3/8-8 UN-2A	not used	10
14	1 1/2	20	3 3/8	1 1/2-8 UN-2A	not used	10 3/4
16	1 5/8	20	3 1/2	1 5/8-8 UN-2A	not used	11 1/4
18	1 7/8	20	4	1 7/8-8 UN-2A	not used	12 3/4
20	2	20	4 1/4	2-8 UN-2A	not used	13 3/4
24	2 1/2	20	5 1/2	2 1/2-8 UN-2A	not used	17 1/4

^A 1 in. = 25.4 mm.

^B For dimensions of these pipe sizes, refer to Table 6.

TABLE 6 Bolting Lengths for 1500-lb Steel Flanged Joints to ASME B16.5 (see Fig. 3 and Fig. 4)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Alloy Steel, in. ^A	Stud Bolt Length Alloy Steel, in. ^A
1/2	3/4	4	7/8	3/4-10 UNC-2A	not used	4 1/4
3/4	3/4	4	1	3/4-10 UNC-2A	not used	4 1/2
1	7/8	4	1 1/8	7/8-9 UNC-2A	not used	5
1 1/4	7/8	4	1 1/8	7/8-9 UNC-2A	not used	5
1 1/2	1	4	1 1/4	1-8 UNC-2A	not used	5 1/2
2	7/8	8	1 1/2	7/8-9 UNC-2A	not used	5 3/4
2 1/2	1	8	1 5/8	1-8 UNC-2A	not used	6 1/4
3	1 1/8	8	1 7/8	1 1/8-8 UN-2A	not used	7
4	1 1/4	8	2 1/8	1 1/4-8 UN-2A	not used	7 3/4
5	1 1/2	8	2 7/8	1 1/2-8 UN-2A	not used	9 3/4
6	1 5/8	12	3 1/4	1 5/8-8 UN-2A	not used	10 1/4
8	1 5/8	12	3 5/8	1 5/8-8 UN-2A	not used	11 1/2
10	1 7/8	12	4 1/4	1 7/8-8 UN-2A	not used	13 1/4
12	2	16	4 7/8	2-8 UN-2A	not used	14 3/4
14	2 1/4	16	5 1/4	2 1/4-8 UN-2A	not used	16
16	2 1/2	16	5 3/4	2 1/2-8 UN-2A	not used	17 1/2
18	2 3/4	16	6 3/8	2 3/4-8 UN-2A	not used	19 1/2
20	3	16	7	3-8 UN-2A	not used	21 1/4
24	3 1/2	16	8	3 1/2-8 UN-2A	not used	24 1/4

^A 1 in. = 25.4 mm.

TABLE 7 Bolting Lengths for 2500-lb Steel Flanged Joints to ASME B16.5 (see Fig. 3 and Fig. 4)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Alloy Steel, in. ^A	Stud Bolt Length Alloy Steel, in. ^A
1/2	3/4	4	1 3/16	3/4-10 UNC-2A	not used	4 3/4
3/4	3/4	4	1 1/4	3/4-10 UNC-2A	not used	5
1	7/8	4	1 3/8	7/8-9 UNC-2A	not used	5 1/2
1 1/4	1	4	1 1/2	1-8 UNC-2A	not used	6
1 1/2	1 1/8	4	1 3/4	1 1/8-8 UN-2A	not used	6 3/4
2	1	8	2	1-8 UNC-2A	not used	7
2 1/2	1 1/8	8	2 1/4	1 1/8-8 UN-2A	not used	7 3/4
3	1 1/4	8	2 5/8	1 1/4-8 UN-2A	not used	8 3/4
4	1 1/2	8	3	1 1/2-8 UN-2A	not used	10
5	1 3/4	8	3 5/8	1 3/4-8 UN-2A	not used	11 1/4
6	2	8	4 1/4	2-8 UN-2A	not used	13 1/2
8	2	12	5	2-8 UN-2A	not used	15
10	2 1/2	12	6 1/2	2 1/2-8 UN-2A	not used	19 1/4
12	2 3/4	12	7 1/4	2 3/4-8 UN-2A	not used	21 1/4

^A 1 in. = 25.4 mm.

TABLE 8 Bolting Lengths for 150-lb Bronze Flanged Joints to ASME B16.24 (see Fig. 1 and Fig. 2)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A	Bolt Stud Bolt Thread	Bolt Length Carbon Steel, in. ^A	Stud Bolt Length Carbon Steel, in. ^A
1/2	1/2	4	5/16	1/2-13 UNC-2A	1 1/2	2
3/4	1/2	4	1 1/32	1/2-13 UNC-2A	1 3/4	2 1/4
1	1/2	4	3/8	1/2-13 UNC-2A	1 3/4	2 1/4
1 1/4	1/2	4	1 3/32	1/2-13 UNC-2A	1 3/4	2 1/4
1 1/2	1/2	4	7/16	1/2-13 UNC-2A	1 3/4	2 1/4
2	5/8	4	1/2	5/8-11 UNC-2A	2	2 3/4
2 1/2	5/8	4	9/16	5/8-11 UNC-2A	2 1/4	2 3/4
3	5/8	4	5/8	5/8-11 UNC-2A	2 1/4	3
3 1/2	5/8	8	1 1/16	5/8-11 UNC-2A	2 1/2	3
4	5/8	8	1 1/16	5/8-11 UNC-2A	2 1/2	3
5	3/4	8	3/4	3/4-10 UNC-2A	2 3/4	3 1/2
6	3/4	8	1 3/16	3/4-10 UNC-2A	3	3 1/2
8	3/4	8	1 5/16	3/4-10 UNC-2A	3 1/4	3 3/4
10	7/8	12	1	7/8-9 UNC-2A	3 1/2	4 1/4
12	7/8	12	1 1/8	7/8-9 UNC-2A	3 1/2	4 1/4

^A 1 in. = 25.4 mm.

TABLE 9 Bolting Lengths for 300-lb Bronze Flanged Joints to ASME B16.24 (see Fig. 1 and Fig. 2)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A		Bolt Stud Bolt Thread	Bolt Length Carbon Steel, in. ^A	Stud Bolt Length Carbon Steel, in. ^A
			Steel	Bronze			
1/2	1/2	4	7/16	5/16	1/2-13 UNC-2A	1 3/4	2 1/4
3/4	5/8	4	1/2	11/32	1/2-13 UNC-2A	1 3/4	2 1/4
1	5/8	4	9/16	3/8	1/2-13 UNC-2A	1 3/4	2 1/4
1 1/4	5/8	4	5/8	13/32	1/2-13 UNC-2A	2	2 1/2
1 1/2	3/4	4	1 1/16	7/16	1/2-13 UNC-2A	2	2 1/2
2	5/8	4	3/4	1/2	5/8-11 UNC-2A	2 1/4	3
2 1/2	3/4	8	7/8	9/16	5/8-11 UNC-2A	2 1/2	3 1/4
3	5/8	4	1 5/16	5/8	5/8-11 UNC-2A	2 3/4	3 1/4
3 1/2	5/8	8	1 5/16	1 1/16	5/8-11 UNC-2A	2 3/4	3 1/4
4	5/8	8	1 5/16	1 1/16	5/8-11 UNC-2A	2 3/4	3 1/4
5	3/4	8	1 5/16	3/4	3/4-10 UNC-2A	3	3 3/4
6	3/4	8	1	13/16	3/4-10 UNC-2A	3	3 3/4
8	3/4	8	1 1/8	1 5/16	3/4-10 UNC-2A	3 1/4	4
10	7/8	12	1 3/16	1	7/8-9 UNC-2A	3 1/2	4 1/2
12	7/8	12	1 1/4	1 1/16	7/8-9 UNC-2A	3 3/4	4 1/2

^A 1 in. = 25.4 mm.

TABLE 10 Bolting Lengths for 150-lb Steel Flat Face to Bronze Flanged Joints to ASME B16.5 and B16.24 (see Fig. 1 and Fig. 2)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A		Bolt Stud Bolt Thread	Bolt Length Carbon Steel, in. ^A	Stud Bolt Length Carbon Steel, in. ^A
			Steel	Bronze			
1/2	1/2	4	7/16	5/16	1/2-13 UNC-2A	1 3/4	2 1/4
3/4	1/2	4	1/2	11/32	1/2-13 UNC-2A	1 3/4	2 1/4
1	1/2	4	9/16	3/8	1/2-13 UNC-2A	1 3/4	2 1/4
1 1/4	1/2	4	5/8	13/32	1/2-13 UNC-2A	2	2 1/2
1 1/2	1/2	4	1 1/16	7/16	1/2-13 UNC-2A	2	2 1/2
2	5/8	4	3/4	1/2	5/8-11 UNC-2A	2 1/4	3
2 1/2	5/8	4	7/8	9/16	5/8-11 UNC-2A	2 1/2	3 1/4
3	5/8	4	1 5/16	5/8	5/8-11 UNC-2A	2 3/4	3 1/4
3 1/2	5/8	8	1 5/16	1 1/16	5/8-11 UNC-2A	2 3/4	3 1/4
4	5/8	8	1 5/16	1 1/16	5/8-11 UNC-2A	2 3/4	3 1/4
5	3/4	8	1 5/16	3/4	3/4-10 UNC-2A	3	3 3/4
6	3/4	8	1	13/16	3/4-10 UNC-2A	3	3 3/4
8	3/4	8	1 1/8	1 5/16	3/4-10 UNC-2A	3 1/4	4
10	7/8	12	1 3/16	1	7/8-9 UNC-2A	3 1/2	4 1/2
12	7/8	12	1 1/4	1 1/16	7/8-9 UNC-2A	3 3/4	4 1/2

^A 1 in. = 25.4 mm.

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TABLE 11 Bolting Lengths for 300-lb Steel Flat Face to Bronze Flanged Joints to ASME B16.5 and B16.24 (see Fig. 1 and Fig. 2)

Nominal Pipe Size, in.	Bolt Diameter, in. ^A	Quantity per Joint	Flange Thickness, in. ^A		Bolt Stud Bolt Thread	Bolt Length Carbon Steel, in. ^A	Stud Bolt Length Carbon Steel, in. ^A
			Steel	Bronze			
1/2	1/2	4	9/16	1/2	1/2-13 UNC-2A	2	2 1/2
3/4	5/8	4	5/8	17/32	5/8-11 UNC-2A	2 1/4	2 3/4
1	5/8	4	1 1/16	19/32	5/8-11 UNC-2A	2 1/4	3
1 1/4	5/8	4	3/4	5/8	5/8-11 UNC-2A	2 1/2	3
1 1/2	3/4	4	13/16	1 1/16	3/4-10 UNC-2A	2 3/4	3 1/2
2	5/8	8	7/8	3/4	5/8-11 UNC-2A	2 3/4	3 1/4
2 1/2	3/4	8	1	13/16	3/4-10 UNC-2A	3	3 3/4
3	3/4	8	1 1/8	29/32	3/4-10 UNC-2A	3 1/4	4
3 1/2	3/4	8	1 3/16	31/32	3/4-10 UNC-2A	3 1/2	4
4	3/4	8	1 1/4	1 1/16	3/4-10 UNC-2A	3 1/2	4 1/4
5	3/4	8	1 3/8	1 1/8	3/4-10 UNC-2A	3 3/4	4 1/2
6	3/4	12	1 7/16	13/16	3/4-10 UNC-2A	3 3/4	4 1/2
8	7/8	12	1 5/8	1 3/8	7/8-9 UNC-2A	4 1/2	5 1/4

^A 1 in. = 25.4 mm.