



Standard Specification for Lap Joint Flange Pipe End Applications¹

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1. Scope

1.1 This specification covers the pipe material and wall thickness applicable to lap joint flange pipe ends, manufactured by a mechanical forming process.

1.2 The lap joint flange connection has been widely used for low-pressure systems in the marine, process piping, and similar industries.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

A 53/A 53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless²

A 106 Specification for Seamless Carbon Steel Pipe for High-Temperature Service²

A 135 Specification for Electric-Resistance-Welded Steel Pipe²

A 139 Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)²

A 161 Specification for Seamless Low-Carbon and Carbon-Molybdenum Steel Still Tubes for Refinery Service²

A 178/A 178M Specification for Electric-Resistance-Welded Carbon Steel and Carbon-Manganese Steel Boiler and Superheater Tubes²

A 199/A 199M Specification for Seamless Cold-Drawn Intermediate Alloy-Steel Heat-Exchanger and Condenser Tubes³

A 200 Specification for Seamless Intermediate Alloy-Steel Still Tubes for Refinery Service²

A 209/A 209M Specification for Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes²

A 210/A 210M Specification for Seamless Medium-Carbon Steel Boiler and Superheater Tubes²

A 250/A 250M Specification for Electric-Resistance-Welded Ferritic Alloy-Steel Boiler and Superheater Tubes²

A 252 Specification for Welded and Seamless Steel Pipe Piles²

A 312/A 312M Specification for Seamless and Welded Austenitic Stainless Steel Pipes²

A 333/A 333M Specification for Seamless and Welded Steel Pipe for Low-Temperature Service²

A 334/A 334M Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service²

A 500 Specification for Cold-Formed Welded and Seamless Carbon-Steel Structural Tubing in Rounds and Shapes²

A 512 Specification for Cold-Drawn Buttweld Carbon-Steel Mechanical Tubing²

A 519 Specification for Seamless Carbon and Alloy Steel Mechanical Tubing²

A 587 Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry²

A 589 Specification for Seamless and Welded Carbon-Steel Water-Well Pipe²

A 672 Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures²

B 42 Specification for Seamless Copper Pipe, Standard Sizes⁴

B 88 Specification for Seamless Copper Water Tube⁴

B 88M Specification for Seamless Copper Water Tube [Metric]⁴

B 280 Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service⁴

B 337 Specification for Seamless and Welded Titanium and Titanium Alloy Pipe⁵

B 338 Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers⁶

B 466/B 466M Specification for Seamless Copper-Nickel Pipe and Tube⁴

B 467 Specification for Welded Copper-Nickel Pipe⁴

2.2 *ANSI Standards:*

B31.1 Power Piping⁷

B31.3 Chemical Plant and Petroleum Refining Piping⁷

¹ This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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² *Annual Book of ASTM Standards*, Vol 01.01.

³ Discontinued; see *1994 Annual Book of ASTM Standards*, Vol 01.01. Replaced by Specification A 200.

⁴ *Annual Book of ASTM Standards*, Vol 02.01.

⁵ Discontinued; see *1996 Annual Book of ASTM Standards*, Vol 02.04. Replaced by Specifications B 861 and B 862.

⁶ *Annual Book of ASTM Standards*, Vol 02.04.

⁷ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

- B16.5 Pipe Flanges and Flanged Fittings⁷
- B16.9 Factory-Made Wrought Steel Butt-Welding Fittings⁷
- B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500⁷
- B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300⁷
- 2.3 ISO Standard:
- ISO-7005-1 Metallic Flanges Part 1: Steel Flanges⁷
- ISO-7005-2 Metallic Flanges Part 2: Cast Iron Flanges⁷
- ISO-7005-3 Metallic Flanges Part 3: Copper Alloy and Composite Flanges⁷

3. Terminology

- 3.1 *back-up flange*—the flange used to back up the lap joint to facilitate the pipe connection, also known in industry as loose, slip, plate, or spin flange.
- 3.2 *convoluted flange*—a back-up flange designed with a variable cross section to provide the material in the stress-related zones.
- 3.3 *lap joint end*—the formed pipe end to accommodate the back-up flange, commonly referred to as a Van Stone flange (see Fig. 1).

4. Dimensions and Tolerances

- 4.1 The lap joint end outside diameter shall be formed to the raised face flange diameter as covered under ISO Standard 7005-1, 7005-2, 7005-3, and ANSI B16.9 Table 7, Dim. G.
- 4.2 The back-up flange dimensions are covered under ANSI Standards B16.5, B16.24, and B16.42, and ISO Standards 7005-1, 7005-2, and 7005-3.

5. Fabrication

- 5.1 The formed lap joint end may have a smooth or serrated face.
- 5.2 The back-up flange may be a different material from the lap joint end pipe as long as it conforms to the applicable piping system codes or standards.
- 5.3 Convoluted back-up flanges may be used if they comply with the applicable piping system codes or standards.

6. Pipe Materials and Limitations

6.1 Table 1 contains a list of materials that have been found to have acceptable forming qualities to produce a lap joint end.

TABLE 1 Materials Having Acceptable Forming Qualities to Produce a Lap Joint End

Material	ASTM Material Specifications
Copper	B 88 B 280
Copper nickel	B 466/B 466M B 467
Titanium ^A	B 337 Grades 1 and 2 B 338 Grades 1 and 2
Steel ^B	A 53 A 135 A 161 low carbon A 199/A 199M Grade T11 A 209/A 209M Grade T1 A 250 Grade T16 A 333/A 333M Grade 1 A 500 Grade A A 519 Grade 1010 A 589 Grade A A 106 Grade B A 139 Grade A A 178/A 178M A 200 Grade T36 A 210/A 210M Grade A-1 A 252 Grade 1 A 334/A 334M Grade 1 A 512 Grade MT 1010 A 587 A 672 Grade A4
Stainless steel	A 312/A 312M TP 304 A 312/A 312M TP 304L A 312/A 312M TP 309S A 312/A 312M TP 310S A 312/A 312M TP 316 A 312/A 312M TP 316L A 312/A 312M TP 317 A 312/A 312M TP 321 A 312/A 312M TP 347

^ATitanium run pipe must be commercially pure (99.1 %).
^BSteel shall be hot formed in the temperature range from 850 to 1000°C (from 1562 to 1832°F). Under these conditions, no subsequent stress relieving is required.

7. Finish, Appearance and Repairs

- 7.1 The lap joint flange pipe connection shall be produced in accordance with accepted shop practices and shall be free from burrs and cracks, which would affect the suitability for the intended service.
- 7.2 Pipe/tube repairs are permitted in accordance with the applicable ASTM specification.

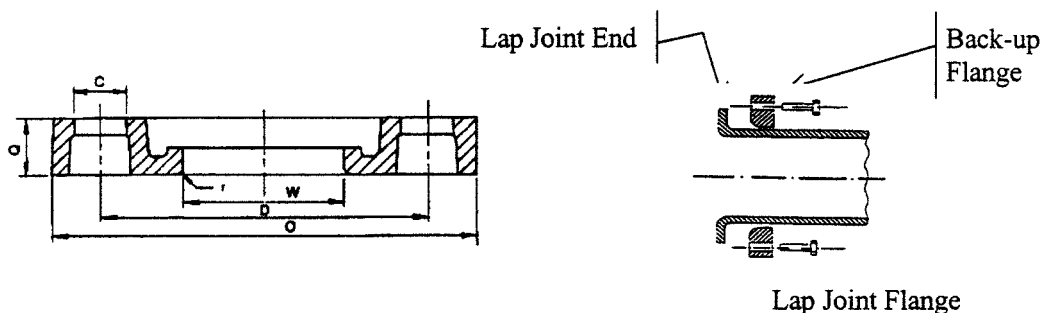


FIG. 1 Lap Joint End

8. Dimensional Limitations (see Tables 2-4)

8.1 Interpolation is allowable for sizes not covered.

8.2 The limitations are based on current technology subject to amendment to equipment or process developments, or both.

TABLE 2 Lap Joint Flange—Dimensional Limitations for Tube (SI Units)

NOTE 1—Key: 10 ≤ maximum wall in mm. 2 ≤ minimum wall in mm.

Tube Diameter, mm	Material			
	Carbon Steel	Stainless Steel	Copper Nickel	Titanium
21.3	3.0	3.0	3.0	2.4
	1.0	1.0	1.0	1.0
26.9	3.7	3.5	4.0	2.4
	1.0	1.0	1.0	1.0
33.7	4.0	3.7	4.5	3.1
	1.5	1.5	1.5	1.5
42.4	5.5	4.7	5.5	3.1
	1.5	1.5	1.5	1.5
48.3	6.2	5.0	6.0	3.1
	1.5	1.5	1.5	1.5
60.3	7.0	5.0	6.0	3.1
	1.5	1.5	1.5	1.5
76.1	8.0	5.8	6.0	3.4
	1.5	1.5	1.5	1.5
88.9	8.8	5.8	6.0	3.4
	1.5	1.5	1.5	1.5
114.3	9.5	5.8	6.0	3.4
	1.5	1.5	1.5	1.5
139.7	9.5	5.8	6.0	3.8
	1.5	1.5	1.5	1.5
168.3	9.5	5.8	6.0	3.8
	1.5	1.5	1.5	1.5
219.1	9.5	5.8	6.0	4.2
	1.5	1.5	1.5	1.5
273	9.5	5.8	6.0	4.7
	2.0	2.0	2.0	2.0
323.9	10.3	5.8	6.4	5.1
	2.0	2.0	2.0	2.0
355.6	10.3	5.8		5.3
	2.0	2.0		2.0
406.4	10.3	5.8		5.3
	2.0	2.0		2.0

TABLE 3 Lap Joint Flange—Dimensional Limitations for Tube (Inches-Pound Units)

NOTE 1—Key: 0.375 ≤ maximum wall in inches. 0.06 ≤ minimum wall in inches.

Tube Diameter, in.	Material			
	Carbon Steel	Stainless Steel	Copper Nickel	Titanium
7/8	0.120	0.120	0.120	0.094
	0.040	0.040	0.040	0.040
1	0.145	0.138	0.158	0.094
	0.040	0.040	0.040	0.040
1¼	0.158	0.145	0.177	0.123
	0.060	0.060	0.060	0.060
1½	0.217	0.185	0.216	0.123
	0.060	0.060	0.060	0.060
2	0.245	0.200	0.235	0.123
	0.060	0.060	0.060	0.060
2½	0.275	0.200	0.235	0.123
	0.060	0.060	0.060	0.060
3	0.315	0.200	0.235	0.136
	0.060	0.060	0.060	0.060
4	0.346	0.200	0.235	0.136
	0.060	0.060	0.060	0.060
5	0.375	0.200	0.235	0.136
	0.060	0.060	0.060	0.060
6	0.375	0.200	0.235	0.151
	0.060	0.060	0.060	0.060
7	0.375	0.200	0.235	0.151
	0.060	0.060	0.060	0.060
8	0.375	0.200	0.235	0.167
	0.060	0.060	0.060	0.060
10	0.375	0.200	0.235	0.186
	0.080	0.080	0.080	0.080
12	0.406	0.200	0.250	0.203
	0.080	0.080	0.080	0.080

9. Allowable Pressure and Temperature

9.1 The allowable pressures and temperatures shall be in accordance with ANSI B31.1 and B31.3, and the individual limitations imposed by the back-up flange, gasket, pipe, and fasteners in accordance with ANSI B16.5.

10. Keywords

10.1 lap joint flange; loose flange joint; slip flange joint; spin flange joint; Van Stone flange

TABLE 4 Lap Joint Flange—Dimensional Limitations for Pipe

NOTE 1—Key—Nearest pipe schedule to max wall (where applicable) \geq Schedule 40. $0.375 \leq$ maximum wall in inches. $0.08 \leq$ minimum wall in inches.

Pipe Diameter (NPS)	Material							
	Carbon Steel		Stainless Steel		Copper and Copper Nickel ^A		Titanium	
1/2	Schedule 40	0.120	Schedule 40	0.120	0.120	Schedule 10	0.094	
		0.040		0.040	0.040		0.040	
3/4	Schedule 40	0.145	Schedule 40	0.138	0.158	Schedule 10	0.094	
		0.040		0.040	0.040		0.040	
1	Schedule 40	0.158	Schedule 40	0.145	0.177	Schedule 10	0.123	
		0.060		0.060	0.060		0.060	
1 1/4	Schedule 40	0.217	Schedule 40	0.185	0.216	Schedule 10	0.123	
		0.060		0.060	0.060		0.060	
1 1/2	Schedule 40	0.245	Schedule 40	0.200	0.235	Schedule 10	0.123	
		0.060		0.060	0.060		0.060	
2	Schedule 40	0.275	Schedule 40	0.200	0.235	Schedule 10	0.123	
		0.060		0.060	0.060		0.060	
2 1/2	Schedule 40	0.315	Schedule 40	0.230	0.235	Schedule 10	0.136	
		0.060		0.060	0.060		0.060	
3	Schedule 40	0.346	Schedule 40	0.230	0.235	Schedule 10	0.136	
		0.060		0.060	0.060		0.060	
4	Schedule 40	0.375	Schedule 10	0.230	0.235	Schedule 10	0.136	
		0.060		0.060	0.060		0.060	
5	Schedule 40	0.375	Schedule 10	0.230	0.235	Schedule 10	0.151	
		0.060		0.060	0.060		0.060	
6	Schedule 40	0.375	Schedule 10	0.230	0.235	Schedule 10	0.151	
		0.060		0.060	0.060		0.060	
8	Schedule 40	0.375	Schedule 10	0.230	0.235	Schedule 10	0.167	
		0.060		0.060	0.060		0.060	
10	Schedule 40	0.375	Schedule 10	0.230	0.235	Schedule 10	0.186	
		0.080		0.080	0.080		0.080	
12	Schedule 40	0.406	Schedule 10	0.230	0.250	Schedule 10	0.203	
		0.080		0.080	0.080		0.080	
14	standard wall	0.406	Schedule 10S	0.230	0.250	Schedule 10S	0.212	
		0.080		0.080	0.080		0.080	
16	standard wall	0.406	Schedule 10S	0.230	0.250	Schedule 10S	0.212	
		0.080		0.080	0.080		0.080	

^AFor copper-nickel, nearest pipe class to maximum pipe wall is Class 200.

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