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Standard Specification for Lap Joint Flange Pipe End Applications[1]

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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 Seamless [2]

A 106 Specification for Seamless Carbon Steel Pipe for High-Temperature Service [2]

A 135 Specification for Electric-Resistance-Welded Steel Pipe[2]

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 Service [2]

A 178/A 178M Specification for Electric-Resistance-Welded Carbon Steel and Carbon-Manganese Steel Boiler and Superheater Tubes[2]

A 199/A 199M Specification for Seamless Cold-Drawn Intermediate Alloy-Steel Heat-Exchanger and Condenser Tubes[3]

A 200 Specification for Seamless Intermediate Alloy-Steel Still Tubes for Refinery Service[2]

A 209/A209M Specification for Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes [2]

A 210/A 210M Specification for Seamless Medium-Carbon Steel Boiler and Superheater Tubes [2]

A 250/A 250M Specification for Electric-Resistance-Welded Ferritic Alloy-Steel Boiler and Superheater Tubes [2]

A 252 Specification for Welded and Seamless Steel Pipe Piles[2]

A 312/A 312M Specification for Seamless and Welded Austenitic Stainless Steel Pipes [2]

A 333/A 333M Specification for Seamless and Welded Steel Pipe for Low-Temperature Service [2]

A 334/A 334M Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service [2]

A 500 Specification for Cold-Formed Welded and Seamless Carbon-Steel Structural Tubing in Rounds and Shapes [2]

A 512 Specification for Cold-Drawn Buttweld Carbon-Steel Mechanical Tubing[2]

A 519 Specification for Seamless Carbon and Alloy Steel Mechanical Tubing[2]

A 587 Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry [2]

A 589 Specification for Seamless and Welded Carbon-Steel Water-Well Pipe[2]

A 672 Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures [2]

B 42 Specification for Seamless Copper Pipe, Standard Sizes[4]

B 88 Specification for Seamless Copper Water Tube [4]

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

B 280 Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service [4]

B 337 Specification for Seamless and Welded Titanium and Titanium Alloy Pipe[5]

B 338 Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers[6]

B 466/B 466M Specification for Seamless Copper-Nickel Pipe and Tube[4]

B 467 Specification for Welded Copper-Nickel Pipe [4]

2.2 *ANSI Standards:*

B31.1 Power Piping[7]

B31.3 Chemical Plant and Petroleum Refining Piping [7]

B16.5 Pipe Flanges and Flanged Fittings [7]

[1] This specification is under the jurisdiction of ASTM Committee F-25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.13 on 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.

B16.9 Factory-Made Wrought Steel Butt-Welding Fittings [7]
B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500 [7]
B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300 [7]

2.3 *ISO Standard:*

ISO-7005-1 Metallic Flanges Part 1: Steel Flanges [7]
ISO-7005-2 Metallic Flanges Part 2: Cast Iron Flanges [7]
ISO-7005-3 Metallic Flanges Part 3: Copper Alloy and Composite Flanges [7]

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.

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.

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

[A] Titanium run pipe must be commercially pure (99.1 %).
[B] Steel 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.

7.2 Pipe/tube repairs are permitted in accordance with the applicable ASTM specification.

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.

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

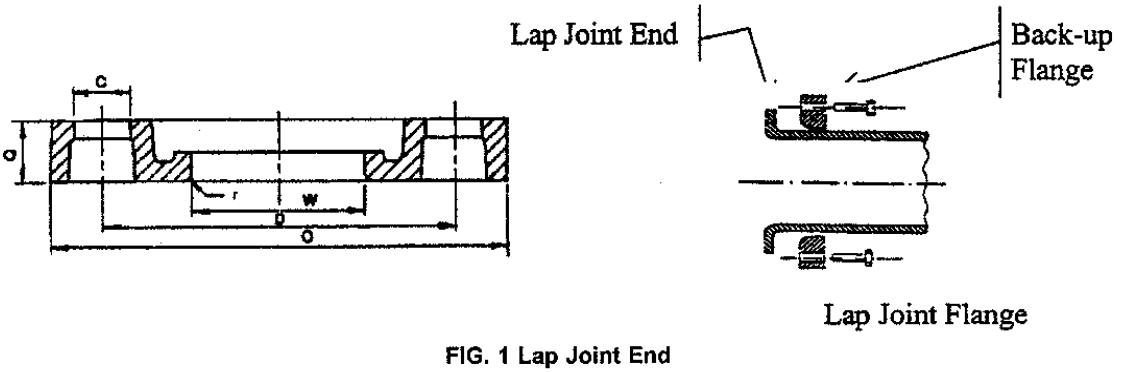

FIG. 1 Lap Joint End

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

limitations imposed by the back-up flange, gasket, pipe, and fasteners in accordance with ANSI B16.5.

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
⅛	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

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) ≥ Schedule 40. 0.375 ≤ maximum wall in inches. 0.08 ≤ minimum wall in inches.

	Material							
Pipe Diameter (NPS)	Carbon Steel		Stainless Steel		Copper and Copper Nickel[A]	Titanium		
½	Schedule 40	0.120	Schedule 40	0.120	0.120	Schedule 10	0.094	
		0.040		0.040	0.040		0.040	
¾	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	
1¼	Schedule 40	0.217	Schedule 40	0.185	0.216	Schedule 10	0.123	
		0.060		0.060	0.060		0.060	
1½	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	
2½	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	

[A]For copper-nickel, nearest pipe class to maximum pipe wall is Class 200.