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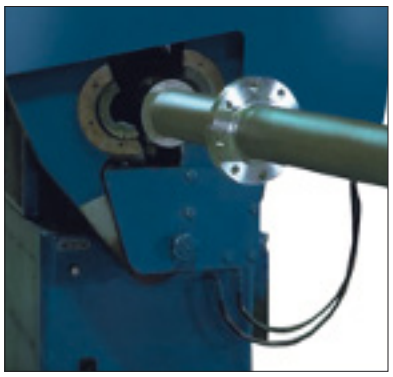
LAP JOINT FLARING

PIPE FORMING GUIDE
Specification No. ES8 | March 1, 1996 (Rev. 6/4/2020)

1.0 SCOPE

Roll flaring the end of pipe, also known as Van Stone Flanging, is a procedure which allows flanged connections without welding. A loose back-up flange is placed on the pipe prior to flaring. Approximately the last inch of pipe is then roll formed into a ring perpendicular to the pipe axis. This ring, or flared lap, matches the raised face of a 150# or 300# flange. Because the flange is not welded to the pipe and rotates, bolt-hole alignment is never an issue. The back-up flange used may be as listed in Section 6.0 of this guide. Flaring is covered by ASME B31.3, Par. 306.4.2.

2.0 SIZES



2.1 General

Depending on the mechanical properties of the pipe being formed, equipment is capable of flaring the following sizes:

1/2" – 12" N.P.S.
Sch 5S, 10S and Std. Wt. (or Sch 40S)

1/2" – 8" N.P.S.
XH (or Sch 80S)

3.0 FLARED LAP DIMENSIONS

3.1 General

Lap diameter and lap thickness are specified in ASME B31.3-93, Par. 306.4.2. The lap diameter matches the outside diameter of the raised face of a typical 150# or 300# flange per ASME B16.5. The lap thickness, measured at any point, shall be at least 95% of the minimum pipe wall multiplied by the ratio of the pipe outside radius to the radius at which the lap thickness is measured. (See FIG. 4)

4.0 MATERIALS

4.1 Carbon Steels

ASTM SA/A587
ASTM SA/A53, Grades A & B
ASTM SA/A106

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4.2 Alloys

ALLOY	SPECIFICATION
Stainless Steel	SA/A312, Types 304, 304L, 316, 316L, 309, 310, 317, 321, 347 Alloy 20, Alloy 254-SMO, AL-6XN, Alloy 2205
Nickel Alloys	Nickel 200, Alloy 400 (Monel®) Alloys 600, 601, 625, 690 (Inconel®) Alloys 800, 825 (Incoloy®) Alloys C-276, B-2 (Hastelloy®)
Aluminum	3003, 5083, 6061-T4, 6061-T6, 6063-T6
Titanium	Grade 1, Grade 2
Zirconium	702 Grade

The above list of alloys is a representative sample of grades typically bent or formed. Please contact APEX with your bending flaring or other forming requirement for a material grade not listed, as we have much experience forming other grades which are not listed.

Monel®, Inconel®, Incoloy® are trademarks of Special Metals Inc. Hastelloy® is the trademark of Haynes International.
AL-6XN is the trademark of ATI Properties, Inc. 254 SMO is a trademark of Outokumpu Stainless.

5.0 FLARED LAP SPECIFICATIONS

5.1 Facing

Most flared laps are smooth faced and will have an RMS 125 finish or smoother. Depending on gasket selection, the flared lap can also be specified with concentric serrations. APEX Mechanical & Fabrication has a method of rolling concentric serrations while the pipe is being flared. Each serration serves as an independent barrier. (See FIG. 1)

5.2 Lap Flatness

Flatness of the lap is determined by laying a straight edge across the lap and measuring any gap between the straight edge and the lap face. (See FIG. 2) No gap should be visible at the outer edge and the maximum gap on the inner edge should be:

Nominal Pipe Size	Chamfer
½" – 4"	1/32"
6" – 12"	1/16"

5.3 Perpendicularity

As per ASME B31.3 Par. 335.1(c), alignment of the lap face shall not deviate from the indicated position measured across any diameter more than 1/16" per foot of diameter. (See FIG. 3)

FIG. 1 - Facing

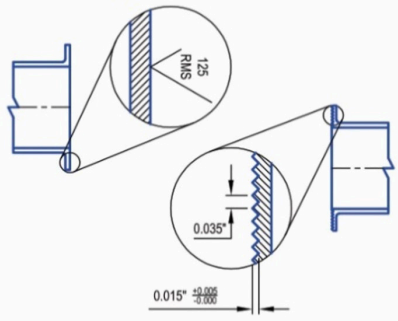


FIG. 2 - Lap Flatness

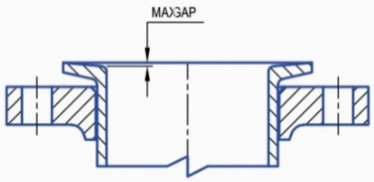
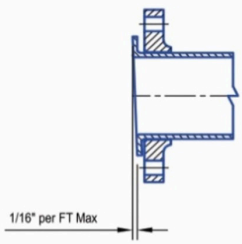


FIG. 3 - Perpendicularity



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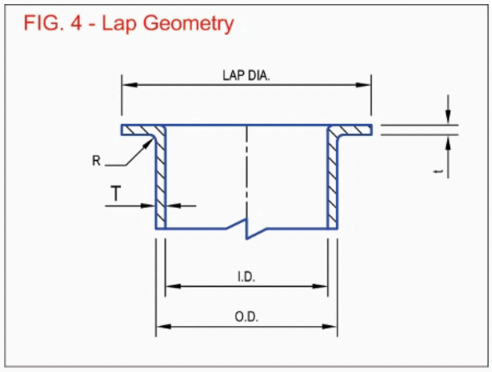
5.4 Lap Geometry

The radius (Dimension "R") is 1/16" for 1/2" thru 4" N.P.S. and 1/8" for 5" through 12" N.P.S. A larger radius is sometimes required for special applications. Pipe flared for plastic lining applications normally requires a larger radius between pipe I.D. and lap which makes the O.D. radius larger as well (See FIG. 4)

T= Pipe Wall Nominal Thickness

t = Thickness of lap after flaring
(See Par. 3.0 and ASME B31.3-93, Par. 306.4.2)

FIG. 4 - Lap Geometry



6.0 BACK UP FLANGES

6.1 Facing

Since the process fluid does not touch the flange, selection of the back-up flange is based on:

1. Operating Pressure/Temperature
2. External Corrosion
3. Economy

As per B31.3, Par. 306.4.2 the flared lap is suitable for use in Normal Fluid Service (for exceptions, see Section 8.0). In most instances, carbon, stainless, and non-ferrous metal laps will use one of the following types of flanges.

A. SA/A105 Slip-On (modified) – to allow for the Lap Radius per 5.4 of the specification above, this flange must be chamfered on the face I.D. as provided in the table to the right:

Nominal Pipe Size	Chamfer
½" – 1"	3/16"
1½" – 3"	1/4"
4" – 12"	3/8"

B. A395 Ductile Iron – Approved for ASME B31.3 and ASME Section VIII use. See ASME 16.42 for Pressure/Temperature ratings.

C. Carbon Steel Plate Flange (i.e. SA/A516 or SA/A36) – Thickness must be calculated according to ASME B31.3 Par. 304.5 or from Appendix II of ASME Section VIII, Div. 1.

D. SA/A105 Lap Joint – More expensive than the Slip-On Flange but in small quantities may prove less expensive then chamfering the Slip-On Flange.

E. Other Choices – Individual cases may indicate other options. Some possibilities, in no particular order, include: Galvanized Carbon Steel, Epoxy Coated Carbon Steel, Stainless Steel Plate Flanges.

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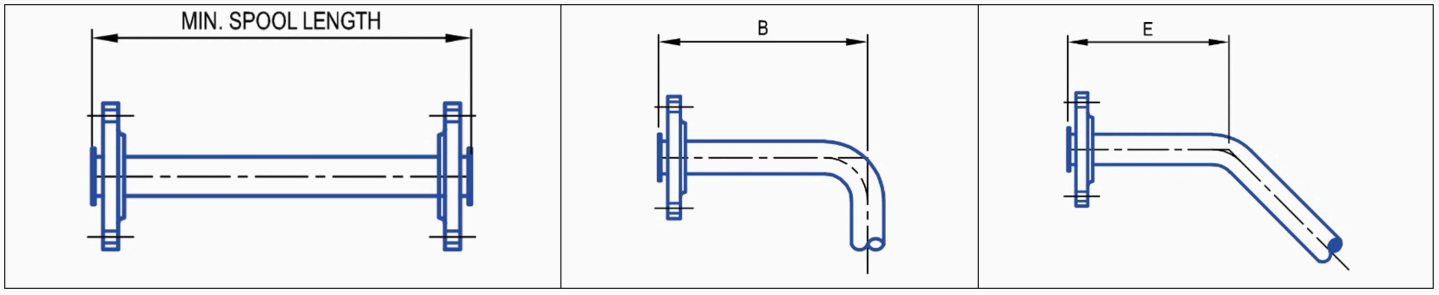
TABLE 1: FLARED PIPE DIMENSIONS

MINIMUM CENTER-TO-END FACE DIMENSIONS FOR BEND RADIUS SHOWN							
				90 Degree Bends		45 Degree Bends	
Pipe Size	Outside DIA.	Lap DIA.	Min. Spool Length*	1-½ DIA. B	3 DIA. B	1-½ DIA. E	3 DIA. E
1/2"	.840"	1-3/8"	6"	7"	7"	6"	6"
3/4"	1.050"	1-11/16"	6"	7"	7"	6"	6"
1"	1.315"	2"	7"	7"	6-7/8"	6"	6"
1-1/2"	1.90"	2-7/8"	7"	8"	9-3/16"	6"	6-1/2"
2"	2.375"	3-5/8"	7-1/2"	8"	10-15/16"	6-1/2"	7-7/16"
2-1/2"	2.875"	4-1/8"	9"	10"		7-3/4"	
3"	3.50"	5"	10"	12"	16"	9"	10-11/16"
4"	4.50"	6-3/16"	10"	14"	19"	9-3/4"	12"
6"	6.625"	8-1/2"	17"		34"		23-1/2"
8"	8.625"	10-5/8"	17"				
10"	10.750"	12-3/4"	18"				
12"	12.750"	15"	18"				

* Minimum Flared Pipe Spool length with two (2) 150# flanges and without a weld. Dimensions for minimum Flared Pipe Spool length with two (2) 300# flanges and without a weld are available upon request. Please contact APEX with questions regarding any minimum forming dimensions at (302) 995-6136 or fax (302) 995-1257.



7.0 SAFETY

Loose flanged pipe systems should have a safety button attached 2" – 4" behind each flange. This can be a drop of weld metal, a stud or any other mechanical stop which will prohibit the flange from sliding down the pipe where it could injure fingers or do other damage.

8.0 LIMITS ON FLARED LAPS

Per ASME B31.3 and reflecting industry-wide usage, Flared Laps:
A. Are not used with 400# or higher rated back-up flanges.
B. Are not used in severe cyclic service or in Category M service.