

Technical Literature of Flanges

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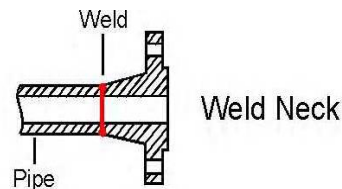
Flanges - General Information

A Flange is a method of connecting pipes, valves, pumps and other equipment to form a pipework system. It also provides easy access for cleaning, inspection or modification. Flanges are usually welded or screwed into such systems and then joined with bolts.

Flange Types

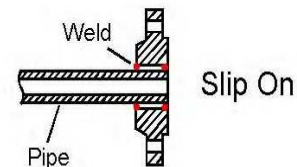
Weld Neck

This flange is circumferentially welded into the system at its neck which means that the integrity of the butt welded area can be easily examined by radiography. The bores of both pipe and flange match, which reduces turbulence and erosion inside the pipeline. The weld neck is therefore favoured in critical applications



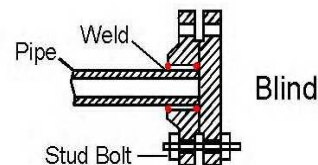
Slip-on

This flange is slipped over the pipe and then fillet welded. Slip-on flanges are easy to use in fabricated applications.



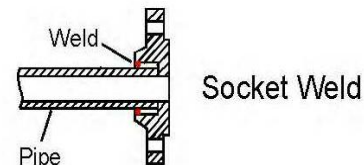
Blind

This flange is used to blank off pipelines, valves and pumps, it can also be used as an inspection cover. It is sometimes referred to as a blanking flange.



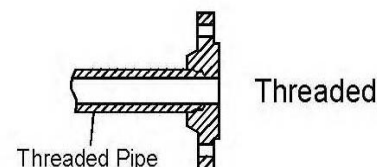
Socket Weld

This flange is counter bored to accept the pipe before being fillet welded. The bore of the pipe and flange are both the same therefore giving good flow characteristics.



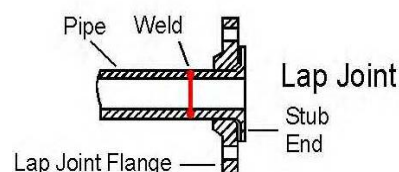
Threaded

This flange is referred to as either threaded or screwed. It is used to connect other threaded components in low pressure, non-critical applications. No welding is required.



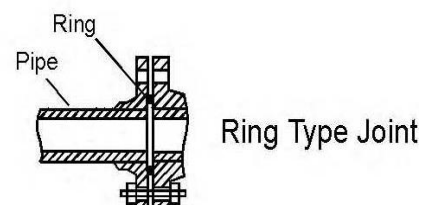
Lap Joint

These flanges are always used with either a stub end or taft which is butt welded to the pipe with the flange loose behind it. This means the stub end or taft always makes the face. The lap joint is favoured in low pressure applications because it is easily assembled and aligned. To reduce cost these flanges can be supplied without a hub and/or in treated, coated carbon steel.



Ring Type Joint

This is a method of ensuring leak proof flange connection at high pressures. A metal ring is compressed into a hexagonal groove on the face of the flange to make the seal. This jointing method can be employed on Weld Neck, Slip-on and Blind Flanges.



Flanges - General Information

Specifications

ASME B16.5 ASME B16.47 BS 4504 BS 3293 BS 10

Manufacture

Summary of materials used for flanges

	ASME/ ANSI B16.5	ASME B16.47 Series A (or MSS SP-44 ¹)	ASME B16.47 Series B (or API 605 ²)	BS 4504	BS 3293	BS 10 ³
Forging (ASTM A 182)	✓	✓	✓	✓	✓	✓
Plate (ASTM A 240) ⁴	✓			✓		✓
Bar ⁵						✓
Casting ⁶	✓			✓		✓

Notes

- 1 MSS SP-44 flanges are designated Series A flanges in ASME B16.47.
- 2 API 605 has been cancelled. API 605 flanges are designated Series B flanges in ASME B16.47.
- 3 BS 10, although obsolete, remains in use for light weight economy stainless steel flanges.
- 4 Within specification ANSI B16.5, plate can only be used to provide blind flanges.
- 5 Most small BS 10 flanges are made from bar.
- 6 Castings are not included in this manual.

- Materials. Most standards specify the material from which the flange is produced. The purchaser should specify the exact requirements.
- Flange Sizes. All sizes and grades compatible to standard pipe ranges and wall thicknesses (pressure ratings) are available. The table below provides a summary.
- Flange Face. There are various face configurations for flanges. Typically: flat face, raised face, tongue and groove, ring joint.
- Face Finish. The finish on the face of a flange is measured as an Arithmetical Average Roughness Height (AARH). The finish is determined by the standard used. For example, ANSI B16.5 specifies face finishes within a range 125AARH - 500AARH (3.2 Ra to 12.5 Ra). Other finishes are available on request, for example 1.6 Ra max, 1.6/3.2 Ra, 3.2/6.3 Ra or 6.3/12.5 Ra. The range 3.2/6.3 Ra is most common.

Summary of flange sizes specified by common standards

Flange Type	Specifications				
	ASME/ANSI B16.5	ASME B16.47 Series A (or MSS SP-44 ¹)	ASME B16.47 Series B (or API 605 ²)	BS 4504 (ISO 7005-1)	BS 3293
	Nominal Pipe Sizes				
	< NPS 26	≥NPS 26	≥NPS 26	DN 10 to DN 4000	≥ NPS 26
	Nominal Pressure (Class)				
	Class (lb)	Class (lb)	Class (lb)	PN (bar)	Class (lb)
Weld Neck	150-2500	150-900	75-900	2.5-40	150-600
Slip-on	150-1500	-	-	2.5-40	150-600
Blind	150-2500	300-900	300-900	2.5-40	-
Lap Joint	150-2500	-	-	6-40 ³	-
Socket Weld	150-1500	-	-	N/A	-
Threaded	150-2500	-	-	6-40	-
Flat/Raised Facings	As above	As above	As above	As above	As above
Ring Joint Facings	150-2500	300-900	300-900	2.5-40	300-600
Other Facings	150-2500 ³	-	-	2.5-40	-

Notes

- 1 MSS SP-44 flanges are designated Series A flanges in ASME B16.47. It also covers flanges in the range NPS 12 to 24, these being equivalent to ASME/ANSI B16.5 flanges in the same range (except for the addition of NPS 22 in MSS SP-44).
- 2 API 605 has been cancelled. API 605 flanges are designated Series B flanges in ASME B16.47. Ranges quoted are based on ASME B16.47 Series B.
- 3 Dimensions not covered in this summary.

BS 3293 : 1960

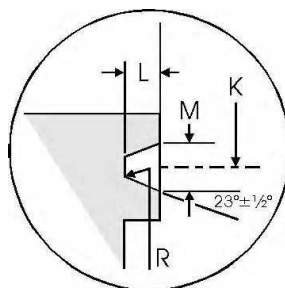
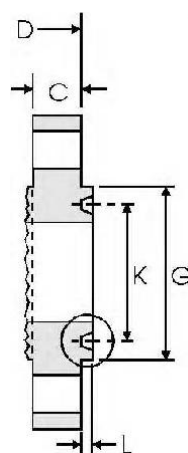
British Standard BS 3293 : 1960 - Carbon Steel Pipe Flanges (over 24 inches nominal size) for the Petroleum Industry, covers Class 150 lb to 600 lb weld neck and slip on flanges.

Dimensions and Tolerances

Tolerances on flange dimensions (BS 3293 : 1960)

Dimension		Tolerance	
Weld Neck and Slip On Flanges (pages 56 to 59)	G (raised face diameter)	$\pm 1/64$	± 0.40
	C (flange thickness)	$+3/16, -0$	$+4.76, -0$
	D (overall length)	$\pm 1/8$	± 3.18
	E (outside diameter at welding end of weld neck hub)	$+5/32, -1/32$	$+3.97, -0.79$
	B (inside diameter of weld neck flange)	$+1/8, -1/16$	$+3.18, -1.59$
	B (inside diameter of slip on flange)	$+1/16, -0$	$+1.59, -0$
Ring Joint Facing on Weld Neck and Slip On Flanges (see below)	L (depth of groove)	$+1/64, -0$	$+0.40, -0$
	M (width of groove)	± 0.008	± 0.20
	K (pitch diameter of groove)	± 0.005	± 0.13






Ring Joint Facings - BS 3293



Note

- Values for minimum flange thickness, C, and overall length, D, are detailed in the flange tables.
- For ring joint tolerances see above.
- $R = 1/16$ in (0.40 mm) max, corner radius at bottom of groove.

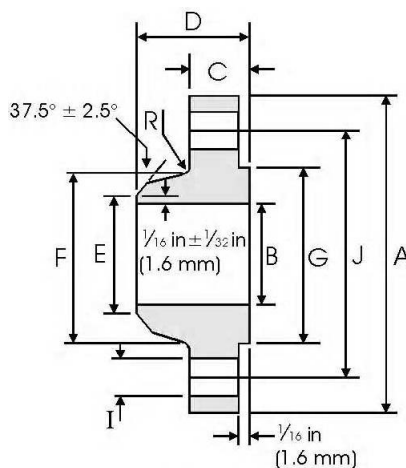
Ring joint facing dimensions - BS 3293

Class (lb)				Groove/Ring Number	Raised Face	Groove			Weight		
150	300	400	600							kg/piece	
Nominal Pipe Size (NPS)					Face Diameter min	Pitch Diameter	Depth	Width	Class 300 lb	Class 400 lb	Class 600 lb
					in mm	in mm	in mm	in mm	WNF Slip on	WNF Slip on	WNF Slip on
	26	26	26	R93	31 ⁷ / ₈ 809.6	29 ¹ / ₂ 749.3	1 ¹ / ₂ 12.7	25 ³ / ₃₂ 19.8	298 270	349 304	446 417
	28	28	28	R94	33 ⁷ / ₈ 860.4	31 ¹ / ₂ 800.1	1 ¹ / ₂ 12.7	25 ³ / ₃₂ 19.8	360 333	409 364	518 482
	30	30	30	R95	36 ¹ / ₈ 917.6	33 ³ / ₄ 857.2	1 ¹ / ₂ 12.7	25 ³ / ₃₂ 19.8	412 376	465 419	570 537
	32	32	32	R96	38 ³ / ₄ 984.2	36 914.4	9 ¹ / ₁₆ 14.3	29 ³ / ₃₂ 23.0	465 425	539 482	697 622
	34	34	34	R97	40 ³ / ₄ 1035.0	38 965.2	9 ¹ / ₁₆ 14.3	29 ³ / ₃₂ 23.0	536 492	608 540	735 670
	36	36	36	R98	43 1092.2	40 ¹ / ₄ 1022.3	9 ¹ / ₁₆ 14.3	29 ³ / ₃₂ 23.0	595 548	689 621	800 764

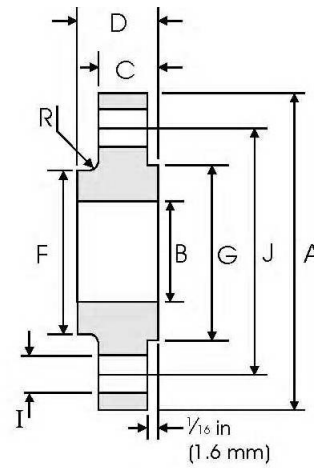
Note

- Weights are based on manufacturer's data and are approximate.

Weld Neck and Slip On Flanges - BS 3293




Weld Neck



Slip On

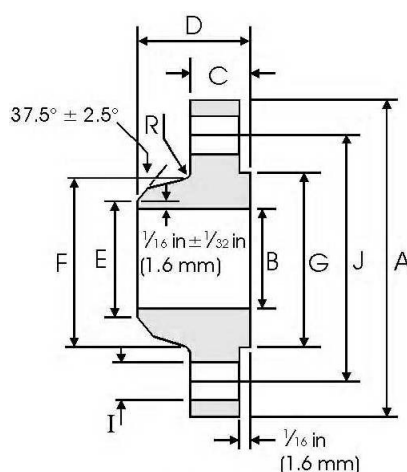
Class 150 lb

Pipe	Flange Data					Hub Data		Raised Face	Drilling Data			Radius	Weight
Nominal Pipe Size	A	B	C	D		E	F	G	H	I	J	R	
	Overall Diameter	Slip on Inside Diameter	Flange Thickness	WNF Overall Length	Slip on Overall Length	WNF Diameter at Weld Bevel	WNF / Slip on Hub Diameter	Face Diameter	Number of Holes	Bolt Hole Diam.	Diameter of Circle of Holes	Fillet	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	in mm	in mm
26	34 ¹ / ₄ 869.9	26 ¹ / ₄ 666.7	2 50.8	5 127.0	3 ³ / ₈ 85.7	26 660.4	28 ¹ / ₂ 723.9	29 ¹ / ₄ 742.9	24	1 ³ / ₈ 34.9	31 ³ / ₄ 806.4	1/4 6.35	118 107
28	36 ¹ / ₂ 927.1	28 ¹ / ₄ 717.6	2 ¹ / ₁₆ 52.4	5 ¹ / ₁₆ 128.6	3 ⁷ / ₁₆ 87.3	28 711.2	30 ³ / ₄ 781.0	31 ¹ / ₄ 793.7	28	1 ³ / ₈ 34.9	34 863.6	1/4 6.35	134 122
30	38 ³ / ₄ 984.2	30 ¹ / ₄ 768.3	2 ¹ / ₈ 54.0	5 ¹ / ₈ 130.2	3 ¹ / ₂ 88.9	30 762.0	32 ³ / ₄ 831.8	33 ³ / ₄ 857.2	28	1 ³ / ₈ 34.9	36 914.4	1/4 6.35	153 138
32	41 ³ / ₄ 1060.4	32 ¹ / ₄ 819.1	2 ¹ / ₄ 57.1	5 ¹ / ₄ 133.3	3 ⁵ / ₈ 92.1	32 812.8	35 889.0	35 ³ / ₄ 908.0	28	1 ⁵ / ₈ 41.3	38 ¹ / ₂ 977.9	5/16 7.94	190 170
34	43 ³ / ₄ 1111.2	34 ¹ / ₄ 869.9	2 ⁵ / ₁₆ 58.7	5 ⁵ / ₁₆ 134.9	3 ¹¹ / ₁₆ 93.7	34 863.6	37 939.8	37 ³ / ₄ 958.8	32	1 ⁵ / ₈ 41.3	40 ¹ / ₂ 1028.7	5/16 7.94	212 184
36	46 1168.4	36 ¹ / ₄ 920.7	2 ³ / ₈ 60.3	5 ³ / ₈ 136.5	3 ³ / ₄ 95.2	36 914.4	39 ¹ / ₄ 996.9	40 ¹ / ₄ 1022.3	32	1 ⁵ / ₈ 41.3	42 ³ / ₄ 1085.8	5/16 7.94	242 211
38	48 ³ / ₄ 1238.2	38 ¹ / ₄ 971.5	2 ³ / ₈ 60.3	5 ³ / ₈ 136.5	3 ³ / ₄ 95.2	38 965.2	41 ³ / ₄ 1060.4	42 ¹ / ₄ 1073.1	32	1 ⁵ / ₈ 41.3	45 ¹ / ₄ 1149.3	3/8 9.53	284 249
40	50 ³ / ₄ 1289.0	40 ¹ / ₄ 1022.3	2 ¹ / ₂ 63.5	5 ¹ / ₂ 139.7	3 ⁷ / ₈ 98.4	40 1016.0	43 ³ / ₄ 1111.2	44 ¹ / ₄ 1123.9	36	1 ⁵ / ₈ 41.3	47 ¹ / ₄ 1200.1	3/8 9.53	311 272
42	53 1346.2	42 ¹ / ₄ 1073.2	2 ⁵ / ₈ 66.7	5 ⁵ / ₈ 142.9	4 101.6	42 1066.8	46 1168.4	47 1193.8	36	1 ⁵ / ₈ 41.3	49 ¹ / ₂ 1257.3	3/8 9.53	358 313
44	55 ¹ / ₄ 1403.3	44 ¹ / ₄ 1123.9	2 ⁵ / ₈ 66.7	5 ⁵ / ₈ 142.9	4 101.6	44 1117.6	48 1219.2	49 1244.6	40	1 ⁵ / ₈ 41.3	51 ³ / ₄ 1314.4	7/16 11.11	376 331
46	57 ¹ / ₄ 1454.2	46 ¹ / ₄ 1174.7	2 ¹¹ / ₁₆ 68.3	5 ¹¹ / ₁₆ 144.5	4 ¹ / ₁₆ 103.2	46 1168.4	50 1270.0	51 1295.4	40	1 ⁵ / ₈ 41.3	53 ³ / ₄ 1365.2	7/16 11.11	399 349
48	59 ¹ / ₂ 1511.1	48 ¹ / ₄ 1225.5	2 ³ / ₄ 69.9	5 ³ / ₄ 146.1	4 ¹ / ₈ 104.8	48 1219.2	52 ¹ / ₄ 1327.2	53 ¹ / ₂ 1358.9	44	1 ⁵ / ₈ 41.3	56 1422.4	7/16 11.11	440 381

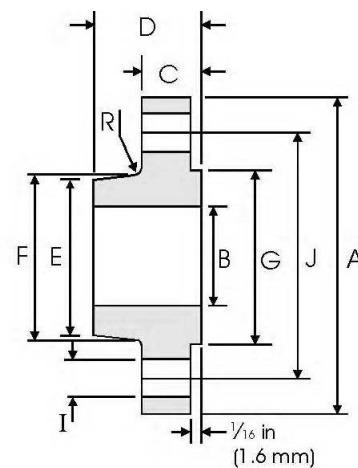
Notes

- For weld neck flanges, dimension B is to be specified by the purchaser. It corresponds to the pipe inside diameter.
- For slip on flanges, the hub may be cylindrical or have a draft of $\leq 7^\circ$ on the outside surface.
- WNF = Weld Neck Flange.
- Weights are based on manufacturer's data and are approximate.
- For ring joint facings see page 55.
- For tolerances see page 55.

Weld Neck and Slip On Flanges - BS 3293



Weld Neck



Slip On

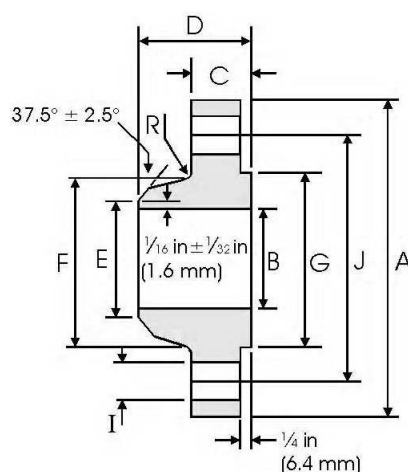
Class 300 lb

Pipe	Flange Data				Hub Data			Raised Face	Drilling Data			Radius	Weight
Nominal Pipe Size	A	B	C	D	E	F	G	H	I	J	R		
	Overall Diameter	Slip on Inside Diameter	Flange Thickness	WNF / Slip on Overall Length	WNF Diam. at Weld Bevel	Slip on Hub Diam. at Small End	Hub Diameter	Face Diameter	Number of Holes	Bolt Hole Diam.	Diameter of Circle of Holes	Fillet	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	in mm	WNF Slip On
26	38 ¹ / ₄ 971.5	26 ¹ / ₄ 666.7	3 ¹ / ₈ 79.4	7 ¹ / ₄ 184.1	26 ¹ / ₄ 666.7	27 ¹ / ₁₆ 687.4	28 ³ / ₈ 720.7	29 ¹ / ₂ 749.3	28	1 ³ / ₄ 44.4	34 ¹ / ₂ 876.3	³ / ₈ 9.53	279 251
28	40 ³ / ₄ 1035.0	28 ¹ / ₄ 717.6	3 ³ / ₈ 85.7	7 ³ / ₄ 196.8	28 ¹ / ₄ 717.5	29 ¹ / ₈ 739.7	30 ¹ / ₂ 774.7	31 ¹ / ₂ 800.1	28	1 ³ / ₄ 44.4	37 939.8	⁷ / ₁₆ 11.11	340 313
30	43 1092.2	30 ¹ / ₄ 768.3	3 ⁵ / ₈ 92.1	8 ¹ / ₄ 209.5	30 ¹ / ₄ 768.3	31 ³ / ₁₆ 792.2	32 ⁹ / ₁₆ 827.2	33 ³ / ₄ 857.2	28	1 ⁷ / ₈ 47.6	39 ¹ / ₄ 996.9	⁷ / ₁₆ 11.11	390 354
32	45 ¹ / ₄ 1149.3	32 ¹ / ₄ 819.1	3 ⁷ / ₈ 98.4	8 ³ / ₄ 222.2	32 ¹ / ₄ 819.1	33 ¹ / ₄ 844.6	34 ¹¹ / ₁₆ 881.1	36 914.4	28	2 50.8	41 ¹ / ₂ 1054.1	⁷ / ₁₆ 11.11	435 395
34	47 ¹ / ₂ 1206.5	34 ¹ / ₄ 869.9	4 101.6	9 ¹ / ₈ 231.8	34 ⁵ / ₁₆ 871.5	35 ⁵ / ₁₆ 896.9	36 ⁷ / ₈ 936.6	38 965.2	28	2 50.8	43 ¹ / ₂ 1104.9	¹ / ₂ 12.7	504 460
36	50 1270.0	36 ¹ / ₄ 920.7	4 ¹ / ₈ 104.8	9 ¹ / ₂ 241.3	36 ⁵ / ₁₆ 922.3	37 ³ / ₈ 949.3	39 990.6	40 ¹ / ₄ 1022.3	32	2 ¹ / ₈ 54.0	46 1168.4	¹ / ₂ 12.7	560 513

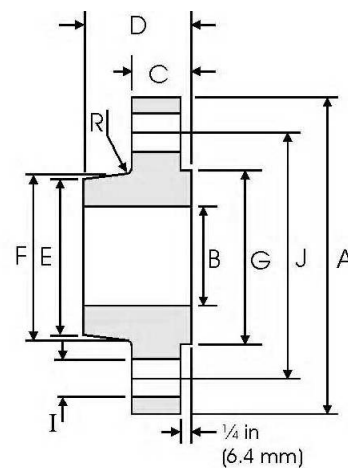
Notes

- For weld neck flanges, dimension B is to be specified by the purchaser. It corresponds to the pipe inside diameter.
- For slip on flanges, the hub may be cylindrical or have a draft of $\leq 7^\circ$ on the outside surface.
- WNF = Weld Neck Flange.
- Weights are based on manufacturer's data and are approximate.
- For ring joint facings see page 55.
- For tolerances see page 55.

Weld Neck and Slip On Flanges - BS 3293



Weld Neck



Slip On

Class 600 lb

Pipe	Flange Data				Hub Data			Raised Face	Drilling Data			Radius	Weight
Nominal Pipe Size	A	B	C	D	E		F	G	H	I	J	R	
	Overall Diameter	Slip on Inside Diameter	Flange Thickness	WNF / Slip on Overall Length	WNF Diam. at Weld Bevel	Slip on Hub Diam. at Small End	Hub Diameter	Face Diameter	Number of Holes	Bolt Hole Diam.	Diameter of Circle of Holes	Fillet	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	in mm	WNF Slip On
26	40 1016.0	26 ¹ / ₄ 666.7	4 ¹ / ₄ 107.9	8 ³ / ₄ 222.2	26 ⁷ / ₁₆ 671.52	27 ¹³ / ₁₆ 706.4	29 ⁷ / ₁₆ 747.7	29 ¹ / ₂ 749.3	28	2 50.8	36 914.4	9 ⁹ / ₁₆ 14.29	437 408
28	42 ¹ / ₄ 1073.1	28 ¹ / ₄ 717.6	4 ³ / ₈ 111.1	9 ¹ / ₄ 234.9	28 ¹ / ₂ 723.9	29 ¹⁵ / ₁₆ 760.4	31 ⁵ / ₈ 803.3	31 ¹ / ₂ 800.1	28	2 ¹ / ₈ 54.0	38 965.2	5 ⁵ / ₈ 15.88	508 472
30	44 ¹ / ₂ 1130.3	30 ¹ / ₄ 768.3	4 ¹ / ₂ 114.3	9 ³ / ₄ 247.6	30 ¹ / ₂ 774.7	32 ¹ / ₁₆ 814.4	33 ¹⁵ / ₁₆ 862.0	33 ³ / ₄ 857.2	28	2 ¹ / ₈ 54.0	40 ¹ / ₄ 1022.3	1 ¹ / ₁₆ 17.46	559 526
32	47 1193.8	32 ¹ / ₄ 819.1	4 ⁵ / ₈ 117.5	10 ¹ / ₄ 260.3	32 ¹ / ₂ 825.5	34 ³ / ₁₆ 868.4	36 ¹ / ₈ 917.6	36 914.4	28	2 ³ / ₈ 60.3	42 ¹ / ₂ 1079.5	1 ¹ / ₁₆ 17.46	680 605
34	49 1244.6	34 ¹ / ₄ 869.9	4 ³ / ₄ 120.6	10 ⁵ / ₈ 269.9	34 ⁹ / ₁₆ 877.9	36 ⁵ / ₁₆ 922.3	38 ⁵ / ₁₆ 973.1	38 965.2	28	2 ³ / ₈ 60.3	44 ¹ / ₂ 1130.3	3 ³ / ₄ 19.05	717 652
36	51 ³ / ₄ 1314.4	36 ¹ / ₄ 920.7	4 ⁷ / ₈ 123.8	11 ¹ / ₈ 282.6	36 ⁹ / ₁₆ 928.7	38 ⁷ / ₁₆ 976.3	40 ⁵ / ₈ 1031.9	40 ¹ / ₄ 1022.3	28	2 ⁵ / ₈ 66.7	47 1193.8	3 ³ / ₄ 19.05	780 744

Notes

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- WNF = Weld Neck Flange.
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