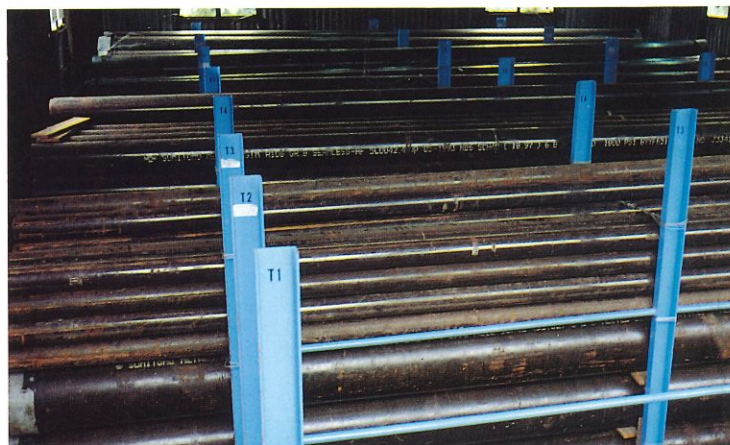




管道

PIPES AND TUBES



管道（壁厚及重量标准）
PIPE SCHEDULE (ASTM OR API STANDARD)

(英制表) Imperial

Nominal pipe size inch/mm	OD inches	5S	10s	10	20	30	STD	40S	40	60	XS	80S	80	100	120	140	160	XXS
1/8	6	0.405	0.049 0.19				0.068 0.24	0.068 0.24	0.068 0.24		0.095 0.31	0.095 0.32	0.095 0.31					
1/4	8	0.540	0.065 0.34				0.088 0.42	0.088 0.43	0.088 0.42		0.119 0.54	0.119 0.55	0.119 0.54					
3/8	10	0.675	0.065 0.43				0.091 0.57	0.091 0.58	0.091 0.57		0.126 0.74	0.126 0.75	0.126 0.74					
1/2	15	0.840	0.065 0.55	0.083 0.68			0.109 0.85	0.109 0.87	0.109 0.85		0.147 1.09	0.147 1.11	0.147 1.09			0.188 1.31	0.294 1.71	
3/4	20	1.050	0.065 0.70	0.083 0.88			0.113 1.13	0.113 1.15	0.113 1.13		0.154 1.47	0.154 1.50	0.154 1.47			0.219 1.94	0.308 2.44	
1	25	1.315	0.065 0.89	0.109 1.43			0.133 1.68	0.133 1.71	0.133 1.68		0.179 2.17	0.179 2.21	0.179 2.17			0.250 2.84	0.358 3.66	
1 1/4	32	1.660	0.065 1.13	0.109 1.85			0.140 2.27	0.140 2.3	0.140 2.27		0.191 3.00	0.191 3.06	0.191 3.00			0.250 3.76	0.382 5.21	
1 1/2	40	1.900	0.065 1.31	0.109 2.13			0.145 2.72	0.145 2.77	0.145 2.72		0.200 3.63	0.200 3.70	0.200 3.63			0.281 4.86	0.400 6.41	
2	50	2.375	0.065 1.64	0.109 2.69			0.154 3.65	0.154 3.72	0.154 3.65		0.218 5.02	0.218 5.12	0.218 5.02			0.344 7.46	0.436 9.03	
2 1/2	65	2.875	0.083 2.63	0.120 3.60			0.203 5.79	0.203 5.91	0.203 5.79		0.276 7.66	0.276 7.81	0.276 7.66			0.375 10.01	0.552 13.69	
3	80	3.500	0.083 3.09	0.120 4.42			0.216 7.58	0.216 7.73	0.216 7.58		0.300 10.25	0.300 10.40	0.300 10.25			0.438 14.32	0.600 18.58	
3 1/2	90	4.000	0.083 3.55	0.120 5.07			0.225 9.11	0.225 9.29	0.225 9.11		0.318 12.50	0.318 12.76	0.318 12.50			-	-	
4	100	4.500	0.083 4.00	0.120 5.72			0.237 10.79	0.237 11.01	0.237 10.79		0.337 14.96	0.337 15.28	0.337 14.96	0.438 19.00		0.531 22.51	0.674 27.54	
5	125	5.563	0.109 6.49	0.134 7.93			0.258 14.62	0.258 14.91	0.258 14.62		0.375 20.76	0.375 21.20	0.375 20.76	0.500 27.04		0.625 32.96	0.750 38.55	
6	150	6.625	0.109 7.75	0.134 9.48			0.280 18.97	0.280 19.35	0.280 18.97		0.432 28.57	0.432 29.14	0.432 28.57	0.562 36.39		0.719 45.35	0.864 53.16	
8	200	8.625	0.109 10.13	0.148 13.67	0.250 22.36	0.277 24.70	0.322 28.55	0.322 29.12	0.322 28.55	0.406 35.64	0.500 43.39	0.500 44.26	0.500 43.39	0.594 50.95	0.719 60.71	0.812 67.76	0.906 74.69	0.875 72.42
10	250	10.750	0.134 15.49	0.165 19.02	0.250 28.04	0.307 34.24	0.365 40.48	0.365 41.29	0.365 40.48	0.500 54.74	0.500 55.83	0.500 54.74	0.594 64.43	0.719 77.03	0.844 89.29	1.000 104.13	1.125 115.64	1.000 104.13
12	300	12.750	0.156 21.40	0.180 24.65	0.250 33.38	0.330 43.77	0.375 49.56	0.375 50.55	0.406 53.52	0.562 73.15	0.500 65.42	0.500 66.73	0.688 88.63	0.844 107.32	1.000 125.49	1.125 160.27	1.312 125.49	1.000 125.49
14	350	14.000	0.156 23.53	0.188 28.28	0.250 36.71	0.312 45.61	0.375 54.57	0.375 55.57	0.438 63.44	0.594 85.05	0.500 72.09	0.500 72.09	0.750 106.13	0.938 130.85	1.094 150.79	1.250 170.21	1.406 189.11	1.000 189.11
16	400	16.000	0.165 28.46	0.188 32.39	0.250 42.05	0.312 52.27	0.375 62.58	0.375 62.58	0.438 82.77	0.594 107.50	0.500 82.77	0.500 82.77	0.844 136.61	1.031 164.82	1.219 192.43	1.438 223.64	1.594 245.25	1.000 245.25
18	450	18.000	0.165 32.06	0.188 36.48	0.250 47.39	0.312 58.94	0.375 82.15	0.375 82.15	0.438 104.67	0.594 138.17	0.500 93.45	0.500 93.45	0.844 170.92	1.031 207.96	1.219 244.14	1.438 274.22	1.594 308.50	1.000 308.50
20	500	20.000	0.188 40.58	0.219 46.98	0.250 52.73	0.375 78.60	0.375 104.13	0.375 78.60	0.438 123.11	0.594 166.40	0.500 104.13	0.500 104.13	0.844 208.87	1.031 256.10	1.219 296.37	1.438 341.09	1.594 379.17	1.000 379.17
22	550	22.000	0.188 44.66	0.219 51.72	0.250 58.07	0.375 86.61	0.375 114.81	0.375 86.61	0.438 131.11	0.594 197.41	0.500 114.81	0.500 114.81	0.844 250.81	1.031 302.88	1.219 353.61	1.438 403.00	1.594 451.06	1.000 451.06
24	600	24.000	0.218 56.48	0.250 64.88	0.250 63.41	0.375 94.82	0.375 140.68	0.375 94.82	0.438 171.29	0.594 238.35	0.500 140.68	0.500 140.68	0.844 296.58	1.031 367.39	1.219 429.39	1.438 483.12	1.594 542.13	1.000 542.13
26	650	26.000		0.312 85.60	0.500 136.17	-	0.375 102.63	-	-	0.500 136.17	-	-	-	-	-	-	-	-
28	700	28.000		0.312 92.26	0.500 146.85	0.625 182.73	0.375 110.64	-	-	0.500 146.85	-	-	-	-	-	-	-	-
30	750	30.000	0.250 81.02	0.312 100.91	0.312 98.93	0.500 157.53	0.625 196.08	0.375 118.65	-	0.500 157.53	-	-	-	-	-	-	-	-
32	800	32.000		0.312 105.59	0.500 168.21	0.625 209.43	0.375 126.66	0.688 230.08	-	0.500 168.21	-	-	-	-	-	-	-	-
34	850	34.000		0.312 112.25	0.500 178.89	0.625 222.78	0.375 134.67	0.688 244.77	-	0.500 178.89	-	-	-	-	-	-	-	-
36	900	36.000		0.312 118.92	0.500 189.57	0.625 236.13	0.375 142.68	0.750 282.35	-	0.500 189.57	-	-	-	-	-	-	-	-
38	950	38.000					0.375 150.69	-	-	0.500 200.25	-	-	-	-	-	-	-	-
40	1000	40.000					0.375 158.70	-	-	0.500 210.93	-	-	-	-	-	-	-	-
42	1050	42.000					0.375 166.71	-	-	0.500 221.61	-	-	-	-	-	-	-	-
44	1100	44.000					0.375 174.72	-	-	0.500 232.29	-	-	-	-	-	-	-	-
46	1150	46.000					0.375 182.73	-	-	0.500 242.97	-	-	-	-	-	-	-	-
48	1200	48.000					0.375 190.74	-	-	0.500 253.65	-	-	-	-	-	-	-	-

Wall Thickness = inches
Weight = lbs./ft. (plain end mass)
5S, 10S, 40S, 80S - ANSI B36.19

管道（壁厚及重量标准）
PIPE SCHEDULE (ASTM OR API STANDARD)

(公制表) Metric

Nominal pipe size mm/inch	OD mm	5S	10s	10	20	30	STD	40S	40	60	XS	80S	80	100	120	140	160	XXS
6 1/8	10,3		1,24 0,28				1,73 0,37	1,73 0,36	1,73 0,37		2,41 0,47	2,41 0,48	2,41 0,47					
8 1/4	13,7		1,65 0,51				2,24 0,63	2,24 0,64	2,24 0,63		3,02 0,80	3,02 0,82	3,02 0,80					
10 3/8	17,1		1,65 0,64				2,31 0,84	2,31 0,86	2,31 0,84		3,20 1,10	3,20 1,12	3,20 1,10					
15 1/2	21,3	1,65 0,82	2,11 1,01				2,77 1,27	2,77 1,30	2,77 1,27		3,73 1,62	3,73 1,65	3,73 1,62				4,78 1,95	7,47 2,55
20 3/4	26,7	1,65 1,04	2,11 1,31				2,87 1,69	2,87 1,71	2,87 1,69		3,91 2,20	3,91 2,24	3,91 2,20				5,56 2,90	7,82 3,64
25 1	33,4	1,65 1,33	2,77 2,13				3,38 2,50	3,38 2,55	3,38 2,50		4,55 3,24	4,55 3,29	4,55 3,24				6,35 4,24	9,05 5,45
32 1 1/4	42,2	1,65 1,68	2,77 2,76				3,56 3,39	3,56 3,46	3,56 3,39		4,85 4,47	4,85 4,56	4,85 4,47				6,35 5,61	9,70 7,77
40 1 1/2	48,3	1,65 1,95	2,77 3,1				3,68 4,05	3,68 4,13	3,68 4,05		5,08 5,41	5,08 5,61	5,08 5,41				7,14 7,25	10,15 9,56
50 2	60,3	1,65 2,44	2,77 4,01				3,91 5,44	3,91 5,64	3,91 5,44		5,54 7,48	5,54 7,63	5,54 7,48				8,74 11,11	11,07 13,44
65 2 1/2	73,0	2,11 3,77	3,05 5,36				5,16 8,63	5,16 8,81	5,16 8,63		7,01 11,41	7,01 11,64	7,01 11,41				9,53 14,92	14,02 20,39
80 3	88,9	2,11 4,60	3,05 6,59				5,49 11,29	5,49 11,52	5,49 11,29		7,62 15,27	7,62 15,59	7,62 15,27				11,13 21,35	15,24 27,68
90 3 1/2	101,6	2,11 5,29	3,05 7,55				5,74 13,57	5,74 13,84	5,74 13,57		8,08 18,63	8,08 19,01	8,08 18,63				-	-
100 4	114,3	2,11 5,96	3,05 8,92				6,02 16,07	6,02 16,40	6,02 16,07		8,56 22,32	8,56 22,77	8,56 22,32		11,13 28,32		13,49 33,54	17,12 41,03
125 5	141,3	2,77 9,67	3,40 11,82				6,55 21,77	6,55 22,20	6,55 21,77		9,53 30,97	9,53 31,59	9,53 30,97		12,70 40,28		15,88 49,11	19,05 57,43
150 6	168,3	2,77 11,55	3,40 14,13				7,11 28,26	7,11 28,83	7,11 28,26		10,97 42,56	10,97 43,42	10,97 42,56		14,27 54,20		18,26 67,56	21,95 79,22
200 8	219,1	2,77 15,09	3,76 20,37		6,35 33,31	7,04 36,81	8,18 42,55	8,18 43,39	8,18 42,55	10,31 53,08	12,70 64,64	12,70 65,95	12,70 64,64	15,09 75,92	18,26 90,44	20,62 100,92	23,01 111,27	22,23 107,92
250 10	273,1	3,40 23,08	4,19 28,34		6,35 41,77	7,80 51,03	9,27 60,31	9,27 61,52	9,27 60,31	12,70 81,55	12,70 83,19	12,70 81,55	12,70 83,19	15,09 96,01	18,26 114,75	21,44 133,06	25,40 155,15	25,40 155,15
300 12	323,9	3,96 31,89	4,57 36,73		6,35 49,73	8,38 65,20	9,53 73,88	9,53 75,32	10,31 79,73	14,27 108,96	12,70 97,46	12,70 99,43	12,70 97,46	17,48 132,08	21,44 159,91	25,40 186,75	28,58 208,14	33,32 238,76
350 14	355,6	3,96 35,06	4,78 42,14	6,35 54,69	7,92 67,90	9,53 81,33	9,53 81,33		11,13 94,55	15,09 126,71	12,70 107,39			19,05 158,10	23,83 194,96	27,79 224,65	31,75 253,56	35,71 281,70
400 16	406,4	4,19 42,41	4,78 48,26	6,35 62,64	7,92 77,83	9,53 93,27	9,53 93,27		12,70 123,30	16,66 160,12	12,70 123,30			21,44 203,53	26,19 245,56	30,96 286,64	36,53 333,19	40,49 365,35
450 18	457,2	4,19 47,77	4,78 54,38	6,35 70,57	7,92 87,71	11,13 122,38	9,53 105,16		14,27 155,80	19,05 205,74	12,70 139,15			23,88 254,55	29,36 309,62	34,93 363,56	39,67 408,26	45,24 459,37
500 20	508,0	4,78 60,46	5,54 70,00	6,35 78,55	9,53 117,15	12,70 155,12	9,53 117,15		15,09 183,42	20,62 247,83	12,70 155,12			26,19 311,17	32,54 381,53	38,10 441,49	44,45 508,11	50,01 564,81
550 22	558,8	4,78 66,57	5,54 77,06	6,35 86,54	9,53 129,13	12,70 171,09	9,53 129,13		- 294,25	22,23 171,09	12,70 171,09			28,58 373,83	34,93 451,42	41,28 527,02	47,63 600,63	53,98 672,26
600 24	609,6	5,54 84,16	6,35 96,37	6,35 94,53	9,53 141,12	14,27 209,64	9,53 141,12		17,48 255,41	24,61 355,26	12,70 187,06			30,96 442,08	38,89 547,71	46,02 640,03	52,37 720,15	59,54 806,22
650 26	660,4			7,92 127,36	12,70 202,72	-	9,53 152,87		-		12,70 202,72							
700 28	711,2			7,92 137,32	12,70 218,69	15,88 271,21	9,53 164,85		-		12,70 218,69							
750 30	762,0	6,35 120,72	7,92 150,36	7,92 147,28	12,70 234,67	15,88 292,18	9,53 176,84		-		12,70 234,67							
800 32	812,8			7,92 157,24	12,70 250,64	15,88 312,15	9,53 188,82		17,48 342,91		12,70 250,64							
850 34	863,6			7,92 167,20	12,70 266,61	15,88 332,12	9,53 200,31		17,48 364,90		12,70 266,61							
900 36	914,4			7,92 176,96	12,70 282,27	15,88 351,70	9,53 212,56		19,05 420,40		12,70 262,27							
950 38	965,2						9,53 224,54				12,70 298,24							
1000 40	1016,0						9,53 236,53				12,70 314,22							
1050 42	1066,8						9,53 248,52				12,70 330,19							
1100 44	1117,8						9,53 260,50				12,70 346,16							
1150 46	1168,4						9,53 272,25				12,70 351,82							
1200 48	1219,2						9,53 284,24				12,70 377,79							
Wall Thickness = mm Weight = kg/m (plain end mass) 5S, 10S, 40S, 80S - ANSI B36.19																		

管道国际标准
TABLES OF COMPARATIVE STEEL SPECIFICATIONS

(对比表) PIPE - TUBES/ASTM-API-BS-DIN

Mechanical properties Mechanische eigenschappen Valeurs mécaniques Datos mecánicos					Chemical analysis (Ladle) Chemische analyse (Smelt) Analyse chimique Análisis químico							
Material Materiaal	Tensile strength treksterkte N/mm ²	Yield point rekgrens min N/mm ²	Elongation Rek % Min.	C %	Si %	Mn %	P % max.	S % max.	Mo %	Cr %	Ni %	Div.
St. 33 St. 34-2 St. 37-2	290-540 335-410 340-470	185 205 235	18 28 25	— max. 0.15 max. 0.17	— — —	— — —	— 0.050 0.050	0.050 0.050 0.050				N max. 0.009
St. 42-2 St. 44-2 St. 44-3 St. 52-3	410-490 410-540 410-540 490-630	255 275 275 355	20 22 22 22	max. 0.25 max. 0.21 max. 0.20 max. 0.20	— — — max. 0.55	— — — max. 1.60	0.060 0.050 0.040 0.040	0.050 0.050 0.040 0.040				N max. 0.009
St. 35 St. 45 St. 52	340-440 440-540 510-610	235 255 355	25 21 22	max. 0.18 max. 0.25 max. 0.20	— — max. 0.55	— — max. 1.50	0.050 0.050 0.050	0.050 0.050 0.050				
St. 35.8 St. 45.8 15Mo3 13 Cr Mo 44 10 Cr Mo 910 12 Cr Mo 19.5	360-480 410-530 450-600 440-590 450-600 410-540	235 255 270 290 280 176	25 21 22 22 20 21	max. 0.17 max. 0.21 0.12-0.20 0.10-0.18 0.08-0.15 max. 0.15	0.10-0.35 0.10-0.35 0.10-0.35 0.10-0.35 max. 0.50 0.30-0.50	0.40-0.80 0.40-1.20 0.40-0.80 0.40-0.70 0.40-0.70 0.30-0.60	0.040 0.040 0.035 0.035 0.035 0.030	0.040 0.040 0.035 0.035 0.035 0.030	0.25-0.35 0.45-0.65 — — 0.90-1.20 0.45-0.65	— — — — 2.00-2.50 4.0-6.0		
TT St. 35 TT St. 41 10 Ni 14	345-445 445-540 445-640	225 265 345	25 21 20	max. 0.17 max. 0.20 max. 0.12	max. 0.35 max. 0.35 0.10-0.35	min. 0.40 min. 0.45 0.30-0.60	0.045 0.045 0.035	0.045 0.045 0.035			3.20-3.80	
St. E 36	500-640	345	22	max. 0.20	0.10-0.50	0.90-1.60	0.040	0.040				
A 53 - Gr A A 53 - Gr B A 106 - Gr A A 106 - Gr B	min. 330 min. 415 min. 330 min. 415	205 240 205 240	variable variable 28 22	max. 0.25 max. 0.30 max. 0.25 max. 0.30	— — min. 0.10 min. 0.10	max. 0.95 max. 1.20 0.27-0.93 0.29-1.06	0.050 0.050 0.048 0.048	0.060 0.060 0.058 0.058				
A 333 Gr 1 A 333 Gr 6 A 333 Gr 3	min. 379 min. 414 min. 448	207 241 241	28 22 22	max. 0.30 max. 0.30 max. 0.19	— min. 0.10 0.18-0.37	0.40-1.06 0.29-1.06 0.31-0.64	0.050 0.048 0.050	0.060 0.058 0.050			3.18-3.82	
A 335 Gr P1 A 335 Gr P11 A 335 Gr P12 A 335 Gr P22 A 335 Gr P5	min. 379 min. 414 min. 414 min. 414 min. 414	207 207 207 207 207	22 22 22 22 22	0.10-0.20 max. 0.15 max. 0.15 max. 0.15 max. 0.15	0.10-0.50 0.50-1.00 max. 0.50 max. 0.50 max. 0.50	0.30-0.80 0.30-0.60 0.30-0.61 0.30-0.60 0.30-0.60	0.045 0.030 0.045 0.030 0.030	0.045 0.045 0.045 0.030 0.030	0.44-0.65 0.44-0.65 0.44-0.65 0.87-1.13 0.45-0.65	— 1.00-1.50 0.80-1.25 1.90-2.60 4.00-6.00		
BS 1387	325-465	—	20	—	—	—	0.060	0.060				
BS3059 pt1-HFS 320 BS3059 pt1-ERW 320 BS 3059 pt2 360 BS3059 pt2 440 BS3059 pt2 243 BS3059 pt2 620 BS3059 pt2 622-440	320-480 320-480 360-500 440-580 450-600 460-610 440-590	195 195 215 245 250 180 175	25 25 24 21 22 22 20	max. 0.16 max. 0.19 max. 0.17 0.12-0.18 0.12-0.20 0.10-0.15 0.08-0.15	— — max. 0.35 0.10-0.35 0.10-0.35 0.10-0.35 max. 0.50	0.30-0.70 0.30-0.70 0.40-0.80 0.90-1.20 0.40-0.80 0.40-0.70 0.40-0.70	0.050 0.050 0.045 0.040 0.040 0.040 0.040	0.050 0.050 0.045 0.035 0.040 0.040 0.040	— — — — 0.25-0.35 0.45-0.65 0.90-1.20	— — — — — 0.90-1.20 2.00-2.50	Al met 0.020 max Al met 0.020 max Al met 0.020 max	
BS3601 S320 BS3601 ERW 320 BS3601 S360 BS3601 ERW 360 BS3601 S410 BS3601 ERW 410 BS3601 SAW 410	320-440 320-440 360-480 360-480 410-530 410-530 410-530	195 195 215 215 235 235 235	25 25 24 24 22 22 22	max. 0.16 max. 0.16 max. 0.17 max. 0.17 max. 0.21 max. 0.21 max. 0.25	— — max. 0.35 max. 0.35 max. 0.35 max. 0.35 —	0.30-0.70 0.30-0.70 0.40-0.80 0.40-0.80 0.40-1.20 0.40-1.20 max. 1.20	0.050 0.050 0.050 0.050 0.050 0.050 0.050	0.050 0.050 0.050 0.050 0.050 0.050 0.050				
BS3603 HFS 410 BS 3603 HFS 503	410-530 440-590	235 245	22 16	max. 0.20 max. 0.15	max. 0.35 0.15-0.35	0.60-1.20 0.30-0.80	0.045 0.025	0.045 0.020			3.25-3.75	Al met 0.015 max
BS3604-620 (N) BS3604-622 BS3604-625	460-610 490-640 450-600	180 275 170	22 20 20	0.10-0.15 0.08-0.15 max. 0.15	0.10-0.35 max. 0.50 max. 0.50	0.40-0.70 0.40-0.70 0.30-0.60	0.040 0.040 0.040	0.040 0.040 0.040	0.45-0.65 0.90-1.20 0.45-0.65	0.70-1.10 2.00-2.50 4.00-6.00		Al met 0.020 max Al met 0.020 max
BS4360-43C BS4360-50C BS4360-50D	430-540 490-640 490-640	255 355 355	22 20 20	max. 0.21 max. 0.20 max. 0.20	max. 0.40 max. 0.40 max. 0.40	max. 1.20 max. 1.40 max. 1.40	0.050 0.050 0.040	0.050 0.050 0.040				Nb 0.003-0.10 V 0.003-0.15

管道国际标准
TABLES OF COMPARATIVE STEEL SPECIFICATIONS

(对比表) PIPE - TUBES/ASTM-API-BS-DIN

Technical standards Technische normen Normes techniques Normas técnicas			Equivalent specifications Equivalentes especificaciones Qualités équivalentes Calidades equivalentes				
Material standards Materiaal norm.	Manufact. standards fabricage norm.	Dimensional standards Afmetingen norm.	ASTM	API	BS	DIN	DIV
DIN 1626/2 DIN 17100 DIN 1626/3 DIN 17100	DIN 1626/2 DIN 2440/2441 DIN 1626/3 DIN 1626/3	DIN 2458 DIN 2440/2441 DIN 2458 DIN 2458	A120 A53 Gr A	— 5L Gr A	1387 3601 ERW 320		ISO-65
DIN 1626/3-4 DIN 17100 DIN 17100 DIN 17100	DIN 1626/3-4 DIN 1626/3-4 DIN 1626/3-4 DIN 1626/3-4	DIN 2458 DIN 2458 DIN 2458 DIN 2458	A 53 Gr B A 53 Gr B A 53 Gr B A381-Y52	5L Gr B 5L Gr B 5L Gr B 5LX-X52	3601 ERW 410 4360-43C 4360-43C 4360-50C		Euronorm 25 Fe 430 A Euronorm 25 Fe 430 B Euronorm 25 Fe 430 C Euronorm 25 Fe 510C/FG 36
DIN 1629/3 DIN 1629/3 DIN 1629/3	DIN 1629/3 DIN 1629/3 DIN 1629/3	DIN 2448 DIN 2448 DIN 2448	A 53 Gr A A 53 Gr B A252 Gr 3	5L Gr A 5L Gr B 5LX-X52	3601-S 360 3601-S 410 1775-HFS23		A519-1518
DIN 17175 DIN 17175 DIN 17175 DIN 17175 DIN 17175 Vd TUV 1207	DIN 17175 DIN 17175 DIN 17175 DIN 17175 DIN 17175 DIN 17175	DIN 2448 DIN 2448 DIN 2448 DIN 2448 DIN 2448 DIN 2448	A106 Gr A A106 Gr B A335 P1 A335 P11-P12 A335 P22 A335 P5	5L Gr A 5L Gr B — — — —	3602-HFS 360 3602-HFS 410 3059-243 3604-620 3604-622 3604-625		BS3059 pt 2 360 BS 3601 S 410 BS 3059-620 BS 3059-622/440
SEW 680 SEW 680 SEW 680	DIN 17175 DIN 17175 DIN 17175	DIN 2448 DIN 2448 DIN 2448	A333 Gr 1 A333 Gr 6 A333 Gr 3	— — —	— 3603-410 3603-503		
SEW 089	DIN 1629/4	DIN 2448	A381-Y52	API-5LX-X52	4360-50C		Fe 510C/FG 36
A 53 A 53 A106 A106	A 53 A 53 A106/A530 A106/A530	ANSI-B 36.10 ANSI-B 36.10 ANSI-B 36.10 ANSI-B 36.10	— — — —	5L Gr A 5L Gr B 5L Gr A 5L Gr B	3601-S360 3601 S410 3602 HFS 23 3602 HFS 27	St 35 St 45 St 35.8 St 45.8	BS 3601 ERW 360 BS 3601 ERW 410
A333 A333 A333	A333/A530 A333/A530 A333/A530	ANSI-B 36.10 ANSI-B 36.10 ANSI-B 36.10	— — —	— — —	— 3603.410 3603-503	TT St 35 TT St 41 TT Ni 14	
A335 A335 A335 A335 A335	A335/A530 A335/A530 A335/A530 A335/A530 A335/A530	ANSI-B 36.10 ANSI-B 36.10 ANSI-B 36.10 ANSI-B 36.10 ANSI-B 36.10	— — — — —	— — — — —	3059-243 3604-620 3604.620 3604-622 3604-625	15 Mo 3 13 Cr Mo 44 13 Cr Mo 44 10 Cr Mo 910 12 Cr Mo 195	
BS 1387	BS 1387	BS 1387	A 120		—	St 33	
BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059	BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059	BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059 BS 3059	A106 Gr A A 53 Gr A A106 Gr A A106 Gr B A335 P1 A335 P11/P12 A335 P22	5L Gr A 5L Gr A 5L Gr A 5L Gr B — — —	— — — — — — —	St 35 St 34-2 St 35.8 St 45.8 15 Mo 3 13 Cr Mo 44 10 Cr Mo 910	
BS 3601 BS 3601 BS 3601 BS 3601 BS 3601 BS 3601 BS 3601	BS 3601 BS 3601 BS 3601 BS 3601 BS 3601 BS 3601 BS 3601	BS 3600 BS 3600 BS 3600 BS 3600 BS 3600 BS 3600 BS 3600	A106 Gr A A 53 Gr A A106 Gr A A 53 Gr A A106 Gr B A 53 Gr B A 53 Gr B	5L Gr A 5L Gr A 5L Gr A 5L Gr A 5L Gr B 5L Gr B 5L Gr B	— — — — — — —	St 35.8 St 34-2 St 35.8 St 37.2 St 45.8 St 44.3 St 44.3	BS 3602 pt1 HFS 360 BS 3602 pt1 ERW 360 BS 3602 pt1 HFS 410 BS 3602 pt1 ERW 410 BS 3602 pt2 SAW 410
BS 3603 BS 3603	BS 3603 BS 3603	BS 3600 BS 3600	A333 Gr 6 A333 Gr 3	— —	— —	TT St 41 10 Ni 14	
BS 3604 BS 3604 BS 3604	BS 3604 BS 3604 BS 3604	BS 3600 BS 3600 BS 3600	A335 P11/P12 A335-P22 A335-P5	— — —	— — —	13 Cr Mo 44 10 Cr Mo 910 12 Cr Mo 195	
BS 4360 BS 4360 BS 4360	BS 4360 BS 4360 BS 4360	— — —	A53 Gr B — —	5L Gr B/5LX-X42 5LX-X52 5LX-X52 (N)	— — —	St 45/St 44.3 St 52.3 St 52.3	Euronorm 25 Fe 430 C Euronorm 25 Fe 510 C Euronorm 25 Fe 510 D /Fg 36

ALLOWABLE WORKING PRESSURE

316 管工作压力表
316 STAINLESS STEEL ANNEALED SEAMLESS TUBING
ASTM A-269

ALLOWABLE STRESS = 18,750 psi between -325°F and 100°F

WALL THICKNESS									
Tubing O.D.	.020	.028	.035	.049	.065	.083	.095	.109	.120
1/8	6881	10013	12656						
3/16	4369	8156	11813						
1/4		4613	5906	8649	11738				
5/16		3619	4613	6731	9225				
3/8			3788	5475	7538				
1/2			2775	3975	5438	7181			
5/8			2194	3131	4256	5569	6488		
3/4			1819	2588	3488	4556	5288	6169	6863
7/8			1549	2194	2962	3844	4462	5194	5775
1			1350	1894	2569	3338	3844	4481	4969

Factor of Safety = 4, Considering Tensile Strength To Be 75,000 psi

Reference: ASA 31.3 – 1959, Table 302.3.1A and Par. 304.1.2

ASME Unfired Pressure Vessels, Section VIII, Table UHA-23 and Par. UG-27 and UA-2.

Recommended maximum working pressures (bar) for 316 stainless steel and 6 Mo tubes to ASTM A-269

Outside diameter of tube (mm)	Tube wall thickness (mm)						
	0,5	0,7	1,0	1,5	2,0	2,5	3,0
2	700						
3	450	660					
4	275	480	685				
6	205	310	515	725			
8	170	225	410	530			
10	130	180	310	490			
12	105	150	245	375	480		
14			195	340	390		
15			170	280	365		
16			160	245	350		
18			140	230	335	380	
20				195	290	335	
22				190	280	305	
25				170	230	265	325

The working pressures in the above table are based on actual tests on ASTM A-269 tubing with a safety factory of 4:1. They apply to a metal temperature range of -20° to +100°C.

For working pressures of monel tubing, multiply the above ratings by 0.8.

TECHNICAL DATA

316 不锈钢管工作压力及温度表

T316 STAINLESS STEEL PIPES

ALLOWABLE WORKING PRESSURE AT TEMPERATURE
WITH ZERO ALLOWANCE FOR CORROSION AND/OR MECHANICAL STRENGTH

NOM. PIPE SIZE		SCH. NO.	WALL THICKNESS	ALLOWABLE WORKING PRESSURES for temperatures (in deg. F) not to exceed																									
				-20 to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500		
1/2	SS	065	065	2290	2290	2180	2130	2100	2090	2080	2070	2060	2040	2010	1950	1840	1710	1490	1290	1090	870	680	510	381	299	235	191		
	10S	083	083	2960	2960	2830	2770	2720	2700	2690	2670	2650	2620	2570	2450	2220	1930	1680	1430	1140	890	670	510	393	309	251			
	40S	109	109	4690	4690	4480	4380	4300	4280	4260	4250	4230	4190	4130	4000	3780	3500	3050	2670	2320	1840	1400	1080	810	640	500			
	80S	147	147	6550	6550	6250	6110	6010	5970	5960	5940	5900	5850	5760	5590	5270	4890	4260	3770	3320	2660	2070	1560	1170	920	730	590		
3/4	SS	065	065	1810	1810	1730	1690	1660	1650	1650	1640	1630	1620	1590	1540	1460	1350	1180	1020	850	680	530	398	299	234	184			
	10S	083	083	2340	2340	2230	2180	2150	2130	2120	2110	2090	2060	2000	1880	1750	1520	1320	1110	890	700	530	391	306	241	196			
	40S	113	113	3830	3830	3650	3570	3510	3490	3480	3470	3450	3420	3370	3260	3080	2860	2490	2170	1850	1480	1150	870	660	510	425			
	80S	154	154	5370	5370	5120	5010	4920	4900	4880	4870	4840	4800	4720	4580	4320	4010	3490	3070	2660	2130	1660	1260	940	740	609			
1	SS	065	065	1430	1430	1370	1340	1310	1300	1300	1290	1280	1260	1220	1150	1070	930	800	670	540	414	313	235	184	144	117			
	10S	083	083	1860	1860	1780	1730	1690	1670	1660	1640	1600	1550	1470	1350	1180	1020	850	700	550	414	313	235	184	144	117			
	40S	133	133	3580	3580	3410	3340	3280	3260	3250	3240	3220	3180	3150	3050	2880	2670	2330	2020	1720	1380	1080	810	610	475	374			
	80S	179	179	4940	4940	4720	4610	4530	4510	4490	4480	4450	4410	4350	4220	3980	3690	3220	2820	2420	1950	1520	1150	860	670	530			
1 1/4	SS	065	065	1130	1130	1080	1050	1030	1030	1030	1020	1010	990	950	880	800	700	600	510	434	358	282	223	169	126	99			
	10S	083	083	1430	1430	1370	1340	1310	1300	1290	1280	1260	1220	1150	1070	930	800	670	540	414	313	235	184	144	117	99			
	40S	140	140	2950	2950	2810	2750	2700	2680	2670	2660	2630	2590	2510	2370	2200	1920	1660	1440	1120	880	660	494	387	305	247			
	80S	191	191	4110	4110	3920	3840	3770	3750	3740	3730	3710	3670	3620	3510	3310	3070	2680	2330	2000	1600	1250	940	710	560	434			
1 1/2	SS	065	065	980	980	940	920	900	900	890	890	880	870	840	790	730	640	550	452	361	282	212	159	124	98	80			
	10S	083	083	1260	1260	1200	1170	1150	1140	1130	1120	1100	1060	1000	920	820	730	640	550	452	361	282	212	159	124	98			
	40S	145	145	2650	2650	2530	2470	2430	2410	2400	2390	2370	2330	2280	2130	1980	1730	1490	1260	1010	790	590	442	346	273	221			
	80S	200	200	3730	3730	3560	3480	3420	3410	3400	3390	3370	3340	3290	3100	2950	2700	2430	2110	1800	1440	1130	850	640	497	391			
2	SS	065	065	780	780	750	730	710	710	710	700	690	670	630	590	510	434	358	282	223	169	126	99	78	63	50			
	10S	083	083	1000	1000	960	940	920	910	900	890	880	870	840	790	740	650	560	470	380	290	200	110	70	50	39			
	40S	154	154	2230	2230	2130	2080	2050	2040	2030	2030	2010	2000	1970	1910	1800	1670	1450	1260	1050	840	660	493	370	298	228			
	80S	218	218	3220	3220	3080	3010	2960	2940	2930	2920	2910	2880	2840	2750	2600	2410	2100	1830	1540	1240	960	730	550	425	335			
2 1/2	SS	083	083	830	830	790	770	750	750	750	750	740	730	710	670	630	540	458	378	303	236	178	134	104	83	67			
	10S	120	120	1000	1000	960	940	920	910	900	890	880	870	840	790	740	650	560	470	380	290	200	110	70	50	39			
	40S	203	203	2440	2440	2340	2280	2240	2220	2210	2200	2180	2150	2080	1970	1820	1590	1370	1150	920	720	550	406	318	250	203			
	80S	276	276	3380	3380	3240	3160	3100	3080	3070	3060	3050	3020	2980	2890	2750	2530	2200	1910	1620	1300	1010	770	580	447	352			
3	SS	083	083	680	680	650	630	620	620	610	610	600	580	540	500	438	375	309	248	192	146	109	85	67	54	43			
	10S	120	120	980	980	940	920	900	900	890	890	880	870	840	790	740	640	550	463	362	283	212	159	125	99	80			
	40S	216	216	2120	2120	2020	1980	1950	1930	1920	1910	1900	1870	1810	1710	1590	1380	1190	1000	800	620	467	350	275	216	175			
	80S	300	300	3000	3000	2860	2800	2750	2730	2720	2710	2700	2680	2640	2550	2410	2140	1830	1540	1240	960	730	550	425	330	251			
3 1/2	SS	083	083	590	590	570	550	540	540	530	530	520	510	473	439	387	327	269	216	168	126	95	74	58	48	38			
	10S	120	120	860	860	820	800	790	790	780	780	770	760	730	690	640	560	477	394	314	245	185	139	108	86	69			
	40S	226	226	1940	1940	1850	1810	1780	1760	1750	1740	1730	1700	1650	1560	1450	1260	1090	910	730	550	425	319	250	197	159			
	80S	318	318	2770	2770	2640	2580	2540	2520	2510	2500	2490	2470	2440	2360	2230	2090	1800	1560	1310	1050	820	620	462	362	285			
4	SS	083	083	530	530	497	487	478	474	473	473	470	465	459	445	420	389	339	290	239	191	149	113	84	66	52			
	10S	120	120	760	760	710	710	700	700	690	690	680	670	650	610	570	493	423	348	278	218	164	123	97	75	62			
	40S	237	237	1800	1800	1720	1680	1650	1640	1640	1630	1620	1610	1580	1540	1450	1340	1170	1010	840	670	500	394	296	232	182			
	80S	337	337	2600	2600	2480	2420	2380	2370	2360	2360	2340	2320	2290	2220	2090	1940	1690	1460	1230	990	770	580	433	339	267			
5	SS	109	109	460	460	430	420	410	410	400	390	380	370	350	310	270	230	190	150	110	80	60	45	35	29	23			
	10S	134	134	690	690	650	640	630	630	620	620	610	590	550	510	440	380	313	251	198	149	110	87	68	55	44			
	40S	258	258	1580	1580	1510	1470	1450	1440	1430	1430	1420	1410	1390	1350	1270	1180	1030	880	740	590	456	344	258	202	159			
	80S	375	375	2340	2340	2220	2170	2130	2120	2120	2110	2100	2080	2050	1990	1870	1740	1510	1310	1100	890	690	520	386	302	238			
6	SS	109	109	464	464	443	443	436	423	422	421	419	414	408	396	374	346	302	258	212	170	133	100	75	58	46			
	10S	134	134	580	580	550	540	530	530	530	520	520	510	510	489	461	427	372	319	262	209	164	123	92	72				
	40S	280	280	1430	1430	1370	1340	1310	1310	1300	1290	1280	1260	1220	1160	1070	940	800	670	530	413	312	234	183	144				
	80S	432	432	2350	2350	2240	2200	2160	2150	2140	2130	2110	2080	2040	1980	1920	1810	1680	1460	1260	1060	850	660	496	372				
8	SS	109	109	456	456	440	432	426	423	422	421	418	414	408	394	366	332	288	242	196	151	114	86	67	51	39			
	10S	148	148	484	484	467	453	444	443	443	443	439	437	432	426	413	390	361	316	270	223	177	138	104	79				
	40S	322	322	1760	1760	1710	1680	1650	1640	1640	1630	1620	1610	1580	1540	1450	1340	1170	1010	840	670	500	394	296	232				
	80S	500	500	2990	2990	2850	2800	2760	2750	2740	2730	2710	2680	2640	2550	2410	2140	1830	1540	1240	960	730	550	425	330	251			
10	SS	144	144	351	351	335	327	322	320	319	318	317	313	308	300	283	261	228	194	160	129	100	75	56	45	35			
	10S	165	165	432	432	413	404	397	394	393	393	392	389	387	380	370	348	316	282	241	198	158	123	94	70				
	40S	365	365	1710	1710</																								

GLOSSARY OF TUBING TERMS

CARBON STEELS

Steels having properties that are principally determined by the carbon content.

ALLOY STEELS

A steel to which one or more elements have been added, in addition to carbon, to produce specific properties.

NORMALISING

This is a process of heating steel to a temperature of 50° C. to 100° C. above its transformation range, followed by cooling in still air. Normalising refines the grain size, produces a more uniform structure, softens mild steel but raises the tensile strength of medium carbon steels.

ANNEALING

The heating and cooling of steel for the purpose of removing stresses, altering ductility or changing the physical and metallurgical properties. 18/8 stainless steels are annealed by heating to 1850° - 2050° F (1010° - 1120° C) and rapid cooling from high to low temperature. It is generally accepted that cooling from quenching temperature to black heat should be achieved within 3 minutes. Maximum softness is obtained by quenching from the top annealing temperature range.

BRIGHT ANNEALING

Annealing in a controlled atmosphere so that no oxide or scale is formed on the surface of the metal.

STRESS RELIEVING

Is a heat treatment given to relieve stresses which result in improved mechanical stability and elastic properties of cold-worked stainless steels. This heat treatment is usually in the range of 650° - 800° F (345° - 430°).

AUSTENITE

A non-magnetic solid solution of carbon in Gamma iron. It is very unstable below its critical temperature but is retained in stable form at room temperature in certain alloys such as the 18%Cr - 8%Ni stainless steels.

CARBIDE

A complex chemical compound of carbon with chromium, iron or other elements which are sometimes found in stainless and heat resistant steels. The quantity and form of carbide can determine the properties of the steel. Chromium carbides present on the grain boundaries of austenitic stainless steels cause poor resistance to corrosion. This is usually due to improper annealing, welding and quenching.

WELDING PROCESS

Tubing manufactured by the inert gas shielded arc welding process provides complete fusion of the base metal. The weld has the same composition as the tube and is free from harmful inclusions.

FULL FINISHED

The weld bead has been entirely removed by either cold drawing or swaging after which there is no weld bead either on the outside or inside of the tubing.

SWAGING

Swaging is a hammering operation on tubing after welding for the purpose of removing the weld bead on both the inside and outside; it also serves as a sizing operation.

PROFILE ROLLED

As Welded or Annealed Circular Stainless Steel Tubes can be supplied profile rolled in sizes 1" o.d. and over in 16 gauge and lighter.

Profile Rolling imparts a smooth contour to the internal surface by planishing of the weld area. Any visible evidence remaining on the external and internal surfaces of the tube does not detract from the widespread application for this type of tubing, especially in the milk and food processing industries, breweries, and other applications where smoothness of the bore is the prime essential.

Profile Rolled Tube can be considered as a substitute for Drawn Welded Stainless Steel Tubing where the internal bore finish is not regarded as critical. It should not be specified in cases where optimum corrosion resistance is desired as Drawn Welded quality may be required to achieve the preferred metallurgical condition.

DRAWN WELDED

Welded Tubing which is subsequently cold drawn through a die and over a plug. Cold drawing removes the internal weld bead, breaks up the grain structure in the weld area so that optimum corrosion resistance is developed in the weld area after proper heat treatment. Cold drawing is used to produce intermediate sizes or to give higher tensile strength if tubes are not required in the annealed condition.

AS WELDED

As the name implies, this is tubing direct from the mill. It has a higher yield point than annealed tube and is generally used for decorative applications or in mildly corrosive conditions.

COLD DRAWING

The drawing of tubing through a hardened steel or tungsten carbide die while at room temperature. Cold drawing can be done with or without a plug or mandrel on the inside. The purpose of cold drawing is to reduce the O.D. or wall or both, produce a smooth surface finish and to break up weld structure which results in re-crystallization when annealed.

SINKING

The process of reducing the diameters of tubes by drawing through dies without any internal support in the tube. Except for extremes in wall thickness (i.e. very thin or very thick) the wall thickness remains unaltered by sinking.

PASSIVATING

The treating of stainless steel by dipping in a dilute solution of nitric acid to remove free iron from the surface and improve the corrosion resistance by forming a passive film on the surface.

PICKLING

Pickling is the immersion of a material in an acid solution for the purpose of removing oxide scale after annealing or heat treatment. Mixtures of nitric and hydrofluoric acid in water are the most effective and most widely used solutions for the removal of scale from all the Chromium Nickel grades of Stainless Steel.

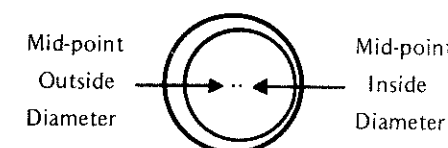
GLOSSARY OF TUBING TERMScontinued.

OVALITY

Out-of-roundness or difference between maximum and minimum dimensions of O.D. obtained by careful micrometer measurement for high and low points at any one section around the tube. The ovality tolerance is considered to be a total spread inside which both the maximum O.D. dimension and minimum O.D. dimension must fall.

TOLERANCE ON THICKNESS

Due to the nature of the hot working processes employed in manufacturing a hot finished tube for cold drawing, the mid-point of the inside diameter of the tube is not always coincident with the mid-point of its outside diameter. This causes a variation in thickness around the tube.



Cold drawing will tend to eliminate this, but will not completely remove it. The variation in thickness caused by the non-coincidence of diameter mid-points is referred to as eccentricity, and is defined as the difference between the maximum and minimum thicknesses at any section along the length of a tube. The allowable difference between the maximum and minimum thickness is called the eccentricity tolerance. It is also necessary to apply a tolerance to allow for the variation of the mean thickness from one tube to another caused by tool wear, etc. The allowable variation of the mean thickness from the nominal thickness is called the mean thickness tolerance. The mean thickness is found by taking the average of at least six equally spaced micrometer readings of the thickness around any section along the length of the tube.

INCLUSIONS

Particles of dirt, slag, etc., usually non-metallic, occurring in steel which did not have time to float off before solidification takes place.

DEFRASING (DEBURRING)

The operation of removing the ragged edges formed during cutting from the tube ends.

SECTION TUBING

Non-circular section tubing such as square, rectangles, ovals, etc., are first made in the round form and roll shaped or drawn as a supplementary operation.

NON-DESTRUCTIVE TESTING

This embraces all types of testing and inspection methods that do not destroy the material under test. While it includes methods that have been in operation for many years, such as magnetic particle and pressure testing, it has recently become more associated with ultrasonic and eddy current testing.

PIPE

Pipe can be defined as tubing made to definite standards usually designated by the nominal inside diameter. It has fixed wall thicknesses and outside diameter established as standard by the American Standards Association, the wall thickness depending upon the working pressures to be maintained. These fixed wall thicknesses are designated as Schedule numbers.

Schedule 5 and 10 pipe is normally used where comparatively low pressures are encountered and where butt weld fittings and connections are to be made. Schedule 40 and 80 pipe is used for high pressures and when threading is required.

NOMINAL BORE

In British and American practice there is a series of O.D. sizes originally used for external threading to take fittings but described in terms of the bore diameter associated with each outside diameter. Tube or pipe of a stated Nominal Bore therefore has the appropriate O.D. size listed in either B.S.1387 or A.S.T.M.A.53.

VAN STONE ENDS

Method of joining two tubes by flaring the ends at right angles and fitting a light back-up flange.

OXIDATION RESISTANCE

Austenitic-Ferritic Stainless Steels and Nickel Alloys

The ability to resist oxidation at elevated temperatures has contributed to the ever widening use of stainless steel in industry. The selection of the proper grade of stainless steel for a particular application is a relatively complex problem and involves manufacturing, metallurgical, chemical and economic considerations.

Although it is complex it has been made easier by industrial research. Data accumulated through years of research and experience gained in helping to solve varied application problems are now available to guide the user in the solution of his present problems.

When a metal is exposed to elevated temperatures for a long period of time, scale will form of sufficient thickness to flake off, causing a progressive loss of metal. The lowest temperature at which this phenomenon occurs is referred to as the "scaling" temperature of the material; the recommended temperature limits for satisfactory operation under oxidising conditions without excessive scaling.

Recommended maximum temperature limits for satisfactory operation under oxidizing conditions without excessive scaling.

AISI Type No.	Other Alloys	Temperature °F	Temperature °C
301		1600	871
302		1600	871
304-304L		1600	871
309		2000	1093
310		2100	1149
314		2100	1149
316-316L		1600	871
317		1600	871
321		1600	871
347		1600	871
410		1400	760
430		1600	871
446		2100	1149
	Nickel 200	1650	899
	Nickel 201	1650	899
	Inconel 600	2150	1179
	Incoloy 800	2050	1121
	Incoloy 825		
	Monel 400	1000	538

NOTE: The temperature limits may have to be revised downward in the presence of combustion products or gases high in sulphur compounds.

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WELDING OF STAINLESS STEEL FITTINGS, PIPE & TUBING

Where Stainless Steel materials are to be exposed to elevated temperatures in the range 800° F. to 1650° F. (425° C. to 870° C.) and to corrosive media, the harmful effects of Chromium carbide precipitation are avoided by addition of a minimum amount of a stabilizing element. Type 321 contains Titanium. Type 347 contains Columbium as a stabilizing element. The stabilizing elements will combine with the Carbon at a higher temperature than will Chromium, thus effectively tying up the available Carbon and thereby eliminating the vulnerable Chromium deficient areas. These materials may be welded and will retain their resistance to corrosion, even in the as-welded state. However, subsequent heat treatment, if possible, will improve the mechanical properties of the weldment.

Welding of the straight Chromium stainless steels will present much the same problems as encountered in the high Carbon or medium Carbon alloy steels. Rapid cooling of the weldment will result in a highly stressed, brittle structure. Use of these materials will make pre-heating and post-weld heat treatment mandatory.

To effectively reduce stresses during welding, a pre-heat and interpass temperature of not less than 600° F. should be maintained. When welding is completed, a stress-relief treatment must follow. However, in these materials a transformation of austenite to martensite must be complete prior to the stress-relief treatment. This can best be checked by allowing the weldment to cool until it becomes magnetic. At this time, it should be re-heated and stress relieved prior to cooling to room temperature. This treatment will result in a tempered martensitic structure which will have the desired mechanical properties.

INSTALLATION HINTS.

Great care should be taken to see that stainless tubing is not subjected to cold working unnecessarily because of its tendency to work harden. If cold work cannot be avoided then the proper thing to do is to anneal the entire piece of tube or assembly and quench it fast following the anneal. Care should be exercised to ensure that tubing installations are free of vibration to avoid work hardening and subsequent cracking of the tube.

Stress corrosion is an acceleration of corrosion rate in a metal caused by internal stresses. These stresses may be induced in stainless tubing by bending, expanding and thermal expansion, particularly where stainless is too rigidly installed and must function under fluctuating temperature conditions.

BENDING

As a general guide, tubing can be bent without a mandrel on a centre line radius approximately three times the diameter of the tubing. The quality of bend obtained without a mandrel depends largely on the bending equipment that is available and the heavier the wall the less distortion after bending. As a general guide, the following formula can be used to determine the minimum bending radius when the angle of bend does not exceed 90°. The formula is:

$$C/L \text{ Rad.} = \frac{(D2 - d2)}{4t}$$

D = O.D. of tube in inches
d = I.D. of tube in inches
t = wall thickness of tube in inches.

WELDED STAINLESS STEEL TUBING AND PIPE

During recent years, automatic welding of stainless steel in an inert gas with a non-consumable electrode has resulted in high quality welded tubing and pipe being produced with considerable cost advantages over seamless stainless steel tubing. ASTM specifications A269 and A312 specifically permit the use of welded stainless steel pipe provided it is properly annealed after manufacture and ASTM specification A249 covers welded stainless steel tubing which has been subjected to sufficient cold work after welding and prior to the final heat treatment to assure that optimum corrosion resistance in the weld area and base metal will be developed during heat treatment.

CORROSION

Corrosion may be simply defined as the destruction of a metal or alloy by a mechanism which is basically electrochemical in nature.

Stainless steels and many other corrosion-resistant alloys are also subject to corrosion. It is only with reservations that the metallurgists use the word "stainless" to designate certain types of steels. Yet this name has become accepted terminology because the users have found that these steels do have desirable corrosion resistance and certain "noble" characteristics. However, to fulfil the promise of their name, the austenitic stainless steels require proper handling to obtain maximum service life and corrosion resistance. By understanding the principles underlying the corrosion resistance of these steels and applying a few precautions which these principles indicate, we can maintain the desirable "noble" characteristics of these steels.

FACTORS AND CONDITIONS WHICH MAY AFFECT CORROSION RESISTANCE OF STAIN- LESS STEEL.

GALVANIC CORROSION — Bi-metal attack. When two or more dissimilar metals are connected or in contact, or when metals of the same analysis have variations in surface conditions, a galvanic cell may be established when an electrolyte is present. The least noble metal in the galvanic series will become sacrificial to the more noble metal.

POSITION OF STAINLESS STEELS IN THE ELECTROMOTIVE SERIES.

(anodic end)	TIN
MAGNESIUM	60 Ni-15% Cr. NICKEL
MAGNESIUM ALLOYS	80 Ni-20% Cr. INCONEL
ZINC	BRASSES
ALUMINIUM 2S	COPPER
CADMIUM	BRONZES
CARBON STEEL	NICKEL SILVER
COPPER STEEL	COPPER NICKEL
CAST IRON	MONEL
4-6% Cr. STEEL	60 Ni-15% Cr. NICKEL
12-14 % Cr. STEEL	80 Ni-20% Cr. INCONEL
16-18 % Cr. STEEL	12-14% Cr. STEEL
23-30 % Cr. STEEL	16-18% Cr. STEEL
7 Ni-17% Cr. STEEL	7 Ni-17% Cr. STEEL
8 Ni-18% Cr. STEEL	8 Ni-18% Cr. STEEL
14 Ni-23% Cr. STEEL	14 Ni-23% Cr. STEEL
20 Ni-25% Cr. STEEL	23-30% Cr. STEEL
12 Ni-18% Cr.	12 Ni-18% Cr.
3% Mo STEEL	3% Mo STEEL
LEAD-TIN SOLDER	SILVER
LEAD	(cathodic end)

PASSIVATION

Most researchers agree that the austenitic steels obtain their corrosion resistance from a thin metal oxide layer which forms a protective film on the surface of the metal. This condition is known as passivation. Air will form this film in time. However, the film formation can be greatly accelerated by exposure to an oxidizing acid such as Nitric Acid, HNO₃. Destruction of this film wholly or partially will greatly affect the corrosion resistance of this type of alloy.

Stainless Steel in the passive state appears in a relatively stable position in the galvanic series and is usually cathodic. Therefore, not subject to attack. However, under certain conditions all or portions of a piece of Stainless Steel may become active.

This active surface becomes anodic to the more noble mass and in the presence of an electrolyte a galvanic cell is set up and attack will occur. The rate of attack will vary with different electrolytes and the area relationship of the anode and cathode. A small anodic or active area in relationship to a large cathodic or passive area will result in rapid, severe attack. The rate of attack will be greater with acid solutions and those having a high degree of ionization. However, with basic solutions, even though a high degree of ionization is possible, corrosion may not occur in basic solutions due to the insolubility of the elements which make up stainless steels.

ELECTROLYTIC OR STRAY CURRENT CORROSION — Stray electric currents may produce pitting attack on Stainless Steel. This attack may occur with A-C or D-C although the rate of attack with A-C is considerably less than D-C and in most cases insufficient to be considered.

If there is the possibility of current leakage, the installation should be grounded. If this is impossible, the attack can be eliminated or reduced by inducing a small counter-current into the system to neutralize the effect of stray current. Another method which may be employed is to connect sacrificial anodes, such as Magnesium, to the system.

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CHEMICAL ATTACK — Austenitic steels are resistant to most chemicals. However, there are a few which cause serious attack. Halogen and Sulphur compounds are notorious for attack on stainless steels. Again acidic solutions cause more severe attack than basic solutions of the same elements. If possible, exposure to these harmful chemicals should be avoided. In cases where it is necessary to use compounds of this type with Stainless Steel, exposure time should be kept to a minimum and temperatures as low as possible used. In many cases inhibitors can be used in the solutions to render them less harmful.

CONTACT OR CREVICE CORROSION — This probably is the most common cause of pitting of stainless steels. Whenever a solid or semi-solid material adheres or lies against a Stainless Steel surface in contact with an electrolyte, pitting may occur. The passivity of the steel is destroyed under the substances, due to Oxygen starvation. This area will then become anodic to the mass and pitting will occur. The rate of attack will be governed by the relative anode and cathode areas and the type of electrolyte.

Oxygen concentration cells may also develop on crevices or fissures and may set up a galvanic cell and result in pitting attack.

These types of corrosion will spread as products of corrosion deposit on other areas of the metal and form new cells which cause further pitting. To overcome crevice, contact or concentration-cell corrosion an installation should be designed with a minimum of laps and crevices. If gaskets or seals are used they must be non-absorbent and well seated. Regular, efficient cleaning with correct cleaning agents will minimize these types of attack.

STRESS CORROSION AND CORROSION FATIGUE — This type of corrosion cracking is a result of residual or applied stresses. Metal under stress is slightly anodic in relation to the unstressed metal of the same analysis. Austenitic steels under stress are subject to attack when exposed to certain corrosive agents. The Halogen salts are probably the most serious offenders.

Correct heat treatment after forming and fabrication will eliminate residual stresses from these operations. It is also important in designing an installation to eliminate sources of stress such as applied loads, vibrations, flexing and excessive expansion and contraction due to changes in temperatures.

EROSION CORROSION — Certain liquids or gases moving at high speed may cause erosion corrosion, though these same materials if motionless would not affect the Stainless Steel. It is believed, by most investigators, that the attack is due in part to the destruction of the passive film on the surfaces. The action of fluids in rapid motion is not always destructive. In some cases the scouring effect keeps the Stainless Steel free of deposits and sludge which may cause other types of corrosion. Many Oxygen bearing solutions maintain the passivity of the stainless steels even at high velocities. To reduce the possibility of erosion corrosion, turbulence and impingement should be kept to a minimum. This will also improve the overall flow efficiency.

Austenitic stainless steels offer excellent corrosion resistance to most corrosives. By correct application, design and maintenance, stainless steels will perform in accordance with their noble characteristics.

STAINLESS STEEL AUSTENITIC ALLOYS

TYPE 301 17/7

This alloy has less chromium and nickel than others in the type 300 series. The alloy is unstable austenite which transforms to martensitic type phase with severe cold working. It develops valuable mechanical properties up to 300,000 PSI when cold worked and the high tensile strength developed makes it specially suitable for applications requiring high wear resistance such as in the automotive, kitchenware and furniture hardware items as well as structural members of transport vehicles.

TYPE 302

This grade is the basic 18/8 type in the 300 series and offers good corrosion resistance combined with good physical properties. For intermittent service involving frequent heating and cooling in air, it is recommended that the upper temperature limit should be 1600° F (870° C). Because of the possibility of carbide precipitation in the temperature range 800° — 1600° F (425° — 870° C) the unmodified 18/8 alloys may be subject to attack by severely corrosive solutions. Carbide precipitation is not in itself harmful, but it does leave the metal susceptible to intergranular-type corrosion in the presence of severe corrosive agents.

TYPE 303

An 18%Cr — 9%Ni nonhardenable alloy containing selenium and extra amounts of sulphur and phosphorus. Most readily machinable of all austenitic grades. Properties close to those of Type 304, elongation somewhat lower. Nonmagnetic in annealed condition. Weldable by resistance methods-fusion welding not recommended. Resistant to scaling up to 1650° F. For use where a free cutting material is required; offers high resistance to corrosion; assures good end product surface. Typical applications: bushings, casters, shafts, rivets, valve and pump parts.

TYPE 304

A widely used grade that has high strength at elevated temperatures and good corrosion resisting properties for applications in a wide range of corrosive media. Less susceptible to precipitations of carbides and therefore suitable for use where welding conditions do not involve prolonged exposures to temperatures in the 800° — 1600° F (425° — 870° C) range. Excellent mechanical properties as low as —325° F (—198° C). Extensively used in the food and drink processing equipment decorative applications and heat exchangers. Scale resistant in continuous service to 1600° F and 1450° F for intermittent service.

TYPE 304L

A low carbon variation of Type 304 with a greatly reduced tendency to inter-crystalline disintegration after welding.

TYPE 305

A high-nickel variant of 18-8. Behaves much the same as Type 304 in corrosion resistance, carbide precipitation, and scale resistance. Low magnetic permeability (1.005 max.) even when mildly cold worked. Low work-hardening rate for severe forming.

For applications where severe forming is involved. Used for electrical instruments, cathode ray tube anodes and grid cups.

TYPE 309

A higher chromium and nickel content than the basic 18/8 types. Primarily a heat resistant alloy containing 25%Cr and 12%Ni with good high tensile and creep strength at elevated temperatures. Subject to carbide precipitation in range 800 — 1600° F (425° — 870° C). This alloy is easily welded or machined, is ductile and malleable. Resists oxidation up to 2000° F (1095° C) for continuous service. Not recommended for heat resistant applications of a cyclic nature because the different rates of expansion of the scale formed and the parent metal results in progressive scaling. Intermittent service to 1800° F (982° C).

TYPE 310

This is a heat resistant alloy containing 25%Cr and 20%Ni suitable for use at elevated temperatures up to 2100° F (1150° C) for continuous service or in applications involving cyclic operation to 1900° F (1038° C) providing reducing sulphur gases are not present. Nonmagnetic at room temperatures in annealed condition with excellent weldability. Mechanical and corrosion resistance properties similar to, but better than Type 304. Offers good resistance to sea water and fuming nitric acid at room temperatures. Used extensively for furnace components, still tubes and fuel lines. Silicon content 1.5% max.

TYPE 314

This is a heat resistant alloy of the Austenitic type containing 25% chromium and 20% nickel very similar to Type 310. The important difference lies in the silicon content which is 1.5—3%. The effect of silicon on the heat resisting properties of iron-chromium-nickel alloys is well recognised and has the effect of reducing carbon and sulphur pick up and to reduce damaging scale formation and increased resistance to intergranular attack. Used extensively for manufacture of chain links and mesh belts and other furnace parts subjected to cyclic operations or continuous service up to 2100° F (1150° C).

TYPE 316

A 18% Cr — 10% Ni — 2 — 3% Mo. alloy that offers the best corrosion resistance of the standard Austenitic grades. This type, with the molybdenum content, is particularly resistant to sulphur, sulphur acids, phosphoric, formic and various hot organic acids.

Offers increased resistance to pitting and pinhole type corrosion when in contact with acid vapours and salt solutions of the halide group in general, and has good high temperature and creep strength. Since this grade is not stabilized it is susceptible to intergranular corrosion when exposed to the critical temperature range 800° — 1600° F (425° — 870° C) and therefore must be heat treated after welding. Extensively used in pulp and paper, chemical, petro-chemical and dyeing industries for the more corrosive service applications. Scale resistance to 1600° F (871° C) max. for continuous and 1500° F (816° C) for intermittent service.

TYPE 316L

Low carbon modification of Type 316. Can be welded and heated in the range 800° — 1600° F (425° — 870° C) without damage to corrosion resistance.

STAINLESS STEEL AUSTENITIC ALLOYS cont.

TYPE 316Ti

A versatile grade of stainless steel which combines the advantages of AISI Type 316, 321 and 316L. Basically Type 316 stainless steel but with the addition of a minimum titanium content of 5 x carbon. This gives the steel particular application in structures subjected to temperatures in the 800° — 1600° F (425° — 870° C) where the steel is in contact with corrosive media. Type 316Ti can be stress relieved without risk of inter-granular corrosion.

TYPE 317

A higher molybdenum and chromium bearing austenitic stainless steel than Type 316. Has optimum corrosion resistance. Is more resistant to inter-granular attack than Type 316 and is preferred where light gauge material is to be welded. Suitable for applications requiring resistance to sulphuric acid concentrations up to 5% at temperatures to 840° F (450° C). Also where condensation of sulphur-bearing gases occurs and increased resistance to pitting corrosion is desired.

TYPE 321

An 18% Cr — 10% Ni titanium-stabilised alloy designed to overcome susceptibility to carbide precipitation and resultant inter-granular corrosion. Can be welded without subsequent annealing.

Corrosion resistance similar to Type 304 but with higher creep resistance suitable for use up to 1600° F (870° C) for intermittent service and up to 1475° F (800° C) for continuous service and can be used in corrosive applications at these temperatures. Recommended for use where heavy welded or field-erected equipment cannot be annealed. Also used where it is necessary for equipment to be cooled slowly through sensitizing range or where operating temperature is between 800° — 1600° F (425° — 870° C).

TYPE 330

An austenitic, nonmagnetic, corrosion-resisting high nickel-chromium alloy steel. It will endure high heat and is most useful at operating temperatures between 1500 and 2150° F. Will also withstand prolonged heating in air at temperatures up to 1900° F without excessive scaling. Can be machined, bent, drawn and spun. Can be welded by use of a rod of special chemical composition to prevent weld cracking.

Used for furnace parts, pyrometer protection tubes and heat resisting parts in jet engines.

TYPE 347

Similar properties to Type 321 but stabilised by columbium instead of titanium. Superior to Type 321 when subjected to corrosive service in the sensitizing temperature range.

NYBY 20-25 UMoCuT

A high-purity austenitic stainless steel with very good resistance to general corrosion in solutions of sulphuric or phosphoric acid. Has high resistance to pitting and stress corrosion and used in salt and brackish waters.

Suitable for use in severe environments in the inorganic and organic chemical process industries, polymer and plastic industry, explosive and petrochemical industries. Some applications:—

- Pulp and paper industry — bleaching equipment
- Petrochemical industry — heat exchangers
- Chemical industry — process equipment where sulphuric or phosphoric acids are frequent and where chlorides and fluorides occur.

- Marine applications — heat exchangers
- Textile and fibres industry — equipment in dyeworks
- Mechanical industry — pickling tanks.

KIN 800 AT STEEL (20 Cv-33Ni-Al-Ti)

For use in heat exchangers and piping that must be oxidation and corrosion resistant at high temperatures and in similar application to Incoloy 800.*

KIN 600 STEEL (15 Cv-72 Ni)

Similar applications to KIN 800 AT and to Inconel 600.*

STAINLESS STEEL MARTENSITIC ALLOYS

TYPE 410

Type 410 is a basic hardenable alloy containing 12% Cr; Magnetic in all conditions and can be hardened to Rockwell C36-40 by quenching or air cooling from 1750-1850° F. Not subject to carbide precipitation, but low in impact properties at low temperatures. Air hardening, they present some difficulty in welding. Widely used wherever good spring properties are needed. Excellent for Bourdon springs, medical instruments and turbine parts.

STAINLESS STEEL FERRITIC ALLOYS

TYPE 430

Basic type of straight chromium ferritic alloy steel combining useful corrosion resistance, mechanical properties, ease of formability and low cost. Used extensively as automotive trim. Resistance to nitric acid permits the use of Type 430 for specific chemical applications. Has good resistance to atmospheric corrosion away from coastal areas. Under oxidising conditions a tight protective scale is formed on the surface making it useful for equipment subjected to repeated heating and cooling up to 1600° F (870° C). It is magnetic in all tempers and non-hardenable.

TYPE 430Ti

Analysis similar to T430 with addition of Titanium 0.60% max. to eliminate coarse grain welds of low ductility. Mechanical properties resemble those of low-carbon steel and machines better than austenitic grades.

TYPE 446

A ferritic alloy, 27% chromium stainless steel with excellent resistance to corrosion and oxidation. Has the highest heat resistance to all ferritic stainless steels. A nitrogen addition is used to prevent embrittlement through the 1200° — 1800° F (649° C—982° C) range and also to help control grain size. Type 446 resists oxidation up to 2150° F (1175° C) for intermittent service and 2000° F (1095° C) for continuous service. At high temperature a tightly, adherent scale forms preventing further oxidation. Resists attack by sulphurous gases at elevated temperatures. Excellent corrosion resistance to nitric acid, concentrated sulphuric acid and most alkalis. Hot strength is rather low and it is somewhat brittle at room temperatures. Used extensively for furnace parts, thermocouple sheaths, chemical processing equipment, muffle tubes, etc.

STAINLESS STEEL FERRITIC ALLOYS cont.

FERRALUM ALLOY†

A patented ferritic-austenitic stainless steel combining high mechanical strength, ductility and hardness with outstanding resistance to corrosion and erosion. Optimum properties are achieved by a simple heat treatment and the alloy is supplied either:—

- (a) Solution treated at 1120°C followed by a rapid cool, or
- (b) Solution treated as (a) and age-hardened at 510°C ± 10°C. Has excellent resistance to sulphuric, phosphoric, nitric, acetic, formic and many other acids and salts.

Because of its outstanding wear and erosion resistance and good anti-galling properties, Ferralium alloy is particularly suitable for pumps, agitators and other critical components handling hot corrosive slurries or where galling is a problem.

SHOMAC 302 (30Cr-2Mo-ULC Ferritic Stainless)

This is a high purity high corrosive ferritic stainless steel with an ultra low carbon of 0.005% max. Developed to give remarkable resistance to chlorine induced stress corrosion cracking and excellent resistance to both pitting and crevice corrosion. Suitable for components in:—

- Strongly corrosive organic acid plants
- Oxidising inorganic acid processing plants
- Evaporators in caustic soda solutions produced through the diaphragm process.
- Processing plants involving polluted brackish water
- Condensers or coolers in which coolant is chlorine containing water or sea water.

Subject to embrittlement at temperatures of about 475°C.

NICKEL & NICKEL BASE ALLOYS

NICKEL 200

Combines excellent mechanical properties with corrosion resistance that is generally good and is outstanding under many conditions of exposure. Strength and hardness may be increased by cold working. Scale resistant in sulphur free atmospheres to 1650°F (900°C). Extensively used in contact with reducing acids, food, chemical processing liquors and caustic solutions. Carbon 0.15% max.

NICKEL 201

Is the low carbon grade of Nickel 200. Carbon content 0.02% max. This alloy has excellent resistance to corrosion and may be used in oxidising temperatures to 1650°F (900°C). Recommended for severe manipulation and use in thermocouple tubing in molten salt bath furnaces.

INCONEL 600*

This alloy is superior in corrosion resistance to commercially pure nickel under oxidising conditions. Its higher nickel content enables it to retain considerable corrosion resistance under reducing conditions. It resists oxidation at elevated temperatures up to 2150°F (1170°C). Resistant to salt at elevated temperatures up to 1832°F (1000°C). Can be readily welded, brazed and soldered. Extensively used for thermocouple protection tubing, sheathing on electric elements and food processing.

INCOLOY 800*

This alloy has good resistance to oxidation up to 2050°F (1100°C) and retains its strength at elevated temperatures. Has excellent workability and welding properties and is superior to Inconel 600 in resisting sulphur and fused neutral salts; comparable in resistance to oxidation; inferior in resistance to nitriding, halogen gases and molten caustics. Used extensively for sheathing on electric elements, furnace muffles and heat exchangers.

INCOLOY 825*

Formerly known as Ni-o-nel* Alloy 825, is a titanium stabilised nickel-chromium-iron-molybdenum-copper alloy. It is fully austenitic and resistant to attack by many mineral and organic acids, particularly under oxidising conditions. Has greatly increased resistance to sulphuric acid and phosphoric acid when fluorides are present than the 300 series stainless steels. This alloy resists stress-corrosion cracking when subjected to a wide range of temperature and the more aggressive mineral acids, chlorine, ammonia and ammonium hydroxide solutions.

MONEL 400*

Combines high strength, ductility and excellent resistance to corrosion and is scale resistant in sulphur free atmospheres to 1000°F (540°C). Has more resistance than nickel to corrosion under reducing conditions and more resistance than copper to corrosion under oxidising conditions. Used extensively in the chemical, food processing industries, power generating apparatus, medical instruments, electric heating elements and marine equipment.

CARPENTER 20Cb-3

This alloy provides excellent resistance to corrosion by sulphuric acid as well as other corrosive solutions. The presence of columbium in the alloy minimises precipitation of carbides during welding.

TITANIUM

This metal has outstanding strength to weight ratio and excellent corrosion resistance for certain applications in the chemical industry. Used extensively in the aluminium anodising field and in the food industry or the manufacture of fine chemicals when traces of iron, nickel or chromium can ruin the product. Readily fusion welded provided the metal is thoroughly protected from contamination by oxygen, nitrogen and hydrogen by the conventional shielded arc using a tungsten electrode. Used extensively for electrochemical anodes, chlorine applications, sea water, inhibited reducing acids, nitric acid, urea equipment anodising and plating, textile, food, petroleum industries.

HASTELLOY "C"

Excellent corrosion resistance, especially to ferric chloride and cupric chloride. Also to wet chlorine gas and hypochlorite and chlorine dioxide solutions. Has excellent high temperature strength. Resistant to oxidizing and reducing atmospheres to 2000°F. Primarily used where exceptional corrosion resistance and high temperature strength are required. Typical are the outer sheath for electric tubular heating elements, thermocouple rakes, probes, photographic processing equipment, and lubricating lines for chemical equipment.

*Monel, Inconel and Incoloy are Registered Trade Names of The International Nickel Co.

†Ferralium Alloy is Registered Trade Name of Langley Alloys Ltd.

AMERICAN SOCIETY OF TESTING MATERIALS SPECIFICATIONS

Abbreviations

- ASA - American Standards Published by the American Standards Association
- ASTM - American Society of Testing Materials
- ASME - American Society of Mechanical Engineers
- API - American Petroleum Institute
- ASA B31.1 - Code for Pressure Piping
- ASA B31.3 - Code for Pressure Piping: Petroleum Refinery Piping
- ASA B31.8 - Gas Transmission and Distributing Piping Systems
- API STD 5A - API Specification for Casing, Tubing and Drill Pipe
- API STD 5L - API Specification for Line Pipe
- API STD 5LX - API Specification for High Test Line Pipe

DIMENSIONAL PIPE SPECIFICATIONS:

- ASA B36.10 - Wrought Steel and Wrought-Iron Pipe covers diameters and wall thicknesses of pipe 1/4" to 36" with the exception of Schedules 5S and 10S.
- ASA B36.19 - Stainless Steel Pipe covers diameters and wall thicknesses of Stainless Steel pipe in Schedules 5S, 10S, 40S and 80S in sizes 1/8" to 30".

ASTM-A53 GRADE A & B

This specification covers seamless and welded black and hot-dipped galvanized steel pipe in nominal sizes 1/8 in. to 26 in. incl. (3.18mm to 660.40mm) with nominal (average) wall thickness.

ASTM-A106 GRADES A, B & C

This specification covers seamless carbon steel pipe for high-temperature service in nominal sizes 1/8 in. to 26 in. inclusive (3.18 mm to 660.40 mm) with nominal (average) wall thickness.

- Grade A Carbon 0.25% max. Manganese 0.27 to 0.93%
- Grade B Carbon 0.30% max. Manganese 0.29 to 1.06%
- Grade C Carbon 0.35% max. Manganese 0.29 to 1.06%

All grades have same values for Sulphur 0.058% max. Phosphorus 0.048% max. Silicon 0.10% min.

ASTM-A120

This specification covers black and hot-dipped galvanized welded and seamless steel pipe in nominal sizes 1/8 in. to 16 in. inclusive (3.18 mm to 406.40 mm) with nominal (average) wall thickness.

ASTM-A155

This specification covers electric-fusion-welded steel pipe suitable for high-pressure service and for use at high, intermediate, or lower temperatures, depending upon grade of material specified, in outside diameters 16 in. (406.40mm) and larger with wall thicknesses up to 3 in. (76.20mm) incl.

ASTM-A161

This specification covers seamless, hot-finished and cold-drawn, low-carbon and carbon-molybdenum steel still tubes, for use in carrying fluids at elevated temperatures and pressures in various types of heaters, in which the tubes may be subjected to a furnace temperature higher than that of the contained fluid.

ASTM-A178

This specification covers electric-resistance-welded tubes made of carbon steel and intended for use as boiler tubes, boiler flues, superheater flues, and safe ends and covers tubes 1/2 in. to 5 in. incl. (12.70 mm to 127.00 mm) in outside diameter and 0.035 in. to 0.320 in. incl. (0.89 mm to 8.13mm) in minimum wall thickness.

ASTM-A179

Seamless Cold Drawn Low-Carbon Steel Heat Exchanger and Condenser Tubes. — 1/8 in. to 3 in. inclusive (3.18 mm to 76.20 mm) in outside diameter and specifies minimum wall thickness.

ASTM-A199

This specification covers several grades of chromium-molybdenum and chromium-molybdenum-silicon seamless cold-drawn intermediate alloy steel tubes for heat exchanger, condensers, and similar heat transfer apparatus and covers tubes 1/8 in. to 3 in. incl. (3.18mm to 76.20 mm) in outside diameter.

Grade covered as in A199 are T3b-T4-T5-T7-T9-T11-T21-T22.

ASTM-A200

This specification covers several grades of chromium-molybdenum and chromium-molybdenum-silicon seamless, hot-finished and cold-drawn, intermediate alloy steel still tubes, for use in carrying fluids at elevated temperatures and pressures in various types of heaters, in which the tubes may be subjected to a furnace temperature higher than that of the contained fluid and covers tubes 2 in. to 9 in. inclusive (50.80 mm to 228.60 mm) in outside diameter and over 0.220 in. (5.59 mm) in minimum wall thickness.

ASTM-A209

This specification covers several grades of seamless carbon-molybdenum alloy-steel boiler and superheater tubes and covers tubes 1/2 in. to 5 in. incl. (12.70 mm to 127.00 mm) in outside diameter and 0.035 in. to 0.500 in. inclusive (0.89 mm to 12.70 mm) in minimum wall thickness.

ASTM-A210

This specification covers seamless medium-carbon steel boiler tubes and boiler flues, including safe ends, arch and stay tubes, and superheater tubes and covers tubes 1/2 in. to 5 in. incl. (12.70 mm to 127.00 mm) in outside diameter and 0.035 in. to 0.500 in. inclusive (0.89 mm to 12.70 mm) in minimum wall thickness.

ASTM-A213

Seamless Ferritic and Austenitic Alloy-Steel Boiler, Super-Heater and Heat Exchanger Tubes. ½ in. to 5 in. inclusive (12.70 mm to 127.00 mm) in outside diameter having wall thicknesses of 0.035 in. to 0.500 in. inclusive (0.89 mm to 12.70 mm) in minimum wall thickness. The steels covered include 12 grades of ferritic in the chromium-molybdenum range as well as a similar range of stainless steels as detailed in ASTM-A249 with the exception of TP305, TP 309 and TP317.

ASTM-A214

Electric-Resistance Welded Carbon Steel Heat Exchanger and Condenser Tubes, up to and including 3 in. (76.20 mm) in outside diameter and specified minimum wall thickness.

ASTM-A249

Welded Austenitic Steel Boiler, Super-Heater, Heat Exchanger, and Condenser Tubes ½ in. to 5 in. inclusive (12.70 mm to 127.00 mm) in outside diameter and 0.035 in. to 0.320 in. (0.89 mm to 8.13 mm) and specified minimum wall thickness. The grades covered by this specification include those listed under A269 plus additional grades such as TP304H, TP305, TP309, TP310, TP316H, TP321H, TP347H and TP348H. Specification lays down that subsequent to welding and final heat-treatment the tube shall be cold worked to ensure that optimum corrosion resistance in the welded area and base metal will be developed during heat treatment.

ASTM-A254

This specification covers copper brazed steel tubing 3/16 in. (4.76 mm) and over in outside diameter. This tubing is suitable for general engineering uses, particularly in the automobile, refrigerator, and stove industries for fuel lines, brake lines, oil lines, heating and cooling units.

ASTM-A268

This specification covers eight grades of stainless steel tubing for general corrosion-resisting and high-temperature service. These grades are commonly known as the "straight-chromium" types and are characterized by being ferromagnetic. Two of these grades, TP410 and TP329, are amenable to hardening by heat treatment, and the high-chromium, ferritic alloys are sensitive to notch-brittleness on slow cooling to ordinary temperatures. These features should be recognized in the use of these materials. Grade T409 may be ordered with no final heat treatment provided certain requirements are met. Modification 1 of TP430 is used primarily for hot water tank service and does not require post weld heat treatment to prevent attack of the heat affected zone.

ASTM-A269

Seamless and Welded Austenitic Stainless Steel Tubing for General Service, from 1/8 in. to 8 in. (3.18 mm to 203.20 mm) O.D. and specific average wall thickness. This specification covers grades of stainless steel tubing for general corrosion resistance and low or high temperature service in the following grades:
TP304-TP304L-TP316-TP316L-TP317-TP321-TP347-TP348.

ASTM-A270

This specification covers a grade of seamless and welded austenitic stainless steel sanitary tubing intended for use in the dairy and food industry and having special surface finishes and covers tubes in sizes up to and including 4 in. (101.60 mm) in outside diameter.

ASTM-A271

This specification covers grades of seamless, hot-finished and cold-finished, austenitic chromium-nickel steel still tubes for use in carrying fluids at elevated temperatures and pressures in various types of heaters, in which the tubes may be subjected to a furnace temperature higher than that of the contained fluid. The specification covers tubes 2 to 9 in. incl. (50.80 to 228.60 mm) in outside diameter and over 0.220 in. (5.59 mm) in minimum wall thickness.

ASTM-A312

This specification covers seamless and welded austenitic steel pipe intended for high-temperature and general corrosive service. Sixteen grades are covered. The grades of austenitic stainless steel pipe furnished in accordance with this specification have been found suitable for low-temperature service down to -325° F (-198°C), where Charpy notched bar impact values of 15 ft-lb (2.07 m-kj), minimum, are required, and need not be impact tested.

ASTM-A333

This specification covers nominal (average) wall seamless and welded carbon and alloy steel pipe intended for use at low temperatures. All Pipe furnished under this specification must be tested for impact resistance at the minimum temperature ranging from -50°F (-46°C) for Grade 1. to -100°F (-73°C) for Grade 9.

ASTM-A334

This specification covers several grades of seamless and welded carbon and alloy-steel tubes intended for use at low temperatures.

ASTM-A335

This specification covers nominal (average) wall seamless alloy-steel pipe intended for high-temperature service. Pipe ordered to this specification shall be suitable for bending, flanging (van-stoning), and similar forming operations, and for fusion welding. Selection will depend upon design, service conditions, mechanical properties, and high-temperature characteristics. Grades covered:
P1-P2-P5-P5b-P5c-P7-P9-P11-P12-P15-P21-P22.

ASTM-A358

This specification covers electric fusion-welded austenitic chromium-nickel alloy steel pipe suitable for corrosive or high-temperature service, or both. Commercial practice is commonly limited to sizes not less than 8 in. (203 mm) nominal diameter and covers seven grades of alloy steel.

ASTM-A376

This specification covers seamless austenitic steel pipe intended for high-temperature and central-station service. Among the ten grades covered are five H grades which are specifically intended for high-temperature service.

ASTM-A381

This specification covers straight seam, double submerged-arc-welded steel pipe suitable for high-pressure transmission service, 16 in. (406 mm) to 42 in. (1077 mm), incl., in outside diameter, with wall thicknesses 5/16 in. to 1½ in. (7.9 to 38 mm) incl. The pipe is intended for carrying liquid, gas, or vapor. Pipe shall be suitable for bending, flanging (van-stoning), corrugating, and similar operations.

ASTM-A405

This specification covers nominal (average) wall seamless, annealed or normalized and tempered alloy steel pipe intended for high-temperature service after special heat treatment. Pipe ordered to this specification shall be suitable for bending, flanging (van-stoning), and similar forming operations, and for fusion welding. The pipe shall be given a special heat treatment after any shop fabrication and prior to installation in service.

ASTM-A409

WELDED LARGE OUTSIDE DIAMETER LIGHT-WALL AUSTENITIC CHROMIUM-NICKEL ALLOY STEEL PIPE

This specification covers electric fusion-welded, light wall, austenitic chromium-nickel alloy steel pipe for corrosive or high-temperature service. The sizes covered are 14 to 30 in. (355 to 762 mm) incl., in nominal diameter with extra light (schedule 5S) and light (schedule 10S) wall thicknesses. Eight grades of alloy steel are covered. Additional special grades may be specified by the purchaser.

The minimum wall thickness at any point shall not be more than 0.018 in. (0.46 mm) under the specified wall thickness. Specified Diameter — Where the specified wall thickness is less than 0.188 in. (4.78 mm), the actual outside diameter, based on circumferential measurement, shall not vary more than ± 0.20 per cent from the specified outside diameter. Where the specified wall thickness is 0.188 in. (4.78 mm) and heavier, the actual outside diameter, based on circumferential measurement, may vary a maximum of ± 0.40 per cent from the specified outside diameter.

Straightness — Using a 10 ft. (305 cm) straightedge placed so that both ends are in contact with the pipe, the camber shall not be more than 3/16 in. (1.59 mm).

Grades covered: TP304-309-310-321-347-316-317-348.

ASTM-A423

This specification covers seamless and electric resistance welded low-alloy steel tubes for pressure containing parts such as economizers or other applications where corrosion resistance is important and covers tubes ½ to 5 in. inclusive (12.7 mm to 127.00 mm) in outside diameter and 0.035 to 0.500 in. inclusive (0.89 mm to 12.70 mm) in minimum wall thickness.

ASTM-A430

AUSTENITIC STEEL FORGED AND BORED PIPE intended primarily for high-temperature central station service. Pipe ordered to this specification shall be suitable for bending and other forming operations and for fusion welding. The "H" grades are specifically intended for high-temperature service. Nine grades of austenitic steels are covered.

ASTM-A450

This specification covers a group of common requirements which, when specified in the purchase order or in an individual specification, shall apply to hot-finished and cold-drawn, welded and seamless carbon steel, and ferritic and austenitic alloy steel under each of the following specifications issued by the American Society for Testing and Materials (or any other ASTM specification which invokes this specification or portion thereof).

Specifications covered are: A161-A178-A179-A192-A199-A200-A209-A210-A213-A214-A226-A249-A250-A254-A268-A269-A270-A271-A334-A423-A556-A557.

ASTM-A498

SEAMLESS AND WELDED CARBON, FERRITIC, AND AUSTENITIC ALLOY STEEL HEAT-EXCHANGER TUBES WITH INTEGRAL FINNS

This specification covers external helical, integral finned, Seamless or welded low-carbon steel, alloy steel, and stainless steel tubes for use in tubular heat exchangers, surface condensers, evaporators, superheaters, and similar heat-transfer apparatus in unfinned end diameter up to 2 in. inclusive. The finned tubes shall be manufactured from plain tubes which conform to one of the following specifications of the American Society for Testing and Materials: A179-A199-A213-A214-A249-A334.

ASTM-A500

This specification covers cold-formed welded and seamless carbon steel round, square, rectangular, or special shape structural tubing for welded, riveted, or bolted construction of bridges and buildings, and for general structural purposes. This tubing is produced in welded sized with a maximum periphery of 32 in. (812.80 mm) and a maximum wall of 0.375 in. (9.53 mm) and in seamless with a maximum periphery of 32 in. (812.80 mm) and a maximum wall of 0.500 in. (12.70 mm).

ASTM-A501

This specification covers hot-formed welded and seamless carbon steel square, round, rectangular, or special shape structural tubing for welded, riveted, or bolted construction of bridges and buildings, and for general structural purposes. Square and rectangular tubing is furnished in sizes 1 to 10 in. (25.40 to 254.00 mm) across flat sides with wall thicknesses 0.095 to 1.000 in. (2.41 to 25.40 mm), depending on size; round tubing is furnished in nominal diameters 1/2 to 24 in., incl. (12.70 to 609.60 mm) with nominal (average) wall thicknesses 0.109 to 1.000 in. (2.77 to 25.40 mm) depending on size.

ASTM-A511

SEAMLESS STAINLESS STEEL MECHANICAL TUBING

This specification covers seamless stainless tubing for use in mechanical applications where corrosion resistant or high temperature strength is needed. This specification covers seamless cold-finished mechanical tubing and seamless hot-finished mechanical tubing in sizes up to 12¼ in. (323.85 mm) in outside diameter (for round tubing) with wall thickness as required.

ASTM-A512

This specification covers cold-drawn butt-weld carbon steel tubes for use as mechanical tubing. This specification covers round, square, rectangular and special shape mechanical tubing. Round tube size ranges covered are outside diameters up to 3½ in. (88.90 mm), and wall thicknesses from 0.035 to 0.500 in. (0.89 to 12.70 mm).

ASTM-A513

This specification covers electric-resistance-welded carbon and alloy steel tubing for use as mechanical tubing, and made from hot- or cold-rolled steel and round, square, rectangular, and special shape tubing.

ASTM-A519

This specification covers several grades of carbon and alloy steel seamless mechanical tubing and covers both seamless hot-finished mechanical tubing and seamless cold-finished mechanical tubing in sizes up to and including 12¾ in. (323.85 mm) outside diameter for round tubes.

ASTM-A524

This specification covers seamless carbon steel pipe primarily for process piping applications, in nominal sizes 1/8 to 26 in., incl. (3.18 to 660.4 mm), with nominal (average) wall thickness as given in USA Standard USAS B36.10-1959. Pipe ordered to this specification shall be suitable both for welding, and for bending, flanging, and similar forming operations.

ASTM-A530

GENERAL REQUIREMENTS FOR SPECIALIZED CARBON AND ALLOY STEEL PIPE

This specification covers common requirements which, when specified in the purchase order or in an individual specification, shall apply to hot-finished and cold-drawn, welded, seamless, forged and bored, and centrifugally cast carbon steel, ferritic, and austenitic alloy steel pipe under each of the following specifications issued by the American Society for Testing and Materials, or any other ASTM specification that invokes this specification or a portion thereof.

Grades covered: A106-A155-A312-A333-A335-A358-A369-A376-A381-A405-A409-A426-A430-A451-A452-A524.

ASTM-A554

This specification covers welded stainless steel tubing for mechanical applications where appearance, mechanical properties or corrosion resistance is needed and covers as-welded or cold-reduced mechanical tubing in sizes to 16 in. (406.40 mm) outside diameter, incl. (for round tubing) and in wall thicknesses 0.020 in. (0.51 mm) and over.

ASTM-A556

This specification covers seamless cold-drawn carbon steel tubes including bending into the form of U-tubes, if specified, for use in tubular feedwater heaters. The tubing sizes covered shall be 5/8 to 1¼ in. (16 to 32 mm) outside diameter incl., with minimum wall thicknesses equal to or greater than 0.045 in. (1.14 mm).

ASTM-A557

This specification covers electric-resistance-welded carbon steel tube including those bent, if specified, into the form of U-tubes for application in tubular feedwater heaters. The tubing sizes covered shall be 5/8 to 1¼ in. (16 to 32 mm) outside diameter incl. and wall thicknesses equal to or greater than 0.045 in. (1.14 mm).

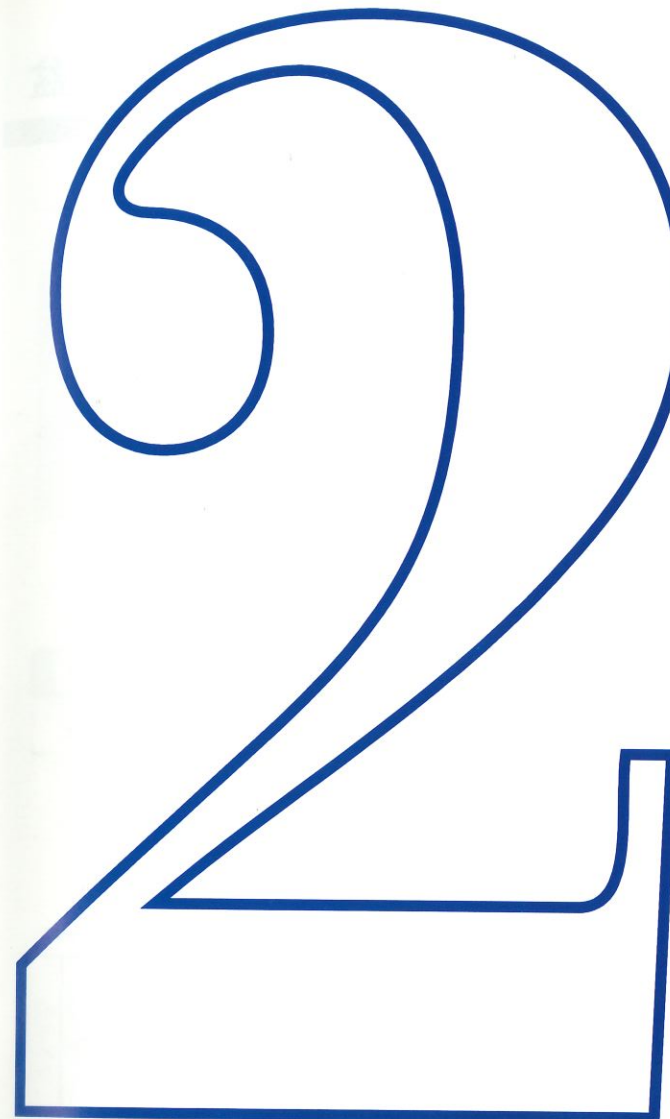
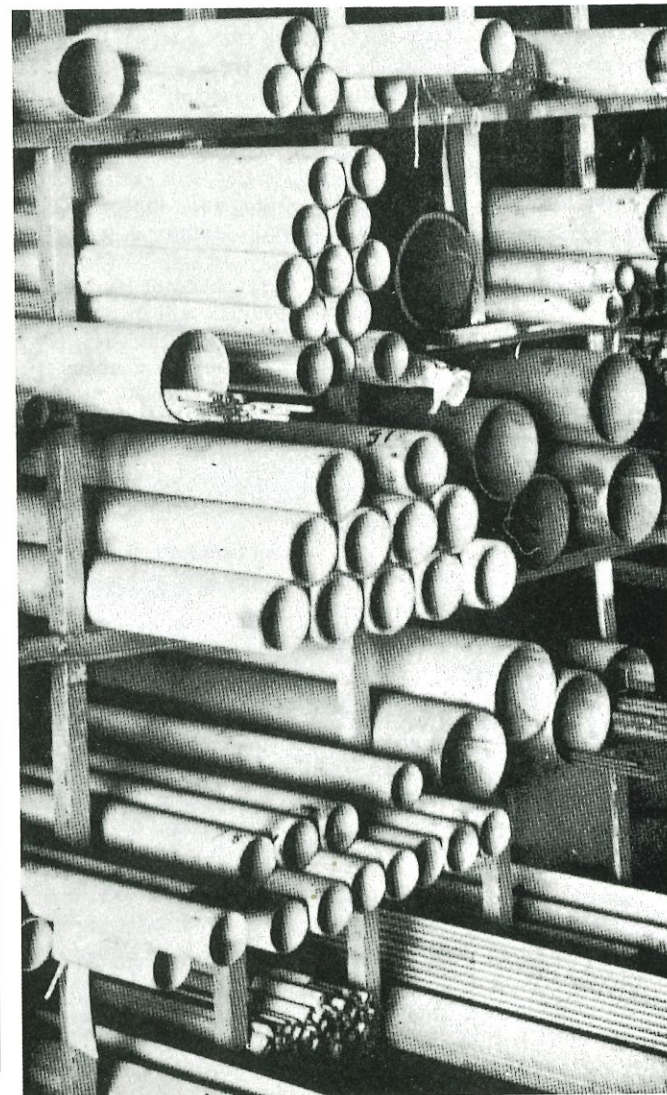
ASTM-A587

This specification covers electric-resistance-welded low-carbon steel pipe intended for use as process lines. Pipe ordered under this specification shall be suitable for severe forming operations involving flanging and bending to close radii and covers nominal sizes ½ to 4 in. (12.7 to 101.6 mm).

ASTM-A632

SEAMLESS AND WELDED AUSTENITIC STAINLESS STEEL TUBING (SMALL-DIAMETER) FOR GENERAL SERVICE

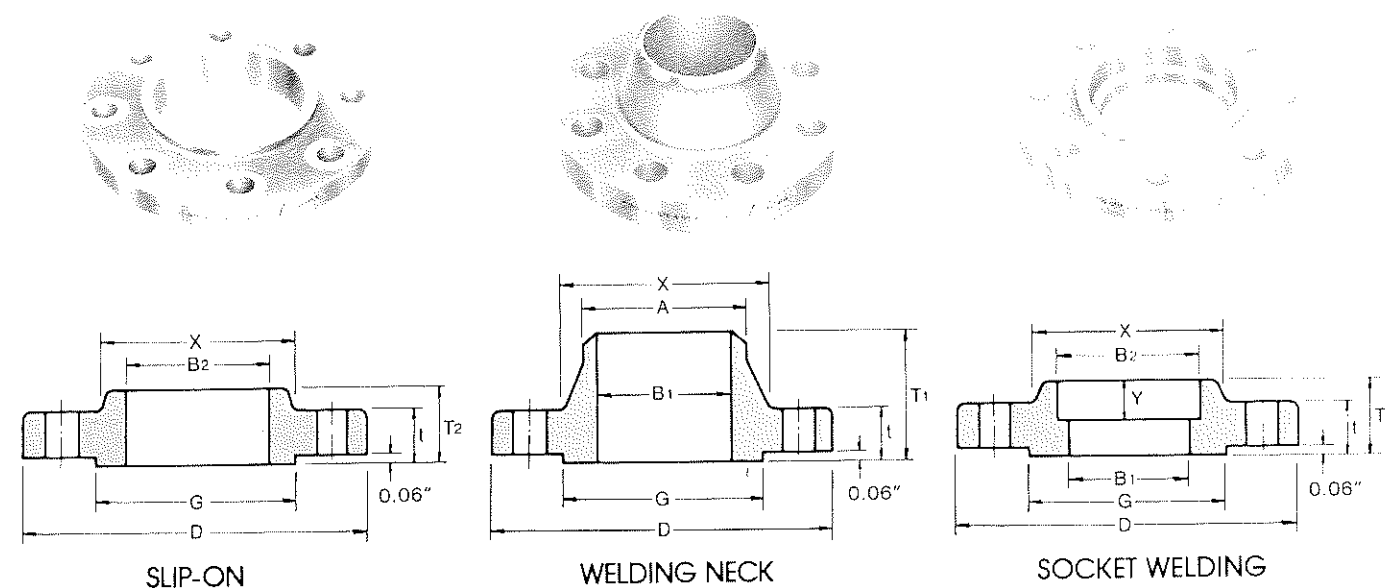
This specification covers grades of stainless steel tubing in sizes under ½ in. down to 0.050 in. (12.700 to 1.270 mm) in outside diameter and wall thicknesses less than 0.065 in. down to 0.005 in. (1.600 to 0.127 mm) for general corrosion-resisting and low- or high-temperature service.



法兰盆 FLANGES



CLASS 150 FLANGES



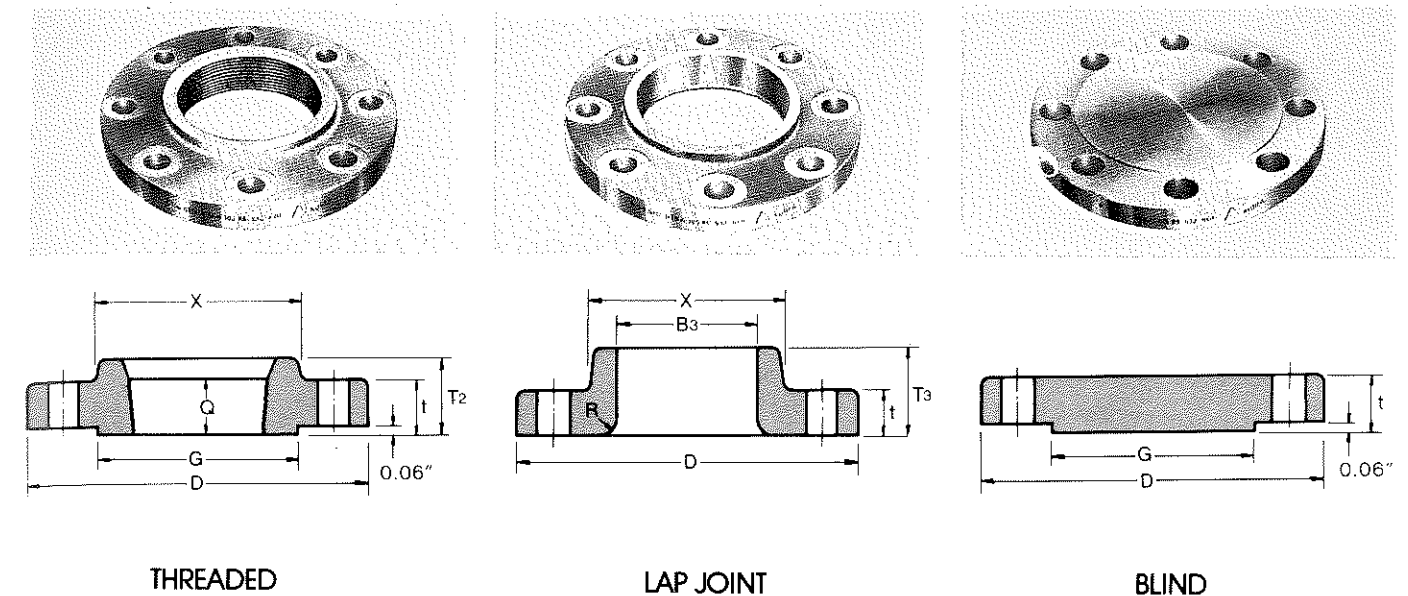
ANSI B16.5 FORGED FLANGES

Dimensions in inches

Nominal Pipe Size	Outside Diam.	Thick-ness	O.D. of Raised Face	Diam. at Base of Hub	BORE			LENGTH THRU HUB			Diam. of Hub at Bevel	Radius of Fillet	Thread Length
					Welding Neck Socket Welding	Slip-on Socket Welding	Lap Joint	Welding Neck	Slip-on Threaded Socket Welding	Lap Joint			
	D	t	G	X	B ₁	B ₂	B ₃	T ₁	T ₂	T ₃	A	R	Q
1/2	3.50	0.44	1.38	1.19	0.62	0.88	0.90	1.88	0.62	0.62	0.84	0.12	0.62
3/4	3.88	0.50	1.69	1.50	0.82	1.09	1.11	2.06	0.62	0.62	1.05	0.12	0.62
1	4.25	0.56	2.00	1.94	1.05	1.36	1.38	2.19	0.69	0.69	1.32	0.12	0.69
1 1/4	4.62	0.62	2.50	2.31	1.38	1.70	1.72	2.25	0.81	0.81	1.66	0.19	0.81
1 1/2	5.00	0.69	2.88	2.56	1.61	1.95	1.97	2.44	0.88	0.88	1.90	0.25	0.88
2	6.00	0.75	3.62	3.06	2.07	2.44	2.46	2.50	1.00	1.00	2.38	0.31	1.00
2 1/2	7.00	0.88	4.12	3.56	2.47	2.94	2.97	2.75	1.12	1.12	2.88	0.31	1.12
3	7.50	0.94	5.00	4.25	3.07	3.57	3.60	2.75	1.19	1.19	3.50	0.38	1.19
3 1/2	8.50	0.94	5.50	4.81	3.55	4.07	4.10	2.81	1.25	1.25	4.00	0.38	1.25
4	9.00	0.94	6.19	5.31	4.03	4.57	4.60	3.00	1.31	1.31	4.50	0.44	1.31
5	10.00	0.94	7.31	6.44	5.05	5.66	5.69	3.50	1.44	1.44	5.56	0.44	1.44
6	11.00	1.00	8.50	7.56	6.07	6.72	6.75	3.50	1.56	1.56	6.63	0.50	1.56
8	13.50	1.12	10.62	9.69	7.98	8.72	8.75	4.00	1.75	1.75	8.63	0.50	1.75
10	16.00	1.19	12.75	12.00	10.02	10.88	10.92	4.00	1.94	1.94	10.75	0.50	1.94
12	19.00	1.25	15.00	14.38	12.00	12.88	12.92	4.50	2.19	2.19	12.75	0.50	2.19
14	21.00	1.38	16.25	15.75	13.25	14.14	14.18	5.00	2.25	3.12	14.00	0.50	2.25
16	23.50	1.44	18.50	18.00	15.25	16.16	16.19	5.00	2.50	3.44	16.00	0.50	2.50
18	25.00	1.56	21.00	19.88	17.25	18.18	18.20	5.50	2.69	3.81	18.00	0.50	2.69
20	27.50	1.69	23.00	22.00	19.25	20.20	20.25	5.69	2.88	4.06	20.00	0.50	2.88
24	32.00	1.88	27.25	26.12	23.25	24.25	24.25	6.00	3.25	4.38	24.00	0.50	3.25

Notes:

Class 150 flanges except Lap Joint will be furnished with 0.06" raised face, which is included in 'Thickness' (t) and 'Length through Hub' (T₁), (T₂). For Slip-on, Threaded, Socket Welding and Lap Joint Flanges, the hubs can be shaped either vertical from base to top or tapered within the limits of 7 degrees.

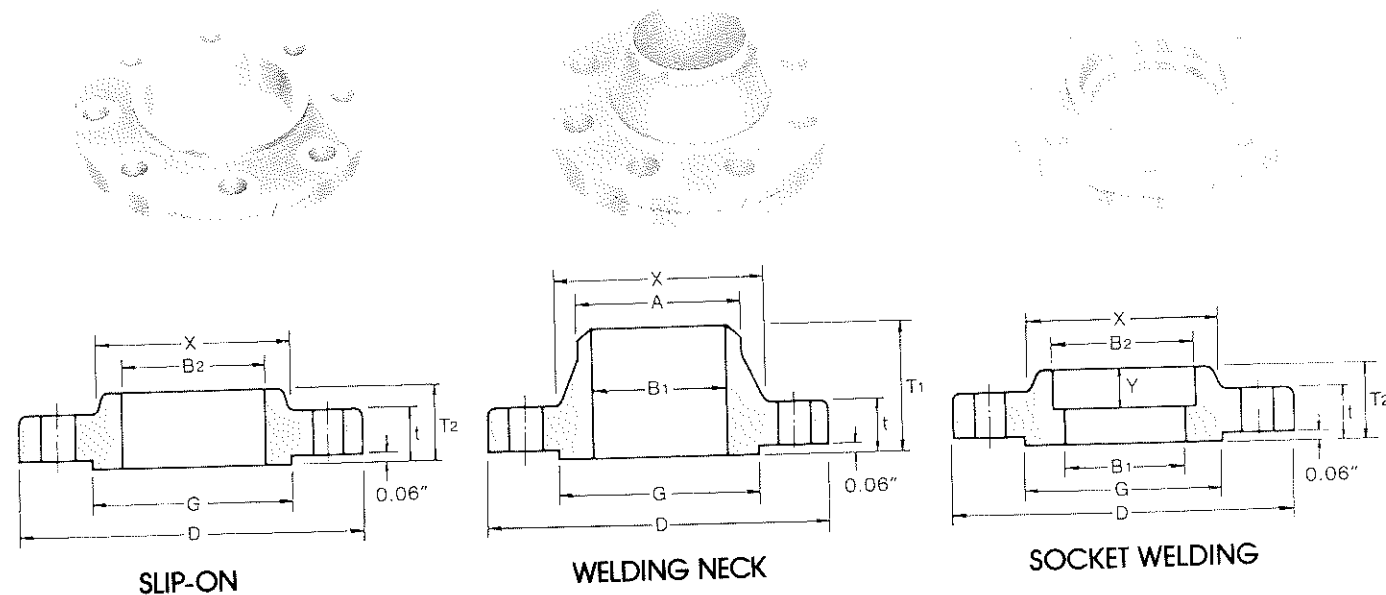


Dimensions in inches

Depth of Socket	DRILLING			BOLTING			APPROXIMATE WEIGHT												Nominal Pipe Size
	Bolt Circle Diam.	Number of Holes	Diam. of Holes	Diam. of Bolts	Machine Bolt Length	Stud Bolt Length		Welding Neck		Slip-on and Threaded		Lap Joint		Blind		Socket Welding			
						Raised Face	Raised Face	Ring Joint	Kg	lb.	Kg	lb.	Kg	lb.	Kg	lb.	Kg	lb.	
Y																			
0.38	2.38	4	0.62	½	2.00	2.25	—	0.51	1.10	0.47	1.00	0.51	1.00	0.47	1.00	0.47	1.00	½	
0.44	2.75	4	0.62	½	2.00	2.50	—	0.73	1.60	0.58	1.30	0.64	1.40	0.63	1.40	0.59	1.30	¾	
0.50	3.12	4	0.62	½	2.25	2.50	3.00	1.07	2.40	0.86	1.90	0.93	1.80	0.94	2.10	0.87	1.90	1	
0.56	3.50	4	0.62	½	2.25	2.75	3.25	1.40	3.10	1.08	2.40	1.16	2.00	1.23	2.70	1.11	2.40	1¼	
0.62	3.88	4	0.62	½	2.50	2.75	3.25	1.81	4.00	1.41	3.10	1.51	3.30	1.62	3.60	1.45	3.20	1½	
0.69	4.75	4	0.75	¾	2.75	3.25	3.75	2.59	5.70	2.26	5.00	2.38	5.20	2.64	5.80	2.33	5.00	2	
0.75	5.50	4	0.75	¾	3.00	3.50	4.00	4.28	9.40	3.43	7.60	3.60	7.90	4.06	9.00	3.55	7.80	2½	
0.81	6.00	4	0.75	¾	3.00	3.50	4.00	5.18	11.40	3.87	8.50	4.04	8.90	4.90	10.80	4.02	8.90	3	
0.88	7.00	8	0.75	¾	3.00	3.50	4.00	5.45	12.00	4.99	11.00	4.99	11.00	5.90	13.00	4.99	11.00	3½	
0.94	7.50	8	0.75	¾	3.00	3.50	4.00	7.32	16.10	5.75	12.70	5.96	13.00	7.41	16.30	5.99	13.20	4	
0.94	8.50	8	0.88	¾	3.25	3.75	4.25	8.91	19.60	6.22	13.70	6.44	14.00	8.76	19.30	6.68	14.70	5	
1.06	9.50	8	0.88	¾	3.25	4.00	4.50	11.26	24.80	7.38	16.30	7.59	16.70	11.31	24.90	7.99	17.60	6	
1.25	11.75	8	0.88	¾	3.50	4.25	4.75	17.68	39.00	12.36	27.30	12.66	27.90	19.92	43.90	13.29	29.30	8	
1.31	14.25	12	1.00	1	4.00	4.50	5.00	24.79	54.70	17.10	37.70	16.78	37.00	29.39	64.80	19.50	43.00	10	
1.56	17.00	12	1.00	1	4.00	4.75	5.25	38.98	85.90	27.68	61.00	28.30	62.40	43.70	96.30	29.03	64.00	12	
1.63	18.75	12	1.12	1	4.50	5.25	5.75	51.71	114.00	35.20	77.60	41.50	91.50	59.42	140.00	38.56	85.00	14	
1.75	21.25	16	1.12	1	4.50	5.25	5.75	64.41	142.00	42.18	93.00	52.98	116.80	77.11	170.00	44.49	98.00	16	
1.94	22.75	16	1.25	1½	5.00	5.75	6.25	74.84	165.00	49.71	109.60	59.00	130.00	94.80	209.00	54.43	120.00	18	
2.13	25.00	20	1.25	1½	5.50	6.25	6.75	89.36	197.00	65.50	140.00	72.12	159.00	123.38	272.00	70.31	155.00	20	
2.50	29.50	20	1.38	1½	6.00	6.75	7.25	119.66	263.80	90.50	199.50	99.02	218.30	188.24	415.00	95.25	210.00	24	

Blind Flanges may be made with the same hub as that used for Slip-on Flanges or without hub. The gasket surface and backside (bearing surface for bolting) are made parallel within 1 degree. To accomplish parallelism, spot facing is carried out according to MSS SP-9, without reducing thickness (t). Depth of Socket (Y) is covered by ANSI B16.5 only in sizes through 3 inch, over 3 inch is at the manufacturer's option.

CLASS 300 FLANGES



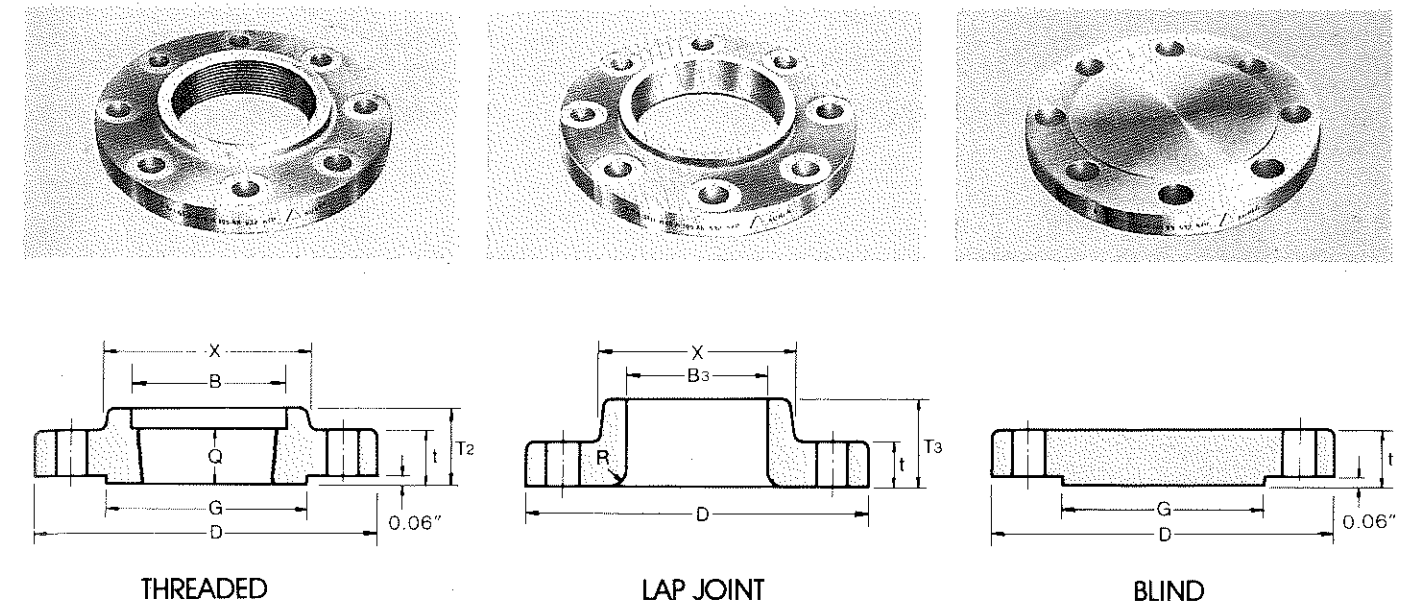
ANSI B16.5 FORGED FLANGES

Dimensions in inches

Nominal Pipe Size	Outside Diam.	Thick-ness	O.D. of Raised Face	Diam. at Base of Hub	BORE				LENGTH THRU HUB			Diam. of Hub at Bevel	Radius of Fillet	Thread Length
					Welding Neck Socket Welding	Slip-on Socket Welding	Lap Joint	Counter Bore Min. Threaded Min.	Welding Neck	Slip-on Threaded Socket Welding	Lap Joint			
	D	t	G	X	B ₁	B ₂	B ₃	B	T ₁	T ₂	T ₃	A	R	Q
1/2	3.75	0.56	1.38	1.50	0.62	0.88	0.90	0.93	2.06	0.88	0.88	0.84	0.12	0.62
3/4	4.62	0.62	1.69	1.88	0.82	1.09	1.11	1.14	2.25	1.00	1.00	1.05	0.12	0.62
1	4.88	0.69	2.00	2.12	1.05	1.36	1.38	1.41	2.44	1.06	1.06	1.32	0.12	0.69
1 1/4	5.25	0.75	2.50	2.50	1.38	1.70	1.72	1.75	2.56	1.06	1.06	1.66	0.19	0.81
1 1/2	6.12	0.81	2.88	2.75	1.61	1.95	1.97	1.99	2.69	1.19	1.19	1.90	0.25	0.88
2	6.50	0.88	3.62	3.31	2.07	2.44	2.46	2.50	2.75	1.31	1.31	2.38	0.31	1.12
2 1/2	7.50	1.00	4.12	3.94	2.47	2.94	2.97	3.00	3.00	1.50	1.50	2.88	0.31	1.25
3	8.25	1.12	5.00	4.62	3.07	3.57	3.60	3.63	3.12	1.69	1.69	3.50	0.38	1.25
3 1/2	9.00	1.19	5.50	5.25	3.55	4.07	4.10	4.13	3.19	1.75	1.75	4.00	0.38	1.44
4	10.00	1.25	6.19	5.75	4.03	4.57	4.60	4.63	3.38	1.88	1.88	4.50	0.44	1.44
5	11.00	1.38	7.31	7.00	5.05	5.66	5.69	5.69	3.88	2.00	2.00	5.56	0.44	1.69
6	12.50	1.44	8.50	8.12	6.07	6.72	6.75	6.75	3.88	2.06	2.06	6.63	0.50	1.81
8	15.00	1.62	10.62	10.25	7.98	8.72	8.75	8.75	4.38	2.44	2.44	8.63	0.50	2.00
10	17.50	1.88	12.75	12.62	10.02	10.88	10.92	10.88	4.62	2.62	3.75	10.75	0.50	2.19
12	20.50	2.00	15.00	14.75	12.00	12.88	12.92	12.94	5.12	2.88	4.00	12.75	0.50	2.38
14	23.00	2.12	16.25	16.75	13.25	14.14	14.18	14.19	5.62	3.00	4.38	14.00	0.50	2.50
16	25.50	2.25	18.50	19.00	15.25	16.16	16.19	16.19	5.75	3.25	4.75	16.00	0.50	2.69
18	28.00	2.38	21.00	21.00	17.25	18.18	18.20	18.19	6.25	3.50	5.12	18.00	0.50	2.75
20	30.50	2.50	23.00	23.12	19.25	20.20	20.25	20.19	6.38	3.75	5.50	20.00	0.50	2.88
24	36.00	2.75	27.25	27.62	23.25	24.25	24.25	24.19	6.62	4.19	6.00	24.00	0.50	3.25

Notes:

Class 300 flanges except Lap Joint will be furnished with 0.06" raised face, which is included in 'Thickness' (t) and 'Length through Hub' (T₁), (T₂).
For Slip-on, Threaded, Socket Welding and Lap Joint Flanges, the hubs can be shaped either vertical from base to or tapered within the limits of 7 degrees.

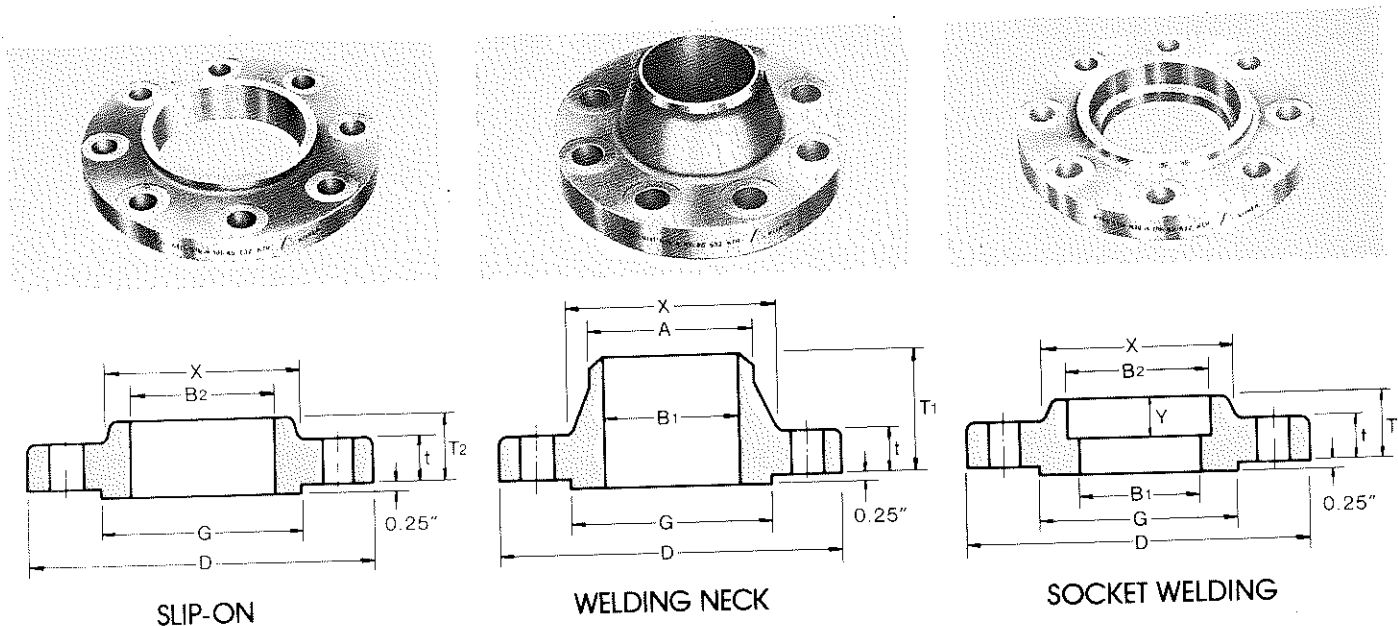


Dimensions in inches

Depth of Socket	DRILLING			BOLTING			APPROXIMATE WEIGHT											Nominal Pipe Size	
	Bolt Circle Diam.	Number of Holes	Diam. of Holes	Diam. of Bolts	Machine Bolt Length	Stud Bolt Length		Welding Neck		Slip-on and Threaded		Lap Joint		Blind		Socket Welding			
Y					Raised Face	Raised Face	Ring Joint	Kg	lb.	Kg	lb.	Kg	lb.	Kg	lb.	Kg	lb.		
0.38	2.62	4	0.62	½	2.25	2.50	3.00	0.78	1.70	0.62	1.40	0.61	1.30	0.62	1.40	0.62	1.40	1	
0.44	3.25	4	0.75	¾	2.50	3.00	3.50	1.34	3.00	1.15	2.50	1.15	2.50	1.16	2.50	1.19	2.60		
0.50	3.50	4	0.75	¾	2.50	3.00	3.50	1.64	3.60	1.39	3.10	1.38	3.00	1.42	3.00	1.44	3.20		
0.56	3.88	4	0.75	¾	2.75	3.25	3.75	2.06	4.50	1.67	3.70	1.66	3.70	1.79	3.90	1.73	3.80	1 ¼	
0.62	4.50	4	0.88	¾	3.00	3.50	4.00	3.06	6.70	2.53	5.60	2.52	5.60	2.68	5.90	2.62	5.80		1 ½
0.69	5.00	8	0.75	¾	3.00	3.50	4.00	3.40	7.50	2.80	6.20	2.79	6.20	3.09	6.80	2.94	6.50		
0.75	5.88	8	0.88	¾	3.25	4.00	4.50	5.31	11.70	4.25	9.40	4.22	9.30	4.75	10.50	4.49	9.90	2 ½	
0.81	6.62	8	0.88	¾	3.50	4.25	4.75	7.32	16.10	5.81	12.80	5.78	12.70	6.79	14.90	6.20	13.70		3
0.88	7.25	8	0.88	¾	3.75	4.25	5.00	8.17	18.00	7.72	17.00	7.72	17.00	9.53	21.00				
0.94	7.88	8	0.88	¾	3.75	4.50	5.00	11.30	24.90	10.13	22.30	10.07	22.20	12.00	26.50			4	
0.94	9.25	8	0.88	¾	4.25	4.75	5.25	15.12	33.30	12.58	27.70	12.52	27.60	15.96	35.20				5
1.06	10.62	12	0.88	¾	4.25	4.75	5.50	19.68	43.40	16.04	35.40	15.95	35.20	21.20	46.70				
1.25	13.00	12	1.00	¾	4.75	5.50	6.00	30.48	67.20	24.50	54.00	24.37	53.70	34.60	76.30			8	
1.31	15.25	16	1.12	1	5.50	6.25	6.75	43.74	96.40	34.16	75.30	39.92	88.00	55.34	122.00				10
1.56	17.75	16	1.25	1 ½	5.75	6.75	7.25	64.41	142.00	51.26	113.00	58.70	129.40	78.90	174.00				
1.63	20.25	20	1.25	1 ½	6.25	7.00	7.50	88.30	194.70	72.12	159.00	83.46	184.00	107.05	236.00			14	
1.75	22.50	20	1.38	1 ¼	6.50	7.50	8.00	112.94	249.00	90.40	199.30	106.14	234.00	139.25	307.00				16
1.94	24.75	24	1.38	1 ¼	6.75	7.75	8.25	138.34	305.00	109.00	240.30	133.95	295.30	176.90	396.00				
2.13	27.00	24	1.38	1 ¼	7.25	8.00	8.75	167.37	369.00	136.00	300.00	157.65	347.60	223.17	492.00			20	
2.50	32.00	24	1.62	1 ½	8.00	9.00	10.00	235.41	519.00	204.00	449.70	240.40	530.00	342.00	754.00				

Blind Flanges may be made with the same hub as that used for Slip-on Flanges or without hub.
The gasket surface and backside (bearing surface for bolting) are made parallel within 1 degree. To accomplish parallelism, spot facing is carried out according to MSS SP-9, without reducing thickness (t).
Depth of Socket (Y) is covered by ANSI B16.5 only is sizes through 3 inch, over 3 inch is at the manufacturer's option.

CLASS 600 FLANGES



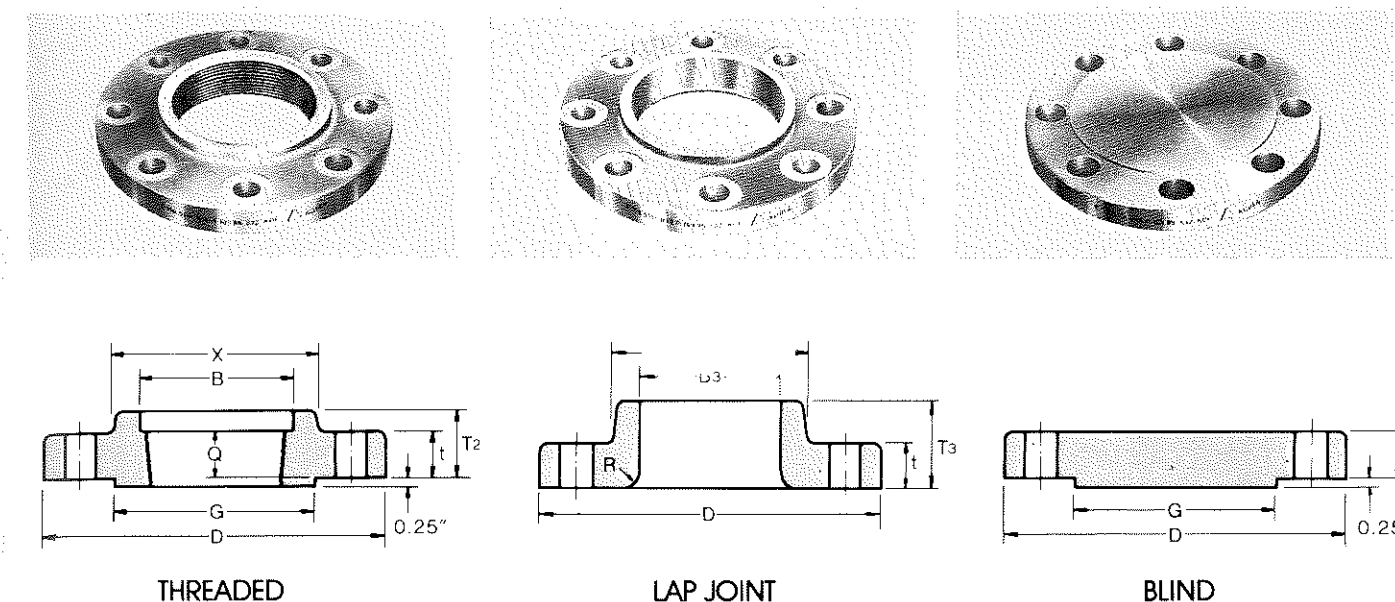
ANSI B16.5 FORGED FLANGES

Dimensions in inches

Nominal Pipe Size	Outside Diam.	Thick-ness	O.D. of Raised Face	Diam. at Base of Hub	BORE				LENGTH THRU HUB			Diam. of Hub at Bevel	Radius of Fillet	Thread Length
					Welding Neck Socket Welding	Slip-on Socket Welding	Lap Joint	Counter Bore Min.	Welding Neck	Slip-on Threaded Socket Welding	Lap Joint			
					B ₁	B ₂	B ₃	B	T ₁	T ₂	T ₃			
1/2	3.75	0.56	1.38	1.50	0.88	0.90	0.93	2.06	0.88	0.88	0.84	0.12	0.62	0.62
3/4	4.62	0.62	1.69	1.88	1.09	1.11	1.14	2.25	1.00	1.00	1.05	0.12	0.62	0.62
1	4.88	0.69	2.00	2.12	1.36	1.38	1.41	2.44	1.06	1.06	1.32	0.12	0.62	0.69
1 1/4	5.25	0.81	2.50	2.50	1.70	1.72	1.75	2.62	1.12	1.12	1.66	0.19	0.81	0.81
1 1/2	6.12	0.88	2.88	2.75	1.95	1.97	1.99	2.75	1.25	1.25	1.90	0.25	0.88	0.88
2	6.50	1.00	3.62	3.31	2.44	2.46	2.50	2.88	1.44	1.44	2.38	0.31	1.12	1.12
2 1/2	7.50	1.12	4.12	3.94	2.94	2.97	3.00	3.12	1.62	1.62	2.88	0.31	1.25	1.25
3	8.25	1.25	5.00	4.62	3.57	3.60	3.63	3.25	1.81	1.81	3.50	0.38	1.38	1.38
3 1/2	9.00	1.38	5.50	5.25	4.07	4.10	4.13	3.38	1.94	1.94	4.00	0.38	1.56	1.56
4	10.75	1.50	6.19	6.00	4.57	4.60	4.63	4.00	2.12	2.12	4.50	0.44	1.62	1.62
5	13.00	1.75	7.31	7.44	5.69	5.69	5.69	4.50	2.38	2.38	5.56	0.44	1.88	1.88
6	14.00	1.88	8.50	8.75	6.72	6.75	6.75	4.62	2.62	2.62	6.63	0.50	2.00	2.00
8	16.50	2.19	10.62	10.75	8.72	8.75	8.75	5.25	3.00	3.00	8.63	0.50	2.25	2.25
10	20.00	2.50	12.75	13.50	10.88	10.92	10.88	6.00	3.38	4.38	10.75	0.50	2.56	2.56
12	22.00	2.62	15.00	15.75	12.88	12.92	12.94	6.12	3.62	4.62	12.75	0.50	2.75	2.75
14	23.75	2.75	16.25	17.00	14.14	14.18	14.19	6.50	3.69	5.00	14.00	0.50	2.88	2.88
16	27.00	3.00	18.50	19.50	16.16	16.19	16.19	7.00	4.19	5.50	16.00	0.50	3.06	3.06
18	29.25	3.25	21.00	21.50	18.18	18.20	18.19	7.25	4.62	6.00	18.00	0.50	3.12	3.12
20	32.00	3.50	23.00	24.00	20.20	20.25	20.19	7.50	5.00	6.50	20.00	0.50	3.25	3.25
24	37.00	4.00	27.25	28.25	24.25	24.25	24.19	8.00	5.50	7.25	24.00	0.50	3.62	3.62

Notes:

Class 600 flanges except Lap Joint will be furnished with 0.25" raised face, which is not included in 'Thickness' (t) and 'Length through Hub' (T₁, T₂).
For Slip-on, Threaded, Lap Joint and Socket Welding Flanges, the hubs can be shaped either vertical from base to top or tapered within the limits of 7 degrees.

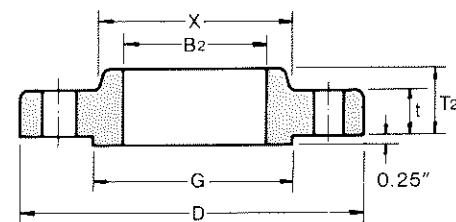
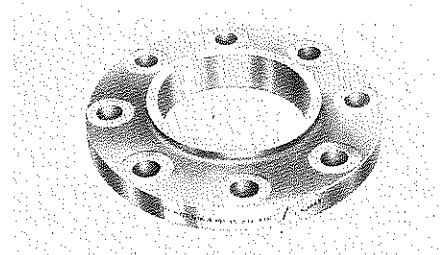


Dimensions in inches

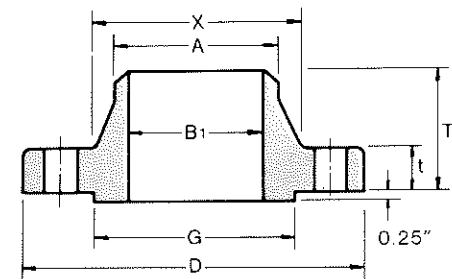
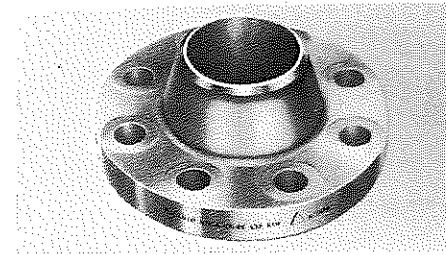
Depth of Socket	DRILLING			BOLTING			APPROXIMATE WEIGHT										Nominal Pipe Size	
				Diam. of Bolts	Stud Bolt Length		Welding Neck		Slip-on and Threaded		Lap Joint		Blind		Socket Welding			
	0.25" Raised Face	Male-Female Tongue-Groove	Ring Joint		Kg	lb.												Kg
γ	Bolt Circle Diam.	Number of Holes	Diam. of Holes															
0.38	2.62	4	0.62	½	3.00	2.75	3.00	0.90	2.00	0.91	2.00	0.80	1.80	0.91	2.00	0.91	2.00	½
0.44	3.25	4	0.75	¾	3.50	3.25	3.50	1.59	3.50	1.40	3.00	1.36	3.00	1.40	3.00	1.36	3.00	¾
0.50	3.50	4	0.75	¾	3.50	3.25	3.50	1.90	4.00	1.70	3.70	1.59	3.50	1.81	4.00	1.81	4.00	1
0.56	3.88	4	0.75	¾	3.75	3.50	3.75	2.49	5.50	2.27	5.00	2.04	4.50	2.40	5.30	2.60	5.70	1 ¼
0.62	4.50	4	0.88	¾	4.25	4.00	4.25	3.63	8.00	3.10	6.80	2.95	6.50	3.40	7.50	3.18	7.00	1 ½
0.69	5.00	8	0.75	¾	4.25	4.00	4.25	4.54	10.00	3.63	8.00	3.63	8.00	4.40	9.70	3.90	8.60	2
0.75	5.88	8	0.88	¾	4.75	4.50	4.75	6.35	14.00	5.44	12.00	4.99	11.00	6.80	15.00	5.90	13.00	2 ½
0.81	6.62	8	0.88	¾	5.00	4.75	5.00	8.16	18.00	7.26	16.00	6.35	14.00	8.90	19.60	7.40	16.30	3
0.88	7.25	8	1.00	¾	5.50	5.25	5.50	11.80	26.00	9.53	21.00	9.08	20.00	13.17	29.00			3 ½
0.94	8.50	8	1.00	¾	5.75	5.50	5.75	16.78	37.00	14.97	33.00	14.06	31.00	18.60	41.00			4
0.94	10.50	8	1.12	1	6.50	6.25	6.50	30.87	68.00	28.50	62.80	27.50	60.60	30.84	68.00			5
1.06	11.50	12	1.12	1	6.75	6.50	6.75	36.77	80.00	36.32	80.00	35.38	78.00	38.00	83.80			6
1.25	13.75	12	1.25	1 ¼	7.50	7.25	7.75	50.80	112.00	44.00	97.00	50.80	112.00	62.20	137.00			8
1.31	17.00	16	1.38	1 ¼	8.50	8.25	8.50	86.26	190.00	76.20	168.00	74.00	163.00	102.00	224.90			10
1.56	19.25	20	1.38	1 ¼	8.75	8.50	8.75	102.51	226.00	97.52	215.00	108.86	240.00	132.00	291.00			12
1.63	20.75	20	1.50	1 ½	9.25	9.00	9.25	121.56	268.00	102.00	224.80	111.00	244.70	158.00	348.30			14
1.75	23.75	20	1.62	1 ½	10.00	9.75	10.00	177.06	290.00	149.82	330.20	165.71	365.30	224.73	495.40			16
1.94	25.75	20	1.75	1 ½	10.75	10.50	10.75	215.65	475.40	180.10	412.30	194.00	427.70	285.00	628.30			18
2.13	28.50	24	1.75	1 ½	11.25	11.00	11.50	267.86	590.50	231.54	510.50	258.78	570.50	365.00	804.70			20
2.50	33.00	24	2.00	1 ½	13.00	12.75	13.25	372.00	820.00	330.00	725.50	362.00	798.00	533.45	1176.0			24

Blind Flanges may be made with the same hub as that used for Slip-on Flanges or without hub.
The gasket surface and backside (bearing surface for bolting) are made parallel within 1 degree. To accomplish parallelism, spot facing is carried out according to MSS SP-9, without reducing thickness (t).
Dimensions of sizes 1/2 through 3 1/2 are the same as for Class 400 Flanges.
Depth of Socket (Y) is covered by ANSI B16.5 only in sizes through 3 inch, over 3 inch is at the manufacturer's option.

CLASS 900 FLANGES



SLIP-ON



WELDING NECK

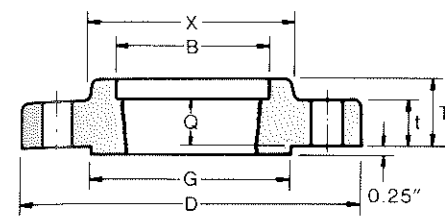
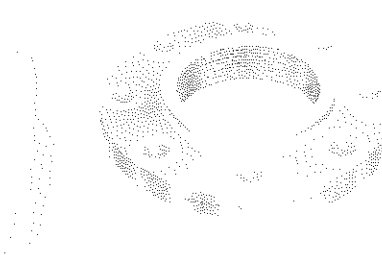
ANSI B16.5 FORGED FLANGES

Dimensions in inches

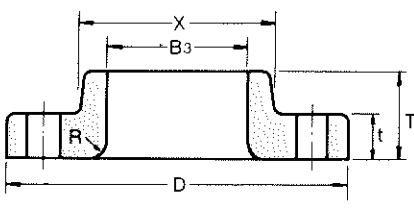
Nominal Pipe Size	Outside Diam.	Thick- ness	O.D. of Raised Face	Diam. at Base of Hub	BORE				LENGTH THRU HUB			Diam. of Hub at Bevel
					Welding Neck	Slip-on	Lap Joint	Counter Bore Min.	Welding Neck	Slip-on and Threaded	Lap Joint	
	D	t	G	X	B ₁	B ₂	B ₃	B	T ₁	T ₂	T ₃	A
$\frac{1}{2}$ $\frac{3}{4}$ 1	4.75	0.88	1.38	1.50	See Note (1) To be specified by purchaser.	0.88	0.90	0.93	2.38	1.25	1.25	0.84
	5.12	1.00	1.69	1.75		1.09	1.11	1.14	2.75	1.38	1.38	1.05
	5.88	1.12	2.00	2.06		1.36	1.38	1.41	2.88	1.62	1.62	1.32
	1 $\frac{1}{4}$ 1 $\frac{1}{2}$ 2	6.25	1.12	2.50		2.50	1.70	1.72	1.75	2.88	1.62	1.62
7.00		1.25	2.88	2.75		1.95	1.97	1.99	3.25	1.75	1.75	1.90
8.50		1.50	3.62	4.12		2.44	2.46	2.50	4.00	2.25	2.25	2.38
2 $\frac{1}{2}$	9.62	1.62	4.12	4.88		2.94	2.97	3.00	4.12	2.50	2.50	2.88
3 4 5	9.50	1.50	5.00	5.00		3.57	3.60	3.63	4.00	2.12	2.12	3.50
	11.50	1.75	6.19	6.25		4.57	4.60	4.63	4.50	2.75	2.75	4.50
	13.75	2.00	7.31	7.50		5.66	5.69	5.69	5.00	3.12	3.12	5.56
6 8 10	15.00	2.19	8.50	9.25		6.72	6.75	6.75	5.50	3.38	3.38	6.63
	18.50	2.50	10.62	11.75		8.72	8.75	8.75	6.38	4.00	4.50	8.63
	21.50	2.75	12.75	14.50		10.88	10.92	10.88	7.25	4.25	5.00	10.75
12 14 16	24.00	3.12	15.00	16.50		12.88	12.92	12.94	7.88	4.62	5.62	12.75
	25.25	3.38	16.25	17.75		14.14	14.18	14.19	8.38	5.12	6.12	14.00
	27.75	3.50	18.50	20.00		16.16	16.19	16.19	8.50	5.25	6.50	16.00
18 20 24	31.00	4.00	21.00	22.25		18.18	18.20	18.19	9.00	6.00	7.50	18.00
	33.75	4.25	23.00	24.50		20.20	20.25	20.19	9.75	6.25	8.25	20.00
	41.00	5.50	27.25	29.50		24.25	24.25	24.19	11.50	8.00	10.50	24.00

Notes:

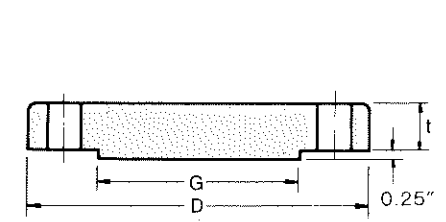
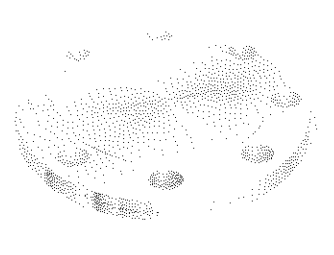
Class 900 flanges except Lap Joint will be furnished with 0.25" raised face, which is not included in 'Thickness' (t) and 'Length through Hub' (T₁), (T₂).
For Slip-on, Threaded and Lap Joint Flanges, the hubs can be shaped either vertical from base to top or tapered within the limits of 7 degrees.



THREADED



LAP JOINT



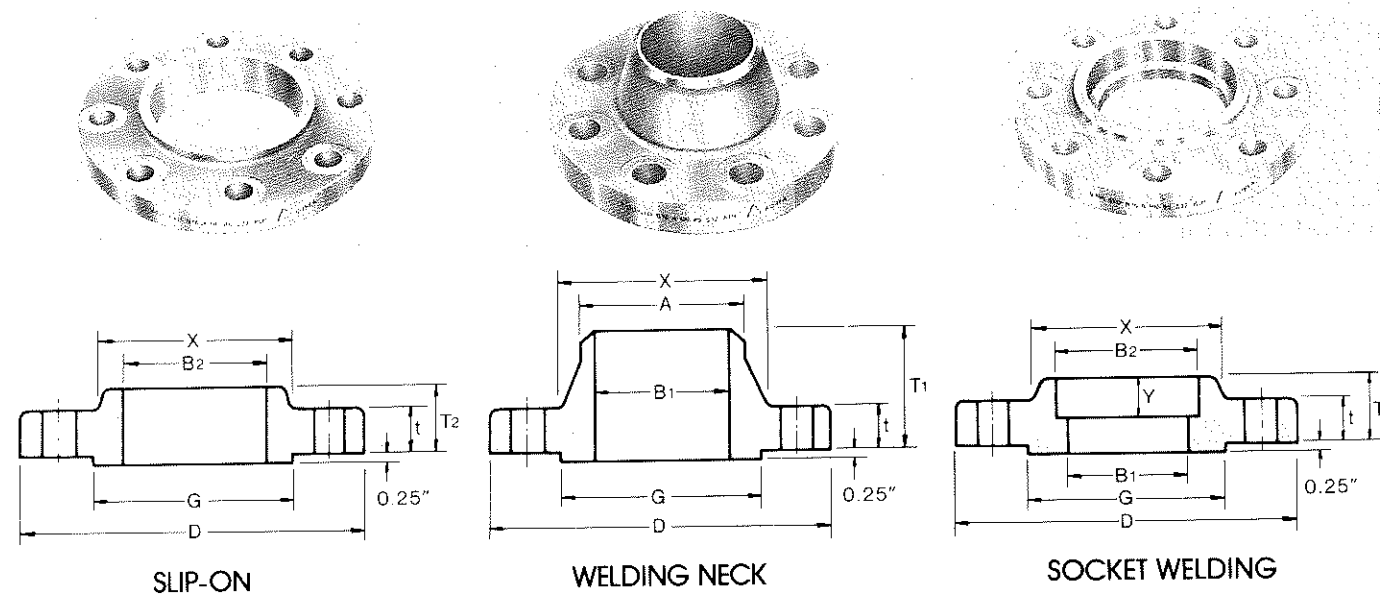
BLIND

Dimensions in inches

Radius of Fillet	Thread Length	DRILLING			BOLTING				APPROXIMATE WEIGHT								Nominal Pipe Size
					Diam. of Bolts	Stud Bolt Length											
		Bolt Circle Diam.	Number of Holes	Diam. of Holes		0.25" Raised Face	Male-Female Tongue-Groove	Ring Joint	Welding Neck		Slip-on and Threaded		Lap Joint		Blind		
R	Q								Kg	lb.	Kg	lb.	Kg	lb.	Kg	lb.	
0.12	0.88	3.25	4	0.88	$\frac{3}{4}$	4.25	4.00	4.25	2.10	4.60	1.81	4.00	1.81	4.00	1.90	4.20	$\frac{1}{2}$
0.12	1.00	3.50	4	0.88	$\frac{3}{4}$	4.50	4.25	4.50	2.72	6.00	2.40	5.30	2.30	5.00	2.70	6.00	$\frac{3}{4}$
0.12	1.12	4.00	4	1.00	$\frac{7}{8}$	5.00	4.75	5.00	3.86	8.50	3.41	7.50	3.40	7.50	4.09	9.00	1
0.19	1.19	4.38	4	1.00	$\frac{7}{8}$	5.00	4.75	5.00	4.54	10.00	4.10	9.00	4.09	9.00	4.54	10.00	1 $\frac{1}{4}$
0.25	1.25	4.88	4	1.12	1	5.50	5.25	5.50	5.90	13.00	5.45	12.00	5.40	11.90	5.90	13.00	1 $\frac{1}{2}$
0.31	1.50	6.50	8	1.00	$\frac{7}{8}$	5.75	5.50	5.75	10.89	24.00	9.98	22.00	9.53	21.00	11.34	25.00	2
0.31	1.88	7.50	8	1.12	1	6.25	6.00	6.25	16.33	36.00	15.80	34.80	13.15	29.00	16.00	35.30	2 $\frac{1}{2}$
0.38	1.62	7.50	8	1.00	$\frac{7}{8}$	5.75	5.50	5.75	15.00	33.00	11.80	26.00	11.34	25.00	13.17	29.00	3
0.44	1.88	9.25	8	1.25	1 $\frac{1}{8}$	6.75	6.50	6.75	23.13	51.00	23.20	51.00	22.60	48.50	24.50	54.00	4
0.44	2.12	11.00	8	1.38	1 $\frac{1}{4}$	7.50	7.25	7.50	38.50	84.90	37.65	83.00	36.74	81.00	39.46	87.00	5
0.50	2.25	12.50	12	1.25	1 $\frac{1}{8}$	7.50	7.25	7.75	49.89	110.00	48.30	106.50	47.50	104.70	51.50	113.50	6
0.50	2.50	15.50	12	1.50	1 $\frac{3}{8}$	8.75	8.50	8.75	79.45	175.00	75.00	166.30	86.00	189.60	89.00	196.20	8
0.50	2.81	18.50	16	1.50	1 $\frac{3}{8}$	9.25	9.00	9.25	118.04	260.00	111.13	245.00	125.64	277.00	131.54	290.00	10
0.50	3.00	21.00	20	1.50	1 $\frac{3}{8}$	10.00	9.75	10.00	157.00	346.00	146.00	321.80	167.00	368.00	187.00	412.30	12
0.50	3.25	22.00	20	1.62	1 $\frac{1}{2}$	10.75	10.50	11.50	181.60	400.40	172.36	380.00	180.07	397.00	224.07	494.00	14
0.50	3.38	24.25	20	1.75	1 $\frac{5}{8}$	11.25	11.00	11.75	224.73	495.50	192.95	425.40	211.11	465.40	272.40	600.50	16
0.50	3.50	27.00	20	2.00	1 $\frac{7}{8}$	12.75	12.50	13.25	308.72	680.60	272.40	600.50	295.10	650.60	385.90	850.80	18
0.50	3.62	29.50	20	2.12	2	13.75	13.50	14.25	376.82	830.70	331.42	730.60	367.74	810.70	488.00	1076.0	20
0.50	4.00	35.50	20	2.62	2 $\frac{1}{2}$	17.25	17.00	18.00	685.00	1510.0	632.00	1393.3	700.00	1543.0	905.00	1995.0	24

Blind Flanges may be made with the same hub as that used for Slip-on Flanges or without hub.
The gasket surface and backside (bearing surface for bolting) are made parallel within 1 degree. To accomplish parallelism, spot facing is carried out according to MSS SP-9, without reducing thickness (t).
Dimensions of sizes 1/2" through 2 1/2" are the same as for Class 1500 Flanges.

CLASS 1500 FLANGES



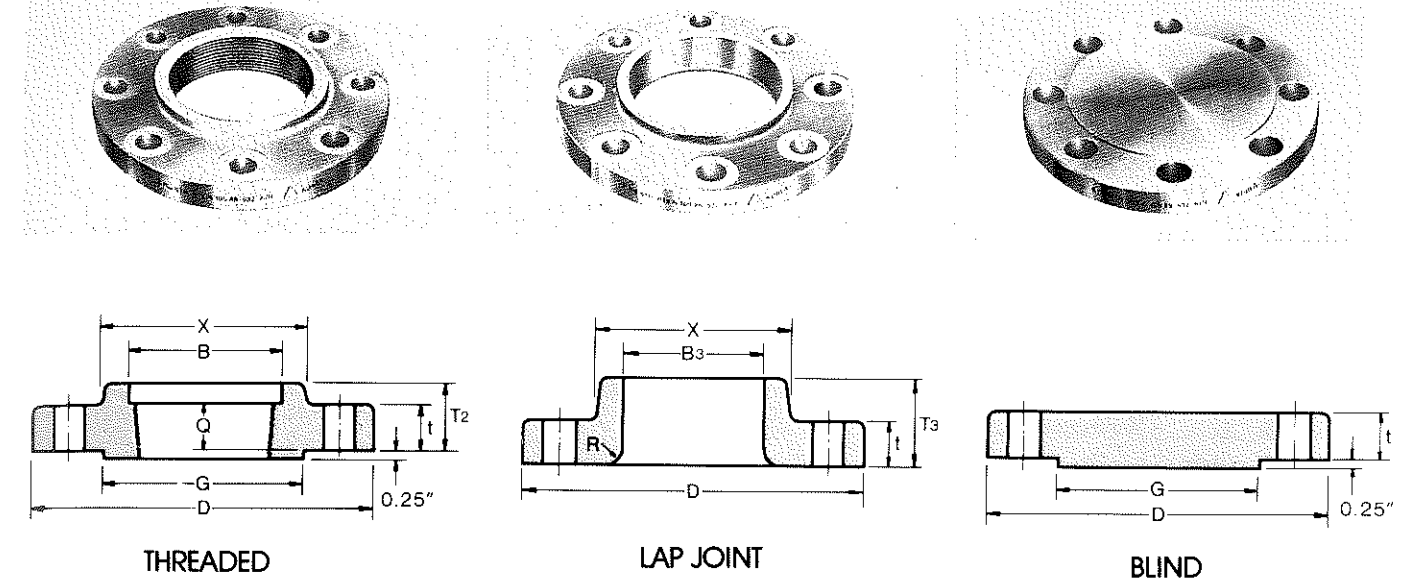
ANSI B16.5 FORGED FLANGES

Dimensions in inches

Nominal Pipe Size	Outside Diam.	Thick- ness	O.D. of Raised Face	Diam. at Base of Hub	BORE				LENGTH THRU HUB			Diam. of Hub at Bevel	Radius of Fillet	Thread Length
					Welding Neck Socket Welding	Slip-on Socket Welding	Lap Joint	Counter Bore Min.	Welding Neck	Slip-on Threaded Socket- Welding	Lap Joint			
	D	t	G	X	B ₁	B ₂	B ₃	B	T ₁	T ₂	T ₃	A	R	Q
½ ¾ 1	4.75	0.88	1.38	1.50	See Note (1) To be specified by purchaser.	0.88	0.90	0.93	2.38	1.25	1.25	0.84	0.12	0.88
	5.12	1.00	1.69	1.75		1.09	1.11	1.14	2.75	1.38	1.38	1.05	0.12	1.00
	5.88	1.12	2.00	2.06		1.36	1.38	1.41	2.88	1.62	1.62	1.32	0.12	1.12
1¼ 1½ 2	6.25	1.12	2.50	2.50		1.70	1.72	1.75	2.88	1.62	1.62	1.66	0.19	1.19
	7.00	1.25	2.88	2.75		1.95	1.97	1.99	3.25	1.75	1.75	1.90	0.25	1.25
	8.50	1.50	3.62	4.12		2.44	2.46	2.50	4.00	2.25	2.25	2.38	0.31	1.50
2½	9.62	1.62	4.12	4.88		2.94	2.97	3.00	4.12	2.50	2.50	2.88	0.31	1.88
	3 4	10.50	1.88	5.00		5.25	3.57	3.60	3.63	4.62	2.88	2.88	3.50	0.38
12.25		2.12	6.19	6.38		4.57	4.60	4.63	4.88	3.56	3.56	4.50	0.44	2.25
5 6 8	14.75	2.88	7.31	7.75		5.66	5.69	5.69	6.12	4.12	4.12	5.56	0.44	2.50
	15.50	3.25	8.50	9.00		6.72	6.75	6.75	6.75	4.69	4.69	6.63	0.50	2.75
	19.00	3.62	10.62	11.50		8.72	8.75	8.75	8.38	5.62	5.62	8.63	0.50	3.00
10 12 14	23.00	4.25	12.75	14.50		10.88	10.92	10.88	10.00	6.25	7.00	10.75	0.50	3.31
	26.50	4.88	15.00	17.75		12.88	12.92	12.94	11.12	7.12	8.62	12.75	0.50	3.62
	29.50	5.25	16.25	19.50		14.14	14.18	14.19	11.75		9.50	14.00	0.50	
16 18 20	32.50	5.75	18.50	21.75		16.16	16.19	16.19	12.25	—	10.25	16.00	0.50	—
	36.00	6.38	21.00	23.50		18.18	18.20	18.19	12.88	—	10.88	18.00	0.50	—
	38.75	7.00	23.00	25.25		20.20	20.25	20.19	14.00	—	11.50	20.00	0.50	—
24	46.00	8.00	27.25	30.00		24.25	24.25	24.19	16.00	—	13.00	24.00	0.50	—

Notes:

Class 1500 flanges except Lap Joint will be furnished with 0.25" raised face, which is not included in 'Thickness' (t) and 'Length through Hub' (T₁), (T₂).
For Slip-on, Threaded, Lap Joint and Socket Welding Flanges, the hubs can be shaped either vertical from base to top or tapered within the limits 7 degrees.



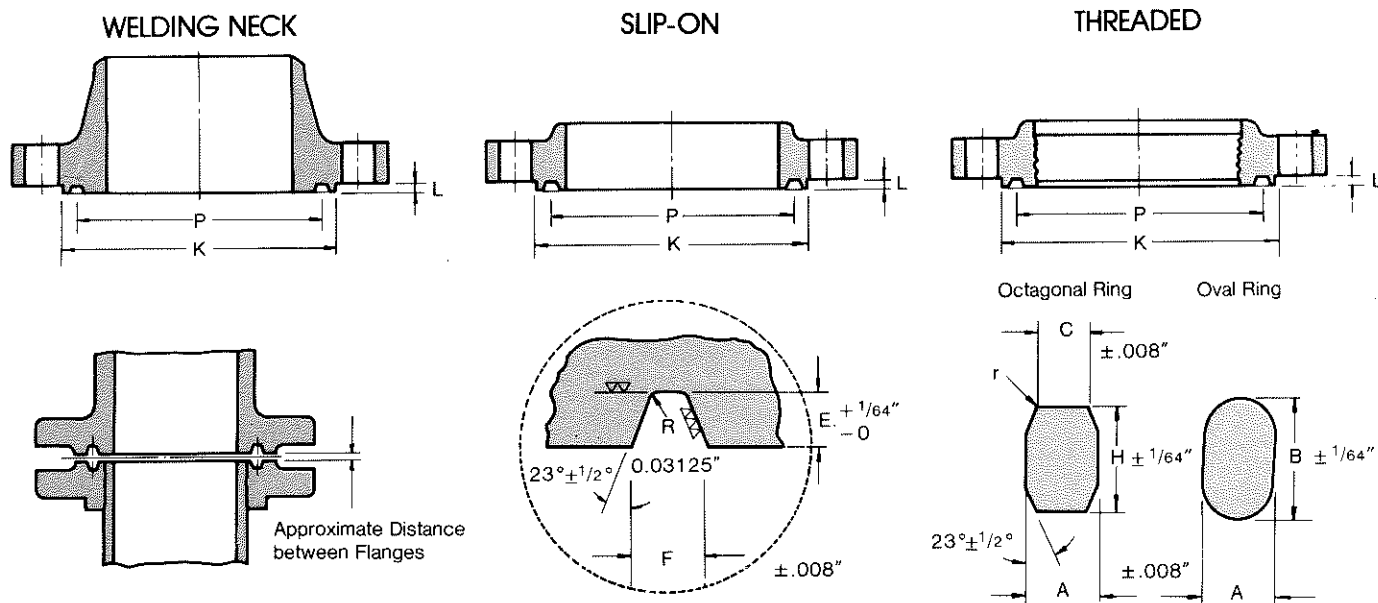
Dimensions in inches

Depth of Sock- et	DRILLING			BOLTING				APPROXIMATE WEIGHT										Nominal Pipe Size	
					Stud Bolt Length			Welding Neck		Slip-on and Threaded		Lap Joint		Blind		Socket Welding			
	Diam. of Bolts	0.25" Raised Face	Male- Female Tongue- Groove		Ring Joint	Kg	lb.												Kg
γ	Bolt Circle Diam.	Number of Holes	Diam. of Holes																
0.38	3.25	4	0.88	¾	4.25	4.00	4.25	2.10	4.60	1.80	4.00	1.80	4.00	1.90	4.00	1.81	4.00	¾	
0.44	3.50	4	0.88	¾	4.50	4.25	4.50	2.72	6.00	2.27	5.00	2.27	5.00	2.72	6.00	2.81	6.20	¾	
0.50	4.00	4	1.00	¾	5.00	4.75	5.00	3.86	8.50	3.40	7.50	3.40	7.50	4.08	9.00	3.61	8.00	1	
0.56	4.38	4	1.00	¾	5.00	4.75	5.00	4.54	10.00	4.10	9.00	4.09	10.80	4.30	9.50	4.99	11.00	1¼	
0.62	4.88	4	1.12	1	5.50	5.25	5.50	5.90	13.00	5.45	12.00	5.40	11.90	5.90	13.00	6.76	14.90	1½	
0.69	6.50	8	1.00	¾	5.75	5.50	5.75	10.89	24.00	10.50	23.00	9.53	21.00	11.30	25.00	10.89	24.00	2	
0.75	7.50	8	1.12	1	6.25	6.00	6.25	16.34	36.00	15.80	34.80	13.15	29.00	16.00	35.30	16.34	36.00	2½	
0.81	8.00	8	1.25	1½	7.00	6.75	7.00	21.79	48.00	21.77	48.00	17.24	38.00	21.79	48.00			3	
0.94	9.50	8	1.38	1¼	7.75	7.50	7.75	31.30	69.00	31.00	68.40	29.00	63.90	33.11	73.00			4	
0.94	11.50	8	1.62	1½	9.75	9.50	9.75	59.02	130.00	58.80	129.60	54.00	119.00	60.00	132.30			5	
1.06	12.50	12	1.50	1½	10.25	10.00	10.50	74.91	165.00	74.00	163.00	62.00	136.70	75.00	165.30			6	
1.25	15.50	12	1.75	1½	11.50	11.25	12.75	123.83	273.00	117.73	258.00	129.73	236.00	136.98	302.00			8	
1.31	19.00	12	2.00	1½	13.25	13.00	13.50	205.93	454.00	197.49	435.40	220.19	485.40	229.97	507.00			10	
1.56	22.50	16	2.12	2	14.75	14.50	15.25	306.00	674.60	264.00	582.00	286.02	630.60	316.00	696.70			12	
1.63	25.00	16	2.38	2¼	16.00	15.75	16.75	416.00	917.00	—	—	404.06	890.80	421.00	928.00			14	
1.75	27.75	16	2.62	2½	17.50	17.25	18.50	567.50	1250.00	—	—	522.10	1151.00	559.00	1232.70			16	
1.94	30.50	16	2.88	2¾	19.50	19.25	20.75	736.00	1622.60	—	—	669.65	1476.30	761.00	1677.70			18	
2.13	32.75	16	3.12	3	21.25	21.00	22.25	929.00	2048.00	—	—	805.85	1776.60	967.00	2131.80			20	
2.50	39.00	16	3.62	3½	24.25	24.00	25.50	1504.00	3315.70	—	—	1285.55	2834.00	1568.00	3456.80			24	

Blind Flanges may be made with the same hub as that used for Slip-on Flanges or without hub.
The gasket surface and backside (bearing surface for bolting) are made parallel within 1 degree. To accomplish parallelism, and facing is carried out according to MSS SP-9, without reducing thickness (t).
Dimensions of sizes 1/2" through 2 1/2" are the same as for Class 900 Flanges.
Depth of Socket (Y) is covered by ANSI B16.5 only in sizes through 2 1/2 inch, over 2 1/2 inch is at the manufacturer's option.

CLASS 300-400-600 FLANGES
RING JOINT FLANGES FACING DIMENSIONS

法兰盆



ANSI B16.5 FORGED FLANGES

Dimensions in inches

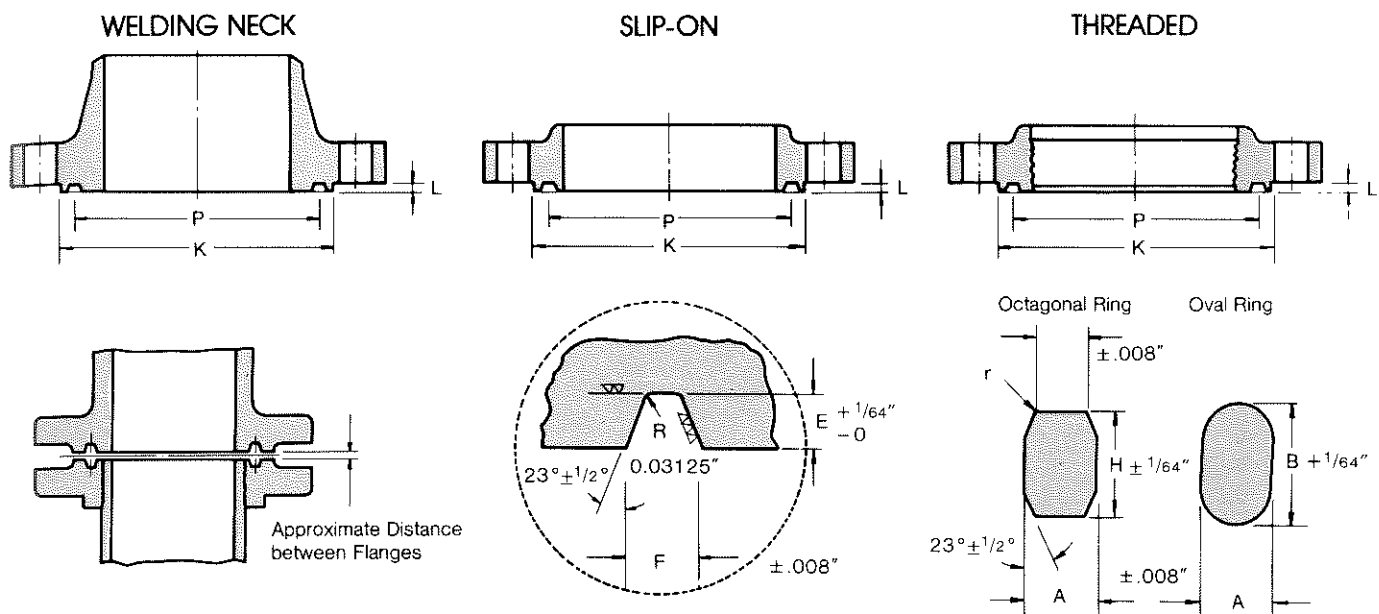
Nominal Pipe Size	Pitch Diam. of Ring and Groove	Width of Ring	HEIGHT OF RING		Width of Flat on Octagonal Rings	Width of Groove	Depth of Groove	Diameter of Raised Face for Ring Joint or Lapped	Ring Number	Approximate Distance Between Flanges of Ring Joints When Ring is Compressed		
			Oval	Octagonal						Class 300	Class 400	Class 600
P	A	B	H	C	F	E (L*)	K (Min)					
1/2 3/4 1	1.344	0.250	0.438	0.375	0.170	0.281	0.219	2.00	R11	0.12	—	0.12
	1.688	0.313	0.563	0.500	0.206	0.344	0.250	2.50	R13	0.16	—	0.16
	2.000	0.313	0.563	0.500	0.206	0.344	0.250	2.75	R16	0.16	—	0.16
1 1/4 1 1/2 2	2.375	0.313	0.563	0.500	0.206	0.344	0.250	3.13	R18	0.16	—	0.16
	2.688	0.313	0.563	0.500	0.206	0.344	0.250	3.56	R20	0.16	—	0.16
	3.250	0.438	0.688	0.625	0.305	0.469	0.312	4.25	R23	0.22	—	0.19
2 1/2 3 3 1/2	4.000	0.438	0.688	0.625	0.305	0.469	0.312	5.00	R26	0.22	—	0.19
	4.875	0.438	0.688	0.625	0.305	0.469	0.312	5.75	R31	0.22	—	0.19
	5.188	0.438	0.688	0.625	0.305	0.469	0.312	6.25	R34	0.22	—	0.19
4 5 6	5.875	0.438	0.688	0.625	0.305	0.469	0.312	6.88	R37	0.22	0.22	0.19
	7.125	0.438	0.688	0.625	0.305	0.469	0.312	8.25	R41	0.22	0.22	0.19
	8.313	0.438	0.688	0.625	0.305	0.469	0.312	9.50	R45	0.22	0.22	0.19
8 10 12	10.625	0.438	0.688	0.625	0.305	0.469	0.312	11.88	R49	0.22	0.22	0.19
	12.750	0.438	0.688	0.625	0.305	0.469	0.312	14.00	R53	0.22	0.22	0.19
	15.000	0.438	0.688	0.625	0.305	0.469	0.312	16.25	R57	0.22	0.22	0.19
14 16 18	16.500	0.438	0.688	0.625	0.305	0.469	0.312	18.00	R61	0.22	0.22	0.19
	18.500	0.438	0.688	0.625	0.305	0.469	0.312	20.00	R65	0.22	0.22	0.19
	21.000	0.438	0.688	0.625	0.305	0.469	0.312	22.63	R69	0.22	0.22	0.19
20 24	23.000	0.500	0.750	0.688	0.341	0.531	0.375	25.00	R73	0.22	0.22	0.19
	27.250	0.625	0.875	0.813	0.413	0.656	0.438	29.50	R77	0.25	0.25	0.22

Notes:

Unless otherwise specified by the customer, Ring Type Joint Flanges will be furnished in accordance with these details.
The depth of groove is added to the minimum flange thickness.
* Raised face "L" is equal to groove dimension "E" but is not subject to tolerances for "E".
* A plus tolerance of 3/64 in. for heights B and H is permitted providing the variation in the height of any given ring does not exceed 1/64 in. throughout its entire circumference.
Dimension "R" is max.
Radius "r" is 1/16" for ring widths 7/8" and less and 3/32" for ring widths 1" and over.

CLASS 900 FLANGES
RING JOINT FLANGES FACING DIMENSIONS

法兰盆



Dimensions in inches

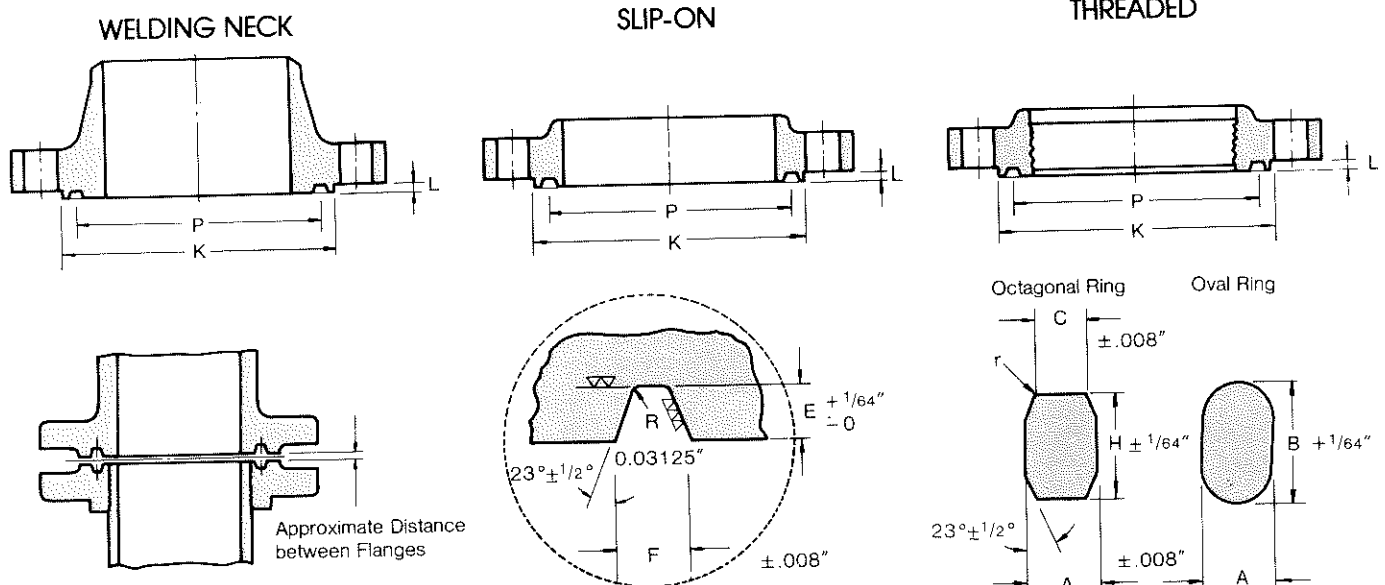
Nominal Pipe Size	Pitch Diam. of Ring and Groove	Width of Ring	HEIGHT OF RING		Width of Flat on Octagonal Rings	Width of Groove	Depth of Groove	Diameter of Raised Face for Ring Joint or Lapped	Ring Number	Approximate Distance Between Flanges of Ring Joints When Ring is Compressed
			Oval	Octagonal						
			P	A						
For size 2 ½ and smaller, use Class 1500 Ring Joint Flanges										
3	4.875	0.438	0.688	0.625	0.305	0.469	0.312	6.12	R31	0.16
4	5.875	0.438	0.688	0.625	0.305	0.469	0.312	7.12	R37	0.16
5	7.125	0.438	0.688	0.625	0.305	0.469	0.312	8.50	R41	0.16
6	8.313	0.438	0.688	0.625	0.305	0.469	0.312	9.50	R45	0.16
8	10.625	0.438	0.688	0.625	0.305	0.469	0.312	12.12	R49	0.16
10	12.750	0.438	0.688	0.625	0.305	0.469	0.312	14.25	R53	0.16
12	15.000	0.438	0.688	0.625	0.305	0.469	0.312	16.50	R57	0.16
14	16.500	0.625	0.875	0.813	0.413	0.656	0.438	18.38	R62	0.16
16	18.500	0.625	0.875	0.813	0.413	0.656	0.438	20.62	R66	0.16
18	21.000	0.750	1.000	0.938	0.438	0.781	0.500	23.38	R70	0.19
20	23.000	0.750	1.000	0.938	0.485	0.781	0.500	25.50	R74	0.19
24	27.250	1.000	1.313	1.250	0.681	1.062	0.625	30.38	R78	0.22

Notes:

Unless otherwise specified by the customer, Ring Type Joint Flanges will be furnished in accordance with these details.
The depth of groove is added to the minimum flange thickness.
* Raised face "L" is equal to groove dimension "E" but is not subject to tolerances for "E".
* A plus tolerance of 3/64 in. for heights B and H is permitted providing the variation in the height of any given ring does not exceed 1/64 in. throughout its entire circumference.
Dimension "R" is max.
Radius "r" is 1/16" for ring widths 7/8" and less and 3/32" for ring widths 1" and over.

CLASS 1500 FLANGES
RING JOINT FLANGES FACING DIMENSIONS

法兰盆



ANSI B16.5 FORGED FLANGES

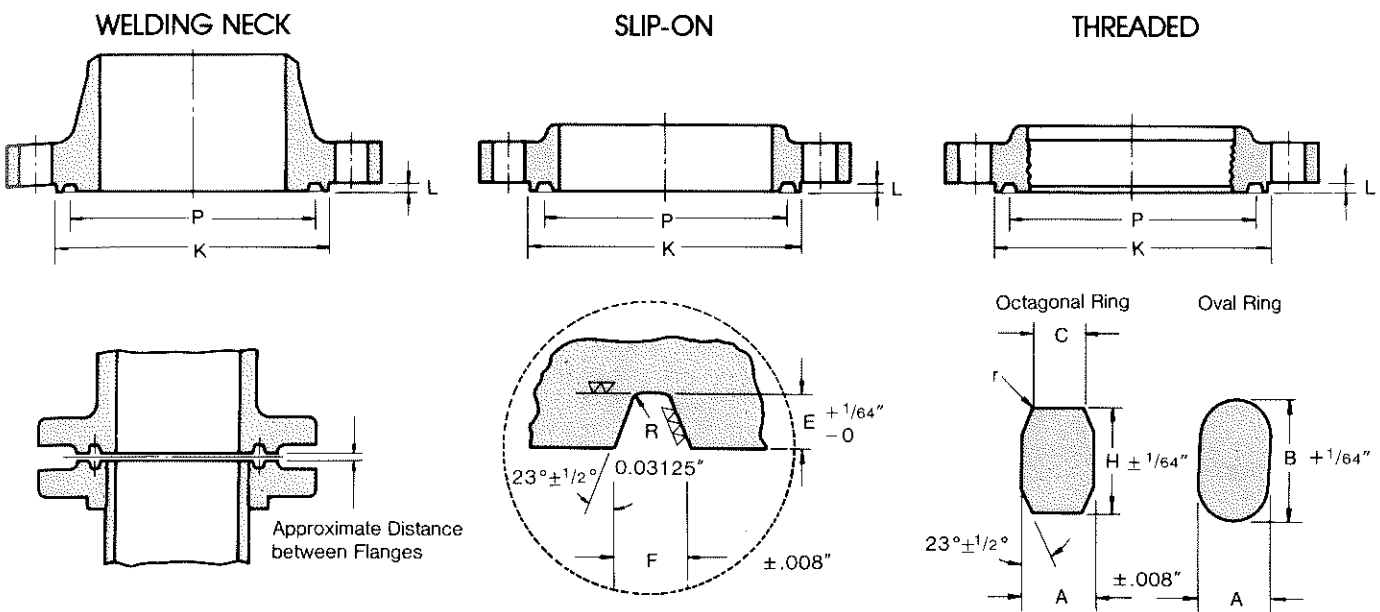
Dimensions in inches

Nominal Pipe size	Pitch Diam. of Ring and Groove	Width of Ring	HEIGHT OF RING		Width of Flat on Octagonal Rings	Width of Groove	Depth of Groove	Diameter of Raised Face for Ring Joint or Lapped	Ring Number	Approximate Distance Between Flanges of Ring Joints When Ring is Compressed
			Oval	Octagonal						
			B	H	C	F	E (L*)	K (Min)		
1/2	1.563	0.313	0.563	0.500	0.206	0.344	0.250	2.38	R12	0.16
	1.750	0.313	0.563	0.500	0.206	0.344	0.250	2.63	R14	0.16
	2.000	0.313	0.563	0.500	0.206	0.344	0.250	2.81	R16	0.16
1 1/4	2.375	0.313	0.563	0.500	0.206	0.344	0.250	3.19	R18	0.16
	2.688	0.313	0.563	0.500	0.206	0.344	0.250	3.63	R20	0.16
	3.750	0.438	0.688	0.625	0.305	0.469	0.312	4.88	R24	0.12
2 1/2	4.250	0.438	0.688	0.625	0.305	0.469	0.312	5.38	R27	0.12
	5.375	0.438	0.688	0.625	0.305	0.469	0.312	6.63	R35	0.12
	6.375	0.438	0.688	0.625	0.305	0.469	0.312	7.63	R39	0.12
5	7.625	0.438	0.688	0.625	0.305	0.469	0.312	9.00	R44	0.12
	8.313	0.500	0.750	0.688	0.341	0.531	0.375	9.75	R46	0.12
	10.625	0.625	0.875	0.813	0.413	0.656	0.438	12.50	R50	0.16
10	12.750	0.625	0.875	0.813	0.413	0.656	0.438	14.63	R54	0.16
	15.000	0.875	1.125	1.063	0.583	0.906	0.562	17.25	R58	0.19
	16.500	1.000	1.313	1.250	0.681	1.062	0.625	19.25	R63	0.22
16	18.500	1.125	1.438	1.375	0.780	1.188	0.688	21.50	R67	0.31
	21.000	1.125	1.438	1.375	0.780	1.188	0.688	24.13	R71	0.31
	23.000	1.250	1.563	1.500	0.879	1.313	0.688	26.50	R75	0.38
24	27.250	1.375	1.750	1.625	0.977	1.438	0.812	31.25	R79	0.44

Notes:
Unless otherwise specified by the customer, Ring Type Joint Flanges will be furnished in accordance with these details.
The depth of groove is added to the minimum flange thickness.
* Raised face "L" is equal to groove dimension "E" but is not subject to tolerances for "E".
* A plus tolerance of 3/64 in. for heights B and H is permitted providing the variation in the height of any given ring does not exceed 1/64 in. throughout its entire circumference.
Dimension "R" is max.
Radius "r" is 1/16" for ring widths 7/8" and less and 3/32" for ring widths 1" and over.

CLASS 2500 FLANGES
RING JOINT FLANGES FACING DIMENSIONS

法兰盆



Dimensions in inches

Nominal Pipe Size	Pitch Diam. of Ring and Groove	Width of Ring	HEIGHT OF RING		Width of Flat on Octagonal Rings	Width of Groove	Depth of Groove	Diameter of Raised Face for Ring Joint or Lapped	Ring Number	Approximate Distance Between Flanges of Ring Joints When Ring is Compressed
			Oval	Octagonal						
			B	H	C	F	E (L*)	K (Min)		
1/2	1.688	0.313	0.563	0.500	0.206	0.344	0.250	2.56	R13	0.16
	2.000	0.313	0.563	0.500	0.206	0.344	0.250	2.88	R16	0.16
	2.375	0.313	0.563	0.500	0.206	0.344	0.250	3.25	R18	0.16
1 1/4	2.844	0.438	0.688	0.625	0.305	0.469	0.312	4.00	R21	0.12
	3.250	0.438	0.688	0.625	0.305	0.469	0.312	4.50	R23	0.12
	4.000	0.438	0.688	0.625	0.305	0.469	0.312	5.25	R26	0.12
2 1/2	4.375	0.500	0.750	0.688	0.341	0.531	0.375	5.88	R28	0.12
	5.000	0.500	0.750	0.688	0.341	0.531	0.375	6.63	R32	0.12
	6.188	0.625	0.875	0.813	0.413	0.656	0.438	8.00	R38	0.16
5	7.500	0.750	1.000	0.938	0.485	0.781	0.500	9.50	R42	0.16
	9.000	0.750	1.000	0.938	0.485	0.781	0.500	11.00	R47	0.16
	11.000	0.875	1.125	1.063	0.583	0.906	0.562	13.38	R51	0.19
10	13.500	1.125	1.438	1.375	0.780	1.188	0.688	16.75	R55	0.25
	16.000	1.250	1.563	1.500	0.879	1.313	0.688	19.50	R60	0.31

Notes:
Unless otherwise specified by the customer, Ring Type Joint Flanges will be furnished in accordance with these details.
The depth of groove is added to the minimum flange thickness.
* Raised face "L" is equal to groove dimension "E" but is not subject to tolerances for "E".
* A plus tolerance of 3/64 in. for heights B and H is permitted providing the variation in the height of any given ring does not exceed 1/64 in. throughout its entire circumference.
Dimension "R" is max.
Radius "r" is 1/16" for ring widths 7/8" and less and 3/32" for ring widths 1" and over.

PRESSURE-TEMPERATURE RATINGS

ANSI B16.5 FORGED FLANGES

法兰盘

CLASS 150

Materials	A105 A350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	285	290	235	265		290				275	275	230	275	275	260		100
200	260	260	215			260				235	240	195	235	245	230		200
300	230	230	210			230				205	215	175	210	225	220		300
400					200					180	195	160	190		200		400
500											170	145			170		500
600											140	140			140		600
650											125	125			125		650
700											110	110			110		700
750						95					95	95			95		750
800						80					80	80			80		800
850						65					65	65			65		850
900						50					50				50		900
950						35					35				35		950
1000						20					20				20		1000

CLASS 300

Materials	A105 A350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	740	750	620	695	750	750	750	750		720	720	600	720	720	670		100
200	675	750	560	680	750	710	715	750		600	620	505	610	635	605		200
300	655	730	550	655	730	675	675	730		530	560	455	545	590	570		300
400	635	705	530	640	705	660	650	705		470	515	415	495	555	535		400
500	600	665	500	620	665		640	665		435	480	380	460	520	505		500
600	550	605	455				605			415	450	360	435	490	480		600
650	535	590	450				590			410	445	350	430	480	465		650
700	535	570	450				570			405	430	345	420	470	455		700
750	505	505	445				530			400	425	335	415	460	445		750
800	410	410	370				510	500	510	395	415	330	415	455	435		800
850		270					485	440	485	390	405	320	410	445	425		850
900		170					450	355	450	385	395		405	430	415		900
950		105		280	345	380		260	370	375	385		385	385	385		950
1000		50		165	215	225	270	190	290	325	365		355	365	335	350	1000
1050					190	140	200	140	190	310	360		345	360	290	335	1050
1100						95	115	105	115	260	325		300	325	225	290	1100
1150						50	105	70	75	195	275		235	275	170	245	1150
1200						35	55	45	50	155	205		180	170	130	205	1200
1250										110	180		140	125	100	160	1250
1300										85	140		105	95	80	120	1300
1350										60	105		80	70	60	80	1350
1400										50	75		60	50	45	55	1400
1450										35	60		50	40	30	40	1450
1500										25	40		40	35	25	25	1500

CLASS 400

Materials	A105 A350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	990	1000	825	925	1000	1000	1000	1000		960	960	800	960	960	895		100
200	900	1000	750	905	1000	950	955	1000		800	825	675	815	850	805		200
300	875	970	730	870	970	895	905	970		705	745	605	725	785	760		300
400	845	940	705	855	940	880	865	940		630	685	550	660	740	710		400
500	800	885	665	830	885		855		885	585	635	510	610	690	670		500
600	730	805	610				805			555	600	480	585	655	635		600
650	715	785	600				785			545	590	470	570	640	620		650
700	710	755	600				755			540	575	460	560	625	610		700
750	670	670	590				710			530	565	450	555	615	595		750
800	550	550	495				675	665	675	525	555	440	550	610	580		800
850		355					650	585	650	520	540	430	545	590	565		850
900		230					600	470	600	510	525		540	575	555		900
950		140		375	460	505		350	495	500	515		515	515	515		950
1000		70		220	285	300	355	255	390	430	485		475	485	450	465	1000
1050					250	185	265	190	250	410	480		460	480	390	445	1050
1100						130	150	140	150	345	430		400	430	300	390	1100
1150						70	140	90	100	260	365		315	365	230	330	1150
1200						45	75	60	70	205	275		240	230	175	275	1200
1250										145	245		185	165	135	215	1250
1300										110	185		140	125	105	160	1300
1350										85	140		110	90	80	105	1350
1400										65	100		80	70	60	75	1400
1450										45	80		65	55	40	50	1450
1500										30	55		50	45	30	30	1500

CLASS 600

Materials	A105 A350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	1480	1500	1235	1390	1500	1500	1500	1500		1440	1440	1200	1440	1440	1345		100
200	1350	1500	1125	1360	1500	1425	1430	1500		1200	1240	1015	1220	1270	1210		200
300	1315	1455	1095	1305	1455	1345	1355	1455		1055	1120	910	1090	1175	1140		300
400	1270	1410	1060	1280	1410	1315	1295	1410		940	1030	825	990	1110	1065		400
500	1200	1330	995	1245	1330	1285	1280	1330		875	955	765	915	1035	1010		500
600	1095	1210	915			1210				830	905	720	875	985	955		600
650	1075	1175	895			1175				815	890	700	855	960	930		650
700	1065	1135	895			1135				805	865	685	840	935	910		700
750	1010	1010	885			1065				795	845	670	830	920	895		750
800	825	825	740			1015		995	1015	790	830	660	825	910	870		800
850		535				975		880	975	780	810	645	815	890	860		850
900		345				900		705	900	770	790		810	865	830		900
950		205		560	685	755		520	740	750	775		775	775	775		950
1000		105		330	425	445	535	385	585	645	725		715	725	670	700	1000
1050					380	275	400	280	380	620	720		695	720	585	665	1050
1100						190	225	205	225	515	645		605	645	445	585	1100
1150						105	205	140	150	390	550		475	550	345	495	1150
1200						70	110	90	105	310	410		365	345	260	410	1200
1250										220	365		280	245	200	325	1250
1300										165	275		210	185	160	240	1300
1350										125	205		165	135	115	160	1350
1400										90	150		125	105	90	110	1400
1450										70	115		95	80	60	75	1450
1500										50	85		75	70	50	50	1500

PRESSURE-TEMPERATURE RATINGS

ANSI B16.5 FORGED FLANGES

法兰盆

CLASS 900

Materials	A105 F350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	2220	2250	1850	2085	2250	2250	2250	2250		2160	2160	1800	2160	2160	2015		100
200	2025	2250	1685	2035	2250	2135	2150	2250		1800	1860	1520	1830	1910	1815		200
300	1970	2185	1640	1955	2185	2020	2030	2185		1585	1680	1360	1635	1765	1705		300
400	1900	2115	1585	1920	2115	1975	1945	2115		1410	1540	1240	1485	1665	1600		400
500	1795	1995	1495	1865	1995	1925	1920	1995		1310	1435	1145	1375	1555	1510		500
600	1640	1815	1370			1815				1245	1355	1080	1310	1475	1435		600
650	1610	1765	1345			1765				1225	1330	1050	1280	1440	1395		650
700	1600	1705	1345			1705				1210	1295	1030	1260	1405	1370		700
750	1510	1510	1325			1595		1490	1525	1195	1270	1010	1245	1385	1340		750
800	1235	1235	1110			1525		1315	1460	1180	1245	985	1240	1370	1305		800
850		805				1460		1060	1350	1165	1215	965	1225	1330	1275		850
900		515				1350				1150	1180		1215	1295	1245		900
950		310		845	1030	1130		780	1110	1125	1160		1160	1160	1160		950
1000		155		495	640	670	805	575	875	965	1090		1070	1090	1010	1050	1000
1050				565		410	595	420	565	925	1080		1040	1080	875	875	1050
1100						290	340	310	340	770	965		905	965	670		1100
1150						155	310	205	225	585	825		710	825	515	740	1150
1200						105	165	135	155	465	620		545	515	390	620	1200
1250										330	545		420	370	300	485	1250
1300										245	410		320	280	235	360	1300
1350										165	310		245	205	175	235	1350
1400										145	225		185	155	135	165	1400
1450										105	175		145	125	95	115	1450
1500										70	125		115	105	70	70	1500

CLASS 1500

Materials	A105 A350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	3705	3750	3085	3470	3750	3750	3750	3750		3600	3600	3000	3600	3600	3360		100
200	3375	3750	2810	3395	3750	3560	3580	3750		3000	3095	2530	3050	3180	3025		200
300	3280	3640	2735	3260	3640	3365	3385	3640		2640	2795	2270	2725	2940	2845		300
400	3170	3530	2645	3200	3530	3290	3240	3530		2350	2570	2065	2470	2770	2665		400
500	2995	3325	2490	3105	3325	3210	3200	3325		2185	2390	1910	2290	2590	2520		500
600	2735	3025	2285			3025				2075	2255	1800	2185	2460	2390		600
650	2685	2940	2245			2940				2040	2220	1750	2135	2400	2330		650
700	2665	2840	2245			2840				2015	2160	1715	2100	2340	2280		700
750	2520	2520	2210			2660				1990	2110	1680	2075	2305	2230		750
800	2060	2060	1850			2540		2485	2540	1970	2075	1645	2065	2280	2170		800
850		1340				2435		2195	2435	1945	2030	1610	2040	2220	2125		850
900		860				2245		1765	2245	1920	1970		2030	2160	2075		900
950		515		1405	1715	1885		1305	1850	1870	1930		1930	1930	1930		950
1000		260		825	1065	1115	1340	960	1460	1610	1820		1785	1820	1680	1750	1000
1050					945	685	995	705	945	1545	1800		1730	1800	1460	1665	1050
1100						480	565	515	565	1285	1610		1510	1610	1115	1460	1100
1150						260	515	345	380	980	1370		1185	1370	860	1235	1150
1200						170	275	225	260	770	1030		910	855	650	1030	1200
1250										550	910		705	615	495	805	1250
1300										410	685		530	465	395	600	1300
1350										310	515		410	345	290	395	1350
1400										240	380		310	255	225	275	1400
1450										170	290		240	205	155	190	1450
1500										120	205		190	170	120	120	1500

CLASS 2500

Materials	A105 A350- LF2	A350- LF3	A350- LF1	A182 F1	A182 F2	A182 F11 F12	A182 F22	A182 F5 F5a	A182 F9	F304 F304H	F316 F316H	F304L F316L	F321 F321H	F347 F347H F348 F348H	(A240 309S)	F310	Temper- ature °F
-20 to 100	6170	6250	5145	5785	6250	6250	6250	6250		6000	6000	5000	6000	6000	5600		100
200	5625	6250	4680	5660	6250	5930	5965	6250		5000	5160	4220	5080	5300	5040		200
300	5470	6070	4560	5435	6070	5605	5640	6070		4400	4660	3780	4540	4900	4740		300
400	5280	5880	4405	5330	5880	5485	5400	5880		3920	4280	3440	4120	4620	4440		400
500	4990	5540	4150	5180	5540	5350	5330	5540		3640	3980	3180	3820	4320	4200		500
600	4560	5040	3805			5040				3460	3760	3000	3640	4100	3980		600
650	4475	4905	3740			4905				3400	3700	2920	3560	4000	3880		650
700	4440	4730	3740			4730				3360	3600	2860	3500	3900	3800		700
750	4200	4200	3685			4430				3320	3520	2800	3460	3840	3720		750
800	3430	3430	3085			4230		4145	4230	3280	3460	2740	3440	3800	3620		800
850		2230				4060		3660	4060	3240	3380	2680	3400	3700	3540		850
900		1430				3745		2945	3745	3200	3280		3380	3600	3460		900
950		860		2345	2860	3145		2170	3085	3120	3220		3220	3220	3220		950
1000		430		1370	1770	1860	2230	1600	2430	2685	3030		2970	3030	2800	2915	1000
1050					1570	1145	1660	1170	1570	2570	3000		2885	3000	2430	2770	1050
1100						800	945	860	945	2145	2685		2515	2685	1860	2430	1100
1150						430	860	570	630	1630	2285		1970	2285	1430	2060	1150
1200						285	460	370	430	1285	1715		1515	1430	1085	1715	1200
1250										915	1515		1170	1030	830	1345	1250
1300										685	1145		885	770	660	1000	1300
1350										515	860		685	570	485	660	1350
1400										400	630		515	430	370	460	1400
1450										285	485		400	345	260	315	1450
1500										200	345		315	285	200	200	1500

GUIDE TO MATERIAL LAYOUT & SPECIFICATIONS

Pipe	Weld Fittings	Screwed & Socket Fittings	Flanges	Valves
A-53	A-234 WPB	A-105, A-181 Gr. 60 or 70	A105, A-181 Gr. 60 or 70	A-105 A-216 WCB
A-106B	A-234 WPB	A-105 A-181 Gr. 60 or 70	A-105 A-181 Gr. 60 or 70	A105 A-216 WCB
A-312 T304	A-403 WP-304	A-182 F-304	A-182 F-304	a-182 F-304 CMO
A-312 T316	A-403 WP-316	A-182 F-316	A-182 F-316	A-182 F-316 CM 8MO
A-333 Gr. 1 or 6	A-420 WPL 1 & 6	A-350 LF-1	A-350 LF-1	A-350 LF-1 A-352 LCB
A-333 Gr. 3	A-420 WPL-3	A-350 LF-3	A-350 LF-3	A-350 LF-3 A-352 LC3
A-335 P-1	A-234 WP-1	A-182 F-1	A-182 F-1	A-217 WC-6
A-335 P-11	A-234 WP-11	A-182 F-11	A-182 F-11	A-182 F-11 A-217 WC-6
A-335 P-12	A-234 WP-12	A-182 F-12	A-182 F-12	A-217 WC-6
A-335 P-22	A-234 WP-22	A-182 F-22	A-182 F-22	A-182 F-22 A-217 WC-9
A-335 P-5	A-234 WP-5	A-182 F-5	A-182 F-5	A-182 F-5 A-216 WC-5
A335 P-7	A-234 WP-7	A-182 F-7	A-182 F-7	A-182 F-7 A-217 WC-12
A-335 P-9	A-234 WP-9	A-182 F-9	A-182 F-9	A-182 F-9 A-217 WC-12

Fittings, Flanges And Pipes Commonly Used

Classification	Pipe	B.W.Fittings	Flanges
Carbon Steels	A 106 Grade A	A 234 Grade WPA	A 105 Grade I
	A 106 Grade B	A 234 Grade WPB	A 105 Grade II
Alloy Steels	A 335 Grade P 1	A 234 Grade WP 1	A 182 Grade F 1
	A 335 Grade P 5	A 234 Grade WP 5	A 182 Grade F 5
	A 335 Grade P 7	A 234 Grade WP 7	A 182 Grade F 7
	A 335 Grade P 9	A 234 Grade WP 9	A 182 Grade F 9
	A 335 Grade P 11	A 234 Grade WP 11	A 182 Grade F 11
	A 335 Grade P 12	A 234 Grade WP 12	A 182 Grade F 12
	A 335 Grade P 22	A 234 Grade WP 22	A 182 Grade F 22
Steels for Low - Temperature Service	A 333 Grade 1	A 420 Grade WPL 1	A 350 Grade LF 1
	A 333 Grade 3	A 420 Grade WPL 3	A 350 Grade LF 3
	A 333 Grade 4	A 420 Grade WPL 4	A 350 Grade LF 4
	A 333 Grade 6	A 420 Grade WPL 6	A 350 Grade LF 6
	A 333 Grade 8	A 420 Grade WPL 8	A 350 Grade LF 8
Stainless Steel	A 312 Grade TP 304	A 403 Grade WP 304	A 182 Grade F 304
	A 312 Grade TP 304H	A 403 Grade WP 304H	A 182 Grade F 304H
	A 312 Grade TP 304L	A 403 Grade WP 304L	A 182 Grade F 304L
	A 312 Grade TP 316	A 403 Grade WP 316	A 182 Grade F 316
	A 312 Grade TP 316H	A 403 Grade WP 316H	A 182 Grade F 316H
	A 312 Grade TP 316L	A 403 Grade WP 316L	A 182 Grade F 316L
	A 312 Grade TP 321	A 403 Grade WP 321	A 182 Grade F 321
	A 312 Grade TP 321H	A 403 Grade WP 321H	A 182 Grade F 321H
	A 312 Grade TP 347	A 403 Grade WP 347	A 182 Grade F 347
	A 312 Grade TP 347	A 403 Grade WP 347	A 182 Grade F 347
	A 312 Grade TP 347H	A 403 Grade WP 347H	A 182 Grade F 347H

NOTES :

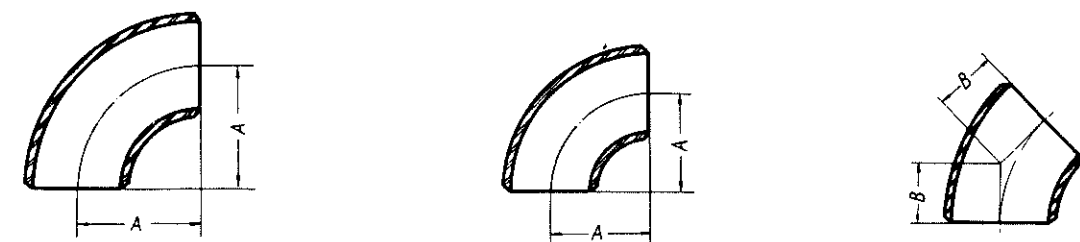
- For materials and grades other than those given above, please refer to steel groups listed on succeeding pages, or to technical sections herein under pipes, flanges, and fittings.
- Materials can also be supplied in accordance to API, ASTM, DIN, BS, UNS, ISO and other international specifications.

SEAMLESS BUTT WELDING FITTINGS

Standard Wall and Extra Strong Wall (A)

平焊弯头

90° and 45° ELBOWS



ASA B16.9 MSS SP-48 ASA B16.28

Nominal Pipe Size	90° Elbows						45° Elbows			
	Long Radius			Short Radius			Long Radius			
	Center to End A	Approx. Weight (lbs)		Center to End A	Approx. Weight (lbs)		Radius A	Center to End B	Approx. Weight (lbs)	
		STD	XS		STD	XS			STD	XS
1/2	1 1/2	.17	.22	—	—	—	1 1/2	5/8	.09	.11
3/4	1 1/8	.17	.22	—	—	—	1 1/8	7/16	.09	.11
1	1 1/2	.34	.43	1	.23	—	1 1/2	7/8	.24	.30
1 1/4	1 7/8	.58	.75	1 1/4	.38	—	1 7/8	1	.37	.48
1 1/2	2 1/4	.83	1.06	1 1/2	.55	.72	2 1/4	1 1/8	.50	.65
2	3	1.49	2.00	2	.99	1.33	3	1 3/8	.82	1.09
2 1/2	3 3/4	2.92	3.82	2 1/2	1.93	2.51	3 3/4	1 3/4	1.64	2.10
3	4 1/2	4.58	6.12	3	3.04	4.04	4 1/2	2	2.43	3.23
3 1/2	5 1/4	6.43	8.72	3 1/2	4.26	5.76	5 1/4	2 1/4	3.29	4.42
4	6	8.70	11.9	4	5.77	7.89	6	2 1/2	4.31	5.86
5	7 1/2	14.7	20.6	5	9.75	13.7	7 1/2	3 1/8	7.30	10.2
6	9	22.9	34.1	6	15.2	22.6	9	3 3/4	11.3	16.7
8	12	46.0	69.1	8	30.5	45.6	12	5	22.8	34.0
10	15	81.5	109	10	54.0	72.5	15	6 1/4	40.4	53.9
12	18	119	157	12	79.5	104.	18	7 1/2	59.5	78.3
14	21	154	202	14	102	135.	21	8 3/4	76.5	100
16	24	201	265	16	135	177.	24	10	100	132
18	27	256	338	18	171	225.	27	11 1/4	128	168
20	30	317	419	20	212	278.	30	12 1/2	158	208
22	33	385	508	—	—	—	33	13 1/2	192	253
24	36	458	606	24	305	404.	36	15	229	312
26	39	539	713	—	—	—	39	16	269	355
30	45	720	953	30	480	634.	45	18 1/2	358	475
36	54	1040	1380	36	692	913.	54	22 1/4	518	686

All dimensions are in inches.

Every thickness conforms to those for standard wall and extra strong wall pipe (ASA B 36.10).

STD designates standard wall and XS designates extra strong wall.

Pressure-temperature ratings are identical with those of seamless pipe of the same size, thickness or schedule, and material grade.

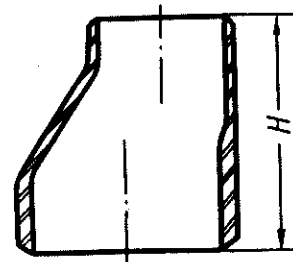
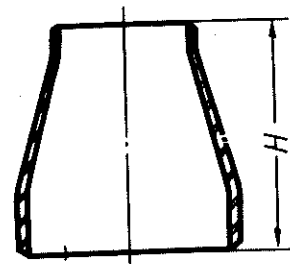
Size 24" to 36" are welded two seam longitudinally.

SEAMLESS BUTT WELDING FITTINGS (3)

Standard Wall and Extra Strong Wall (C)

平焊变径接头

REDUCERS-Concentric and Eccentric



ASA B16.9

ASA B10. 9

Nominal Pipe Size					End to End H	Approx. Weight (lbs)	
Large End	Small End					STD	XS
3/4	1/2	—	—	—	1 1/2	.15	.22
1	3/4	1/2	—	—	2	.28	.36
1 1/4	1	3/4	1/2	—	2	.38	.50
1 1/2	1 1/4	1 1/4	3/4	1/2	2 1/2	.57	.76
2	1 1/2	1 1/4	1	3/4	3	.90	1.25
2 1/2	2	1 1/2	1 1/4	1	3 1/2	1.70	2.23
3	2 1/2	2	1 1/2	1 1/4	3 1/2	2.20	2.99
3 1/2	3	2 1/2	2	1 1/2	4	3.00	4.16
4	3 1/2	3	2 1/2	2	4	3.60	5.00
5	4	3 1/2	3	2 1/2	5	6.10	8.65
6	5	4	3 1/2	3	5 1/2	8.70	13.1
8	6	5	4	3 1/2	6	14.3	21.7
10	8	6	5	4	7	23.6	31.9
12	10	8	6	5	8	33.1	43.6
14	12	10	8	—	13	59.2	78.3
16	14	12	10	—	14	73.0	97.0

All dimensions are in inches.

For bevel detail see page 31

Every thickness conforms to those for standard wall and extra strong wall pipe (ASA B 36.10).

STD designates standard wall, and XS designates extra strong wall.

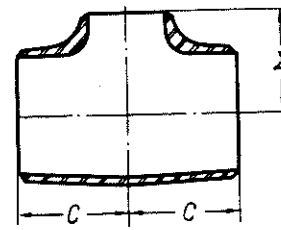
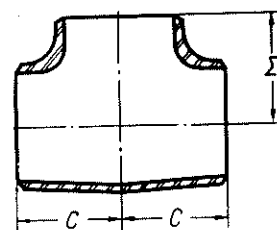
Pressure-temperature ratings are identical with those of seamless pipe of the same size, thickness or schedule,

and material grade. For dimensional tolerance see page 30

18" is seamless, but a scope of this small end is limited. 20" and 20" up are the bucket type welded longitudinally according to AWWA C208—59.

Standard Wall and Extra Strong Wall (4)

TEES-Straight and Reducing



SEAMLESS BUTT WELDING FITTINGS

TEES-Straight and Reducing

平焊三通及变径三通

ASA B16.9

Continued from preceding page

Nominal Pipe Size		Center to End		Approx. Weight (lbs)		Nominal Pipe Size		Center to End		Approx. Weight (lbs)	
Run	Branch	C	M	STD	XS	Run	Branch	C	M	STD	XS
1/2	1/2	1	1	.25	.36	3 1/2	3 1/2	3 3/4	3 3/4	9.85	12.6
	5/8	1	1	.23	.28		3	3 3/4	3 3/8	9.01	11.7
3/4	3/4	1 1/8	1 1/8	.37	.46		2 1/2	3 3/4	3 1/2	8.79	11.5
	1 1/2	1 1/8	1 1/8	.34	.42		2	3 3/4	3 1/4	8.48	11.2
	3/8	1 1/8	1 1/8	.33	.41		1 1/2	3 3/4	3 3/8	8.48	11.1
1	1	1 1/2	1 1/2	.76	.93	4	4	4 1/8	4 1/8	12.6	16.4
	3/4	1 1/2	1 1/2	.65	.80		3 1/2	4 1/8	4	11.6	15.3
	1 1/2	1 1/2	1 1/2	.64	.79		3	4 1/8	3 3/8	11.4	15.0
	5/8	1 1/2	1 1/2	.64	.79		2 1/2	4 1/8	3 3/4	11.3	14.7
							2	4 1/8	3 1/2	11.0	14.5
1 1/4	1 1/4	1 7/8	1 7/8	1.34	1.64	5	5	4 7/8	4 7/8	19.8	26.4
	1	1 7/8	1 7/8	1.17	1.45		4	4 7/8	4 3/8	18.1	24.2
	3/4	1 7/8	1 7/8	1.11	1.38		3 1/2	4 7/8	4 1/2	17.8	23.9
1 1/2	1 1/2	2 1/4	2 1/4	2.02	2.48		3	4 7/8	4 3/8	17.6	23.7
	1 1/4	2 1/4	2 1/4	1.76	2.20		2 1/2	4 7/8	4 3/8	17.4	23.6
	1	2 1/4	2 1/4	1.68	2.09		2	4 7/8	4 1/8	17.2	23.4
	3/4	2 1/4	2 1/4	1.61	2.03	6	6	5 5/8	5 5/8	29.3	42.0
2	2	2 1/2	2 1/2	2.96	3.73		5	5 5/8	5 3/8	26.7	37.8
	1 1/2	2 1/2	2 3/8	2.66	3.40		4	5 5/8	5 1/8	26.2	37.2
	1 1/4	2 1/2	2 1/4	2.45	3.26		3 1/2	5 5/8	5	26.0	37.1
	1	2 1/2	2	2.47	3.17		3	5 5/8	4 7/8	25.8	36.9
2 1/2	3/4	2 1/2	1 3/4	2.41	3.11		2 1/2	5 5/8	4 3/4	25.7	36.9
	2 1/2	3	3	5.21	6.44	8	8	7	7	53.7	76.4
	2	3	2 3/4	4.58	5.75		6	7	6 5/8	48.7	70.4
	1 1/2	3	2 5/8	4.50	5.66		5	7	6 3/8	48.1	69.5
3	1 1/4	3	2 1/2	4.39	5.53		4	7	6 1/8	47.9	69.3
	1	3	2 1/4	4.33	5.46		3 1/2	7	6	47.7	69.1
	3	3 3/8	3 3/8	7.44	9.45	10	10	8 1/2	8 1/2	91.2	118
	2 1/4	3 3/8	3 1/4	6.81	8.60		8	8 1/2	8	83.0	109
3 1/2	2	3 3/8	3	6.51	8.36		6	8 1/2	7 5/8	81.7	108
	1 1/2	3 3/8	2 7/8	6.44	8.30		5	8 1/2	7 1/2	81.4	106
	1 1/4	3 3/8	2 3/4	6.34	8.17	12	12	10	10	132	167
							10	10	9 1/2	121	155
4							8	10	9	118	153
							6	10	8 5/8	117	151
						14	14	11	11	168	203
							12	11	10 5/8	144	186
							10	11	10 1/8	138	178
							8	11	9 3/4	136	176

All dimensions are in inches.

Every thickness conforms to those for standard wall and extra strong wall pipe (ASA B 36.10).

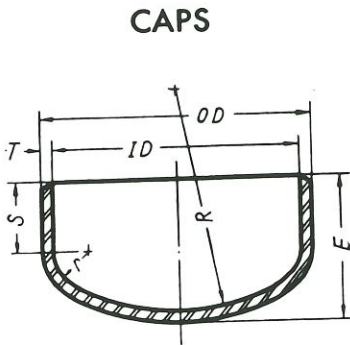
STD designates standard wall, and XS designates extra strong wall.

Pressure-temperature ratings are identical with those of seamless pipe of the same size, thickness or schedule, and material grade.

16" and 16" up are in the construction in which the run and the branch are mitred, according to AWWA C208—59, except Straight Tee of 16" STD which is seamless.



Standard Wall



ASA B16.9

Nominal Pipe Size	Outside Diameter O. D.	Inside Diameter I. D.	Wall Thickness T	Length E	Tangent S	Dish Radius R	Knuckle Radius r	Pipe Schedule Numbers	Approximate Weight (lbs)
1/2	.840	.622	.109	1	.74	.54	.10	40	.07
3/4	1.050	.824	.113	1 1/4	.93	.72	.14	40	.13
1	1.315	1.049	.133	1 1/2	1.10	.92	.17	40	.23
1 1/4	1.660	1.380	.140	1 1/2	1.02	1.35	.23	40	.31
1 1/2	1.900	1.610	.145	1 1/2	.95	1.41	.27	40	.37
2	2.375	2.067	.154	1 1/2	.83	1.81	.34	40	.51
2 1/2	2.875	2.469	.203	1 1/2	.68	2.15	.41	40	.81
3	3.500	3.068	.216	2	1.02	2.69	.51	40	1.41
3 1/2	4.000	3.548	.226	2 1/2	1.39	3.11	.59	40	2.12
4	4.500	4.026	.237	2 1/2	1.26	3.52	.67	40	2.55
5	5.563	5.047	.258	3	1.48	4.42	.84	40	4.20
6	6.625	6.065	.280	3 1/2	1.70	5.31	1.01	40	6.41
8	8.625	7.981	.322	4	1.68	6.98	1.33	40	11.3
10	10.750	10.020	.365	5	2.13	8.77	1.67	40	20.0
12	12.750	12.000	.375	6	2.62	10.50	2.00	STD	29.5
14	14.000	13.250	.375	6 1/2	2.81	11.60	2.21	30	35.3
16	16.000	15.250	.375	7	2.81	13.34	2.54	30	44.3
18	18.000	17.250	.375	8	3.31	15.08	2.88	STD	57.1
20	20.000	19.250	.375	9	3.81	16.84	3.21	20	71.7
22	22.000	21.250	.375	10	4.31	18.60	3.54	STD	86.5
24	24.000	23.250	.375	10 1/2	4.31	20.34	3.88	20	102
26	26.000	25.250	.375	10 1/2	3.81	22.10	4.21	STD	110
30	30.000	29.250	.375	10 1/2	2.81	25.60	4.88	STD	125
34	34.000	33.250	.375	10 1/2	1.81	29.10	5.54	STD	160
36	36.000	35.250	.375	10 1/2	1.31	30.85	5.88	STD	175
42	42.000	41.250	.375	12	1.31	36.10	6.88	STD	230

All dimensions are in inches.

Pressure-temperature ratings are identical with those of seamless pipe of the same size, thickness or schedule, and material grade.

Every thickness conforms to standard wall pipe (ASA B 36.10).
STD designates standard wall.



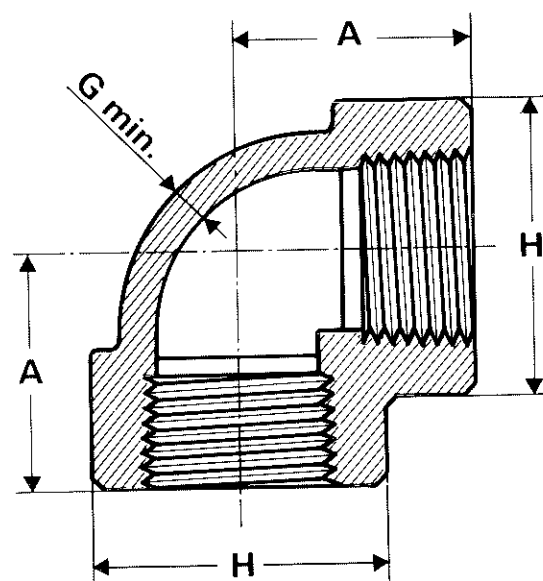
锻钢管道接头
FORGED
FITTINGS



内螺纹 90° 弯头

90° elbows

class 3000 lb — 6000 lb



Thread according to
ANSI B 1.20.1 — 1983

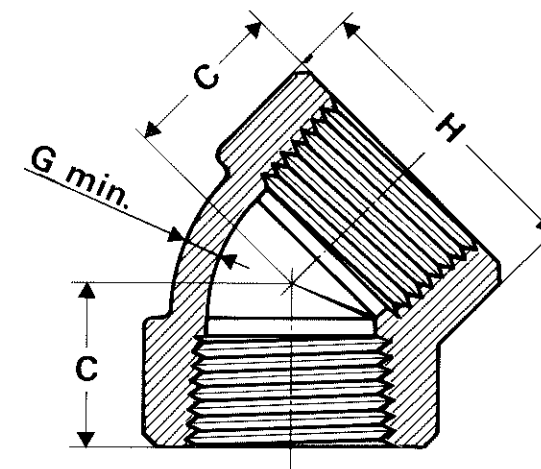
Dimensions according to
ANSI B 16-11 — 1980

Nominal pipe size	3000						6000					
	A		H		G		A		H		G	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
1/4	25	0.97	25	1.00	3,5	0.130	29	1.12	33	1.31	6,5	0.260
3/8	29	1.12	33	1.31	3,5	0.138	33	1.31	38	1.50	7,0	0.275
1/2	33	1.31	38	1.50	4,0	0.161	38	1.50	46	1.81	8,0	0.321
3/4	38	1.50	46	1.81	4,5	0.170	44	1.75	56	2.19	8,5	0.336
1	44	1.75	56	2.19	5,0	0.196	51	2.00	62	2.44	10,0	0.391
1 1/4	51	2.00	62	2.44	5,5	0.208	60	2.38	75	2.97	10,5	0.417
1 1/2	60	2.38	75	2.97	5,5	0.219	64	2.50	84	3.31	11,0	0.436
2	64	2.50	84	3.31	7,0	0.281	83	3.25	102	4.00	12,0	0.476
2 1/2	83	3.25	102	4.00	7,5	0.301	95	3.75	121	4.75	15,5	0.602
3	95	3.75	121	4.75	9,0	0.348	106	4.19	146	5.75	16,5	0.655
4	114	4.50	152	6.00	11,0	0.440	114	4.50	152	6.00	18,5	0.735

内螺纹 45° 弯头

45° elbows

class 3000 lb — 6000 lb



Thread according to
ANSI B 1.20.1 — 1983

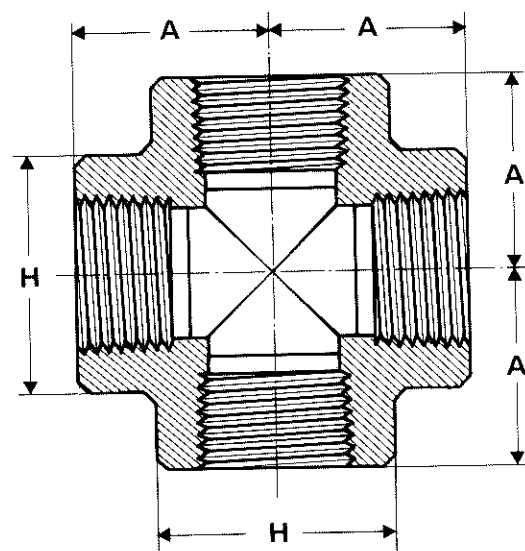
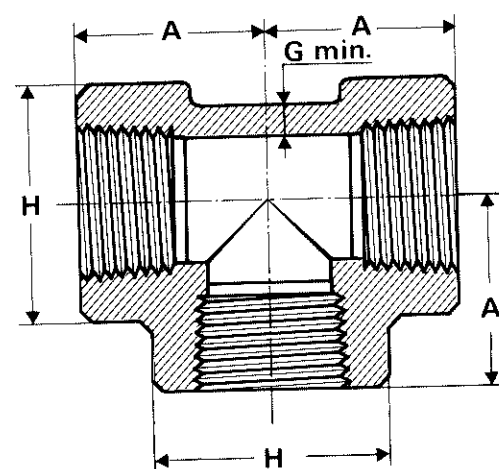
Dimensions according to
ANSI B 16-11 — 1980

Nominal pipe size	3000						6000					
	C		H		G		C		H		G	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
1/4	19	0.75	25	1.00	3,5	0.130	22	0.88	33	1.31	6,5	0.260
3/8	22	0.88	33	1.31	3,5	0.138	25	1.00	38	1.50	7,0	0.275
1/2	25	1.00	38	1.50	4,0	0.161	29	1.12	46	1.81	8,0	0.321
3/4	29	1.12	46	1.81	4,5	0.170	33	1.31	56	2.19	8,5	0.336
1	33	1.31	56	2.19	5,0	0.196	35	1.38	62	2.44	10,0	0.391
1 1/4	35	1.38	62	2.44	5,5	0.208	43	1.69	75	2.97	10,5	0.417
1 1/2	43	1.69	75	2.97	5,5	0.219	44	1.72	84	3.31	11,0	0.436
2	45	1.72	84	3.31	7,0	0.281	52	2.08	102	4.00	12,0	0.476
2 1/2	52	2.08	102	4.00	7,5	0.301	64	2.50	121	4.75	15,5	0.602
3	64	2.50	121	4.75	9,0	0.348	79	3.12	146	5.75	16,5	0.655
4	79	3.12	152	6.00	11,0	0.440	79	3.12	152	6.00	18,5	0.735

内螺纹三通 tees

内螺纹四通 crosses

class 3000 lb — 6000 lb



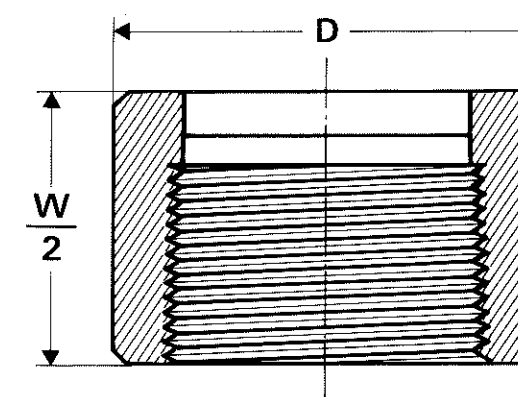
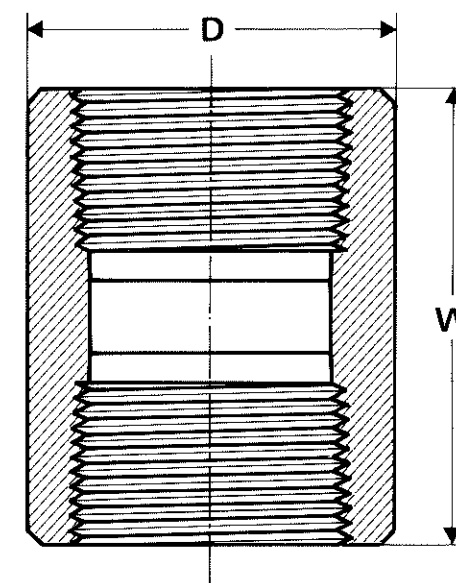
Thread according to
ANSI B 1.20.1 — 1983

Dimensions according to
ANSI B 16-11 — 1980

Nominal pipe size	3000						6000					
	A		H		G		A		H		G	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
1/4	25	0.97	25	1.00	3,5	0.130	29	1.12	33	1.31	6,5	0.260
3/8	29	1.12	33	1.31	3,5	0.130	33	1.31	38	1.50	7,0	0.275
1/2	33	1.31	38	1.50	4,0	0.161	38	1.50	46	1.81	8,0	0.321
3/4	38	1.50	46	1.81	4,5	0.170	44	1.75	56	2.19	8,5	0.336
1	44	1.75	56	2.19	5,0	0.196	51	2.00	62	2.44	10,0	0.391
1 1/4	51	2.00	62	2.44	5,5	0.208	60	2.38	75	2.97	10,5	0.417
1 1/2	60	2.38	75	2.97	5,5	0.219	64	2.50	84	3.31	11,0	0.436
2	64	2.50	84	3.31	7,0	0.281	83	3.25	102	4.00	12,0	0.476
2 1/2	83	3.25	102	4.00	7,5	0.301	95	3.75	121	4.75	15,5	0.602
3	95	3.75	121	4.75	9,0	0.348	106	4.19	146	5.75	16,5	0.655
4	114	4.50	152	6.00	11,0	0.440	114	4.50	152	6.00	18,5	0.735

内螺纹接头 half-couplings

class 3000 lb — 6000 lb



Thread according to
ANSI B 1.20.1 — 1983

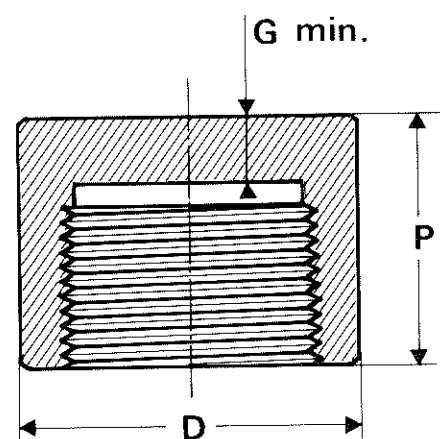
Dimensions according to
ANSI B 16-11 — 1980

Nominal pipe size	3000				6000			
	W		D		W		D	
	mm	inches	mm	inches	mm	inches	mm	inches
1/4	35	1.38	19	0.75	35	1.38	25	1.00
3/8	38	1.50	22	0.88	38	1.50	32	1.25
1/2	48	1.88	29	1.13	48	1.88	38	1.50
3/4	51	2.00	35	1.38	51	2.00	44	1.75
1	60	2.38	44	1.75	60	2.38	57	2.25
1 1/4	67	2.62	57	2.25	67	2.62	64	2.50
1 1/2	79	3.12	64	2.50	79	3.12	76	3.00
2	86	3.38	76	3.00	86	3.38	92	3.62
2 1/2	92	3.62	92	3.62	92	3.62	108	4.25
3	108	4.25	108	4.25	108	4.25	127	5.00
4	121	4.75	140	5.50	121	4.75	159	6.25

内螺纹帽

caps

class 3000 lb — 6000 lb



Thread according to
ANSI B 1.20.1 — 1983

Dimensions according to
ANSI B 16-11 — 1980

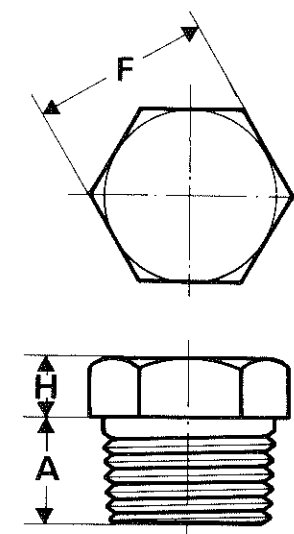
Nominal pipe size	3000						6000					
	P		D		G		P		D		G	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
1/4	25	1.00	19	0.75	5,0	0.19	27	1.06	25	1.00	6,5	0.25
3/8	25	1.00	22	0.88	5,0	0.19	27	1.06	32	1.25	6,5	0.25
1/2	32	1.25	29	1.12	6,5	0.25	33	1.31	38	1.50	8,0	0.31
3/4	37	1.44	35	1.38	6,5	0.25	38	1.50	44	1.75	8,0	0.31
1	41	1.62	44	1.75	9,5	0.38	43	1.69	57	2.25	11,0	0.44
1 1/4	44	1.75	57	2.25	9,5	0.38	46	1.81	64	2.50	11,0	0.44
1 1/2	44	1.75	64	2.50	11,0	0.44	48	1.88	76	3.00	12,5	0.50
2	48	1.88	76	3.00	12,5	0.50	51	2.00	92	3.62	16,0	0.62
2 1/2	60	2.38	92	3.62	16,0	0.62	64	2.50	108	4.25	19,0	0.75
3	65	2.56	108	4.25	19,0	0.75	68	2.69	127	5.00	22,0	0.88
4	68	2.69	140	5.50	22,0	0.88	75	2.94	159	6.25	28,5	1.12

六角塞

series 3000 — 6000

hex head plugs

class 3000 lb — 6000 lb



Thread according to
ANSI B 1.20.1 — 1983

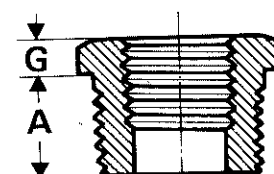
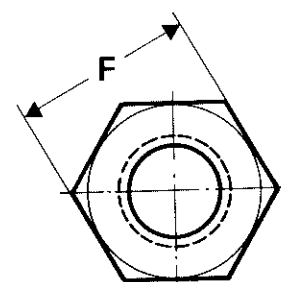
Dimensions according to
ANSI B 16-11 — 1980

Nominal pipe size	3000 — 6000					
	A min.		F nominal		H min.	
	mm	inches	mm	inches	mm	inches
1/4	11,0	0.44	16,0	0.62	6	0.25
3/8	12,5	0.50	17,5	0.69	8	0.31
1/2	14,5	0.56	22,0	0.88	8	0.31
3/4	16,0	0.62	27,0	1.06	10	0.38
1	19,0	0.75	35,0	1.38	10	0.38
1 1/4	20,5	0.81	44,5	1.75	14	0.56
1 1/2	20,5	0.81	51,0	2.00	16	0.62
2	22,0	0.88	63,5	2.50	17	0.69
2 1/2	27,0	1.06	76,0	3.00	19	0.75
3	28,5	1.12	89,0	3.50	21	0.81
4	32,0	1.25	117,5	4.62	25	1.00

外内螺纹变径接头

hex head bushings

class 3000 lb — 6000 lb



Threads according to
ANSI B 1.20.1 — 1983

Dimensions according to
ANSI B 16-11 — 1980

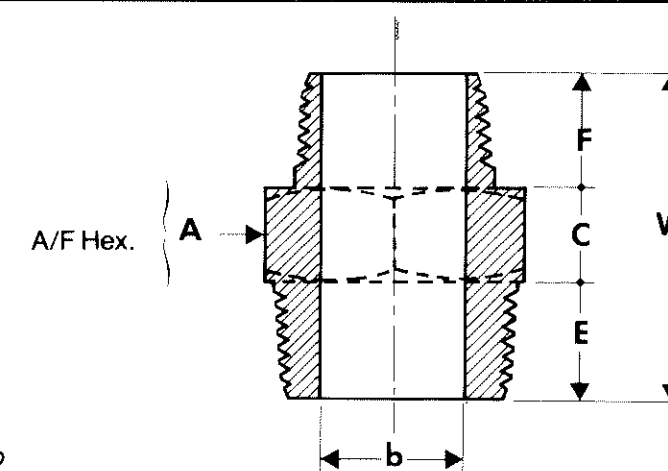
Nominal pipe sizes	3000 — 6000					
	A min.		F nominal		G min.	
	mm	inches	mm	inches	mm	inches
3/8 x 1/4	12,5	0.50	17,5	0.69	4	0.16
1/2 x 3/8	14,5	0.56	22,0	0.86	5	0.19
1/2 x 1/4	14,5	0.56	22,0	0.86	5	0.19
3/4 x 1/2	16,0	0.62	27,0	1.06	6	0.22
3/4 x 1/4	16,0	0.62	27,0	1.06	6	0.22
1 x 3/4	19,0	0.75	35,0	1.38	6	0.25
1 x 1/2	19,0	0.75	35,0	1.38	6	0.25
1 x 1/4	19,0	0.75	35,0	1.38	6	0.25
1 1/4 x 1	20,5	0.81	44,5	1.75	7	0.28
1 1/2 x 1	20,5	0.81	51,0	2.00	8	0.31
1 1/2 x 3/4	20,5	0.81	51,0	2.00	8	0.31
1 1/2 x 1/2	20,5	0.81	51,0	2.00	8	0.31
2 x 1 1/2	22,0	0.88	63,5	2.50	9	0.34
2 x 1	22,0	0.88	63,5	2.50	9	0.34
2 1/2 x 2	27,0	1.06	76,0	3.00	10	0.38
3 x 2	28,5	1.12	89,0	3.50	10	0.41
4 x 3	32,0	1.25	117,5	4.62	13	0.50
4 x 2	32,0	1.25	117,5	4.62	13	0.50

外螺纹变径接头

série 3000 — 6000

reducing hexagonal nipples

class 3000 lb — 6000 lb



Thread according to
ANSI B 1.20.1 — 1983

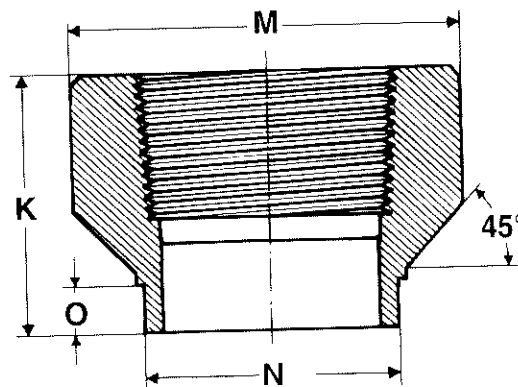
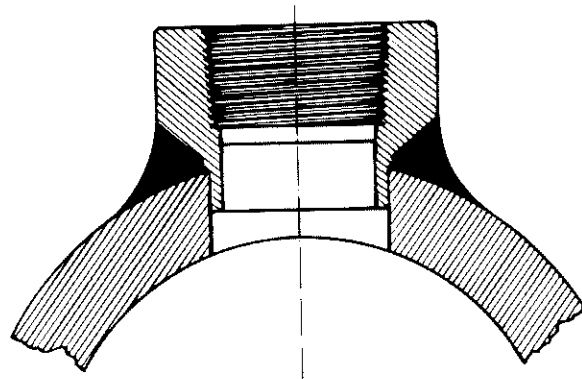
Dimensions according to
BS 3799 - 1974

Nominal size		A (mini)		E (mini)		F (mini)		C (mini)		W (mini)		B ★			
Pouces	mm	mm	Inc.	mm	Inc.	mm	Inc.	mm	Inc.	mm	Inc.	3000		6000	
Inches	mm											mm	Inc.	mm	Inc.
1/4 x 1/8	8 x 6	15	0.59	15	0.59	10	0.39	6	0.24	31	1.22	5	0.20	2	0.08
3/8 x 1/4	10 x 8	18	0.71	16	0.63	15	0.59	8	0.31	39	1.54	8	0.31	6	0.24
1/2 x 3/8	15 x 10	22	0.87	20	0.79	16	0.63	8	0.31	44	1.73	11	0.43	8	0.31
1/2 x 1/4	15 x 8	22	0.87	20	0.79	15	0.59	8	0.31	43	1.69	8	0.31	6	0.24
3/4 x 1/2	20 x 15	27	1.06	21	0.83	20	0.79	9	0.35	50	1.97	14	0.55	11	0.43
3/4 x 3/8	20 x 10	27	1.06	21	0.83	16	0.63	9	0.35	46	1.81	11	0.43	8	0.31
1 x 3/4	25 x 20	35	1.38	25	0.98	21	0.83	10	0.39	56	2.20	19	0.75	13	0.51
1 x 1/2	25 x 15	35	1.38	25	0.98	20	0.79	10	0.39	55	2.17	14	0.55	11	0.43
1 1/2 x 1	40 x 25	50	1.97	26	1.02	25	0.98	16	0.63	67	2.64	24	0.94	17	0.67
1 1/2 x 3/4	40 x 20	50	1.97	26	1.02	21	0.83	16	0.63	63	2.48	19	0.75	13	0.51
1 1/2 x 1/2	40 x 15	50	1.97	26	1.02	20	0.79	16	0.63	62	2.44	14	0.55	11	0.43
2 x 1 1/2	50 x 40	62	2.44	27	1.06	26	1.02	17	0.67	70	2.76	38	1.50	30	1.18
2 x 1	50 x 25	62	2.44	27	1.06	25	0.98	18	0.71	70	2.76	24	0.94	17	0.67
2 x 3/4	50 x 20	62	2.44	27	1.06	21	0.83	17	0.67	65	2.60	19	0.75	13	0.51
2 x 1/2	50 x 15	62	2.44	27	1.06	20	0.79	18	0.71	65	2.60	14	0.55	11	0.43

★ Dimension «b» is nominal and is subject to normal manufacturing tolerances.

class 3000 lb - 6000 lb

class 3000 lb - 6000 lb

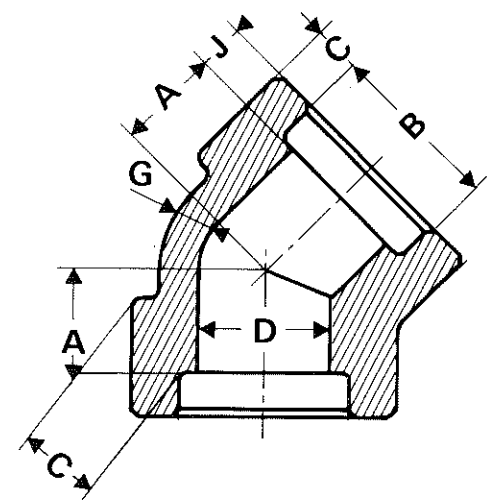
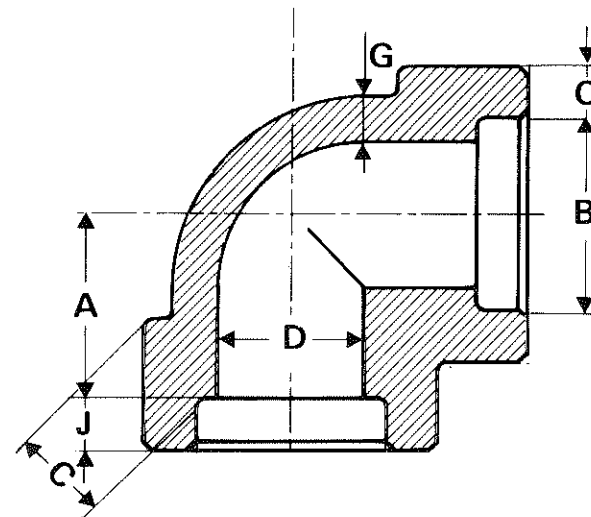


Thread according to
ANSI B 1.20.1 - 1983

From 1/4" to 2" L = 0.375 in

Diamètre nominal Nominal pipe size	3000 - 6000					
	K (1)		M (1)		N (1)	
	mm	inches	mm	inches	mm	inches
1/4	30,5	1.20	28,0	1.10	14,0	0.55
3/8	30,5	1.20	32,0	1.26	17,4	0.69
1/2	33,5	1.32	38,0	1.50	21,6	0.85
3/4	35,0	1.38	44,5	1.75	26,9	1.06
1	43,0	1.69	57,5	2.26	33,6	1.32
1 1/4	48,0	1.89	63,5	2.50	42,4	1.67
1 1/2	51,0	2.00	76,1	3.00	48,5	1.91
2	57,5	2.26	92,0	3.62	60,9	2.40

(1) Dimension not listed in ANSI B 16.11 - 1980 and BS 3799 - 1974 may vary according to the manufacturer.

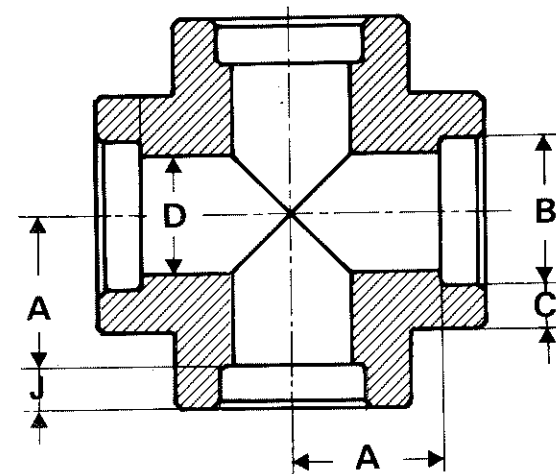
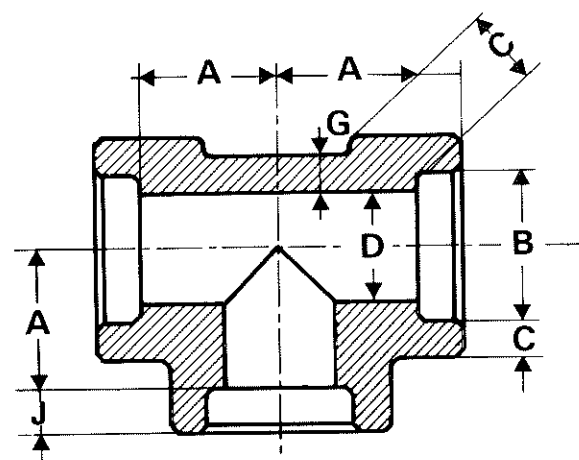


Socket welding end and dimensions according to ANSI B 16-11 - 1980

For dimensions B - C - D - G - J, refer to dimensions of S.W. fittings shown in page 95.

nominal Nominal pipe size	Center to bottom of socket A									
	90°				45°				Tolérances ±	
	3000		6000		3000		6000			
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
1/4	11,0	0.44	13,5	0.53	8,0	0.31	8,0	0.31	1,0	0.03
3/8	13,5	0.53	15,5	0.62	7,5	0.31	11,5	0.44	1,5	0.06
1/2	15,5	0.62	19,5	0.75	11,5	0.44	12,5	0.50	1,5	0.06
3/4	19,5	0.75	22,5	0.88	12,5	0.50	14,5	0.56	1,5	0.06
1	22,0	0.88	27,0	1.06	14,0	0.56	17,0	0.69	2,0	0.08
1 1/4	27,0	1.06	32,0	1.25	17,0	0.69	21,0	0.81	2,0	0.08
1 1/2	32,0	1.25	38,0	1.50	21,0	0.81	25,0	1.00	2,0	0.08
2	38,0	1.50	41,0	1.62	25,0	1.00	29,0	1.12	2,0	0.08
2 1/2	41,5	1.62			29,0	1.12			2,5	0.10
3	57,5	2.25			31,5	1.25			2,5	0.10
4	66,5	2.62			41,5	1.62			2.5	0.10

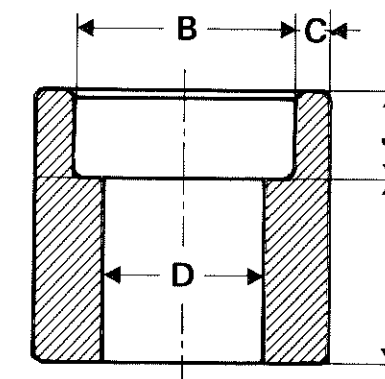
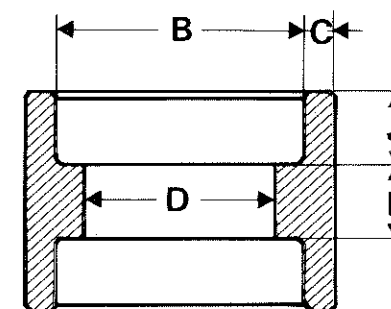
class 3000 lb — 6000 lb



Socket welding end and dimensions according to ANSI B 16-11 — 1980

Nominal pipe size	Center to bottom of socket A					
	3000		6000		Tolerances $\pm$	
	mm	inches	mm	inches	mm	inches
1/4	11,0	0.44	13,5	0.53	1,0	0.03
3/8	13,5	0.53	15,5	0.62	1,5	0.06
1/2	15,5	0.62	19,5	0.75	1,5	0.06
3/4	19,5	0.75	22,5	0.88	1,5	0.06
1	22,0	0.88	27,0	1.06	2,0	0.08
1 1/4	27,0	1.06	32,0	1.25	2,0	0.08
1 1/2	32,0	1.25	38,0	1.50	2,0	0.08
2	38,0	1.50	41,0	1.62	2,0	0.08
2 1/2	41,5	1.62			2,5	0.10
3	57,5	2.25			2,5	0.10
4	66,5	2.62			2,5	0.10

class 3000 lb — 6000 lb



Socket welding end and dimensions according to ANSI B 16-11 — 1980

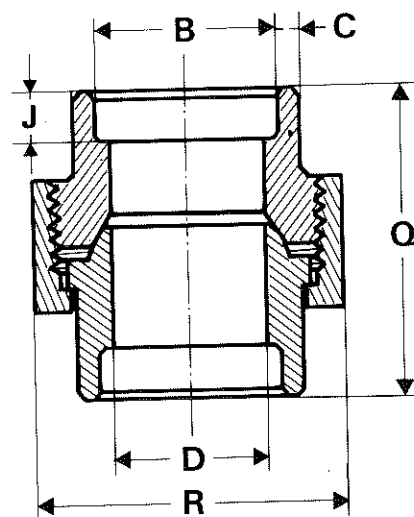
Nominal pipe size	Laying lengths											
	Couplings - E						Half couplings - F					
	3000		6000		Tolerances $\pm$		3000		6000		Tolerances $\pm$	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
1/4	6,5	0.25	6,5	0.25	1,5	0.06	16,0	0.62	16,0	0.62	1,0	0.03
3/8	6,0	0.25	6,0	0.25	3,0	0.12	17,5	0.69	17,5	0.69	1,5	0.06
1/2	9,5	0.38	9,5	0.38	3,5	0.12	22,5	0.88	22,5	0.88	1,5	0.06
3/4	9,5	0.38	9,5	0.38	3,5	0.12	23,5	0.94	23,5	0.94	1,5	0.06
1	13,0	0.50	13,0	0.50	4,0	0.16	29,0	1.12	29,0	1.12	2,0	0.08
1 1/4	13,0	0.50	13,0	0.50	4,0	0.16	30,0	1.19	30,0	1.19	2,0	0.08
1 1/2	13,0	0.50	13,0	0.50	4,0	0.16	32,0	1.25	32,0	1.25	2,0	0.08
2	19,0	0.75	19,0	0.75	4,0	0.16	41,0	1.62	41,0	1.62	2,0	0.08
2 1/2	19,0	0.75	19,0	0.75	5,0	0.20	42,5	1.69	42,5	1.69	2,5	0.10
3	19,0	0.75	19,0	0.75	5,0	0.20	44,5	1.75	44,5	1.75	2,5	0.10
4	19,0	0.75	19,0	0.75	5,0	0.20	47,5	1.88	47,5	1.88	2,5	0.10

套焊活动接头

unions

套焊支管接头

class 3000 lb — 6000 lb



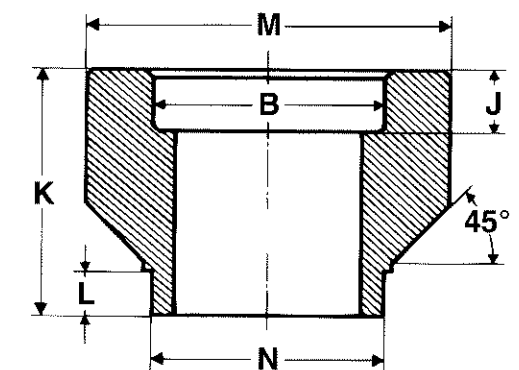
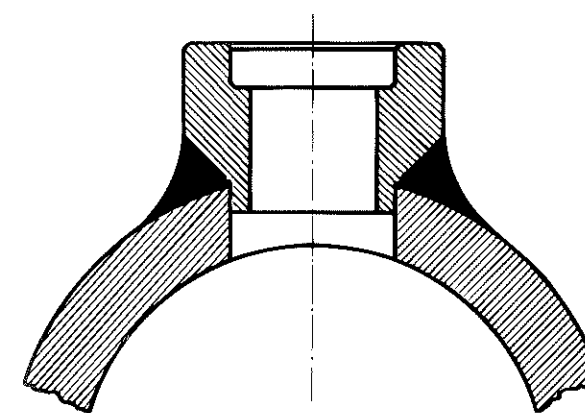
Socket welding end according to ANSI B 16-11 — 1980

Nominal pipe size	3000				6000			
	Q (1)		R (1)		Q (1)		R (1)	
	mm	inches	mm	inches	mm	inches	mm	inches
1/4	42,5	1.67	36,0	1.42	54,0	2.13	46,0	1.81
3/8	47,5	1.87	41,0	1.62	57,0	2.25	51,0	2.00
1/2	52,0	2.05	46,0	1.81	69,0	2.72	60,0	2.36
3/4	57,0	2.25	56,0	2.20	72,0	2.84	72,0	2.84
1	63,0	2.48	65,0	2.56	80,0	3.15	80,0	3.15
1 1/4	70,0	2.76	78,0	3.07	89,0	3.50	94,0	3.70
1 1/2	78,0	3.07	86,0	3.39	108,0	4.25	100,0	3.94
2	89,0	3.50	103,0	4.06	114,0	4.49	122,0	4.80
2 1/2	114,0	4.49	122,0	4.80				
3	130,0	5.12	144,0	5.67				
4	150,0	5.91	180,0	7.09				

Dimensions not listed in ANSI B 16.11 - 1980 and BS 3799 - 1974 may vary according to the manufacturer.

welding bosses

class 3000 lb — 6000 lb



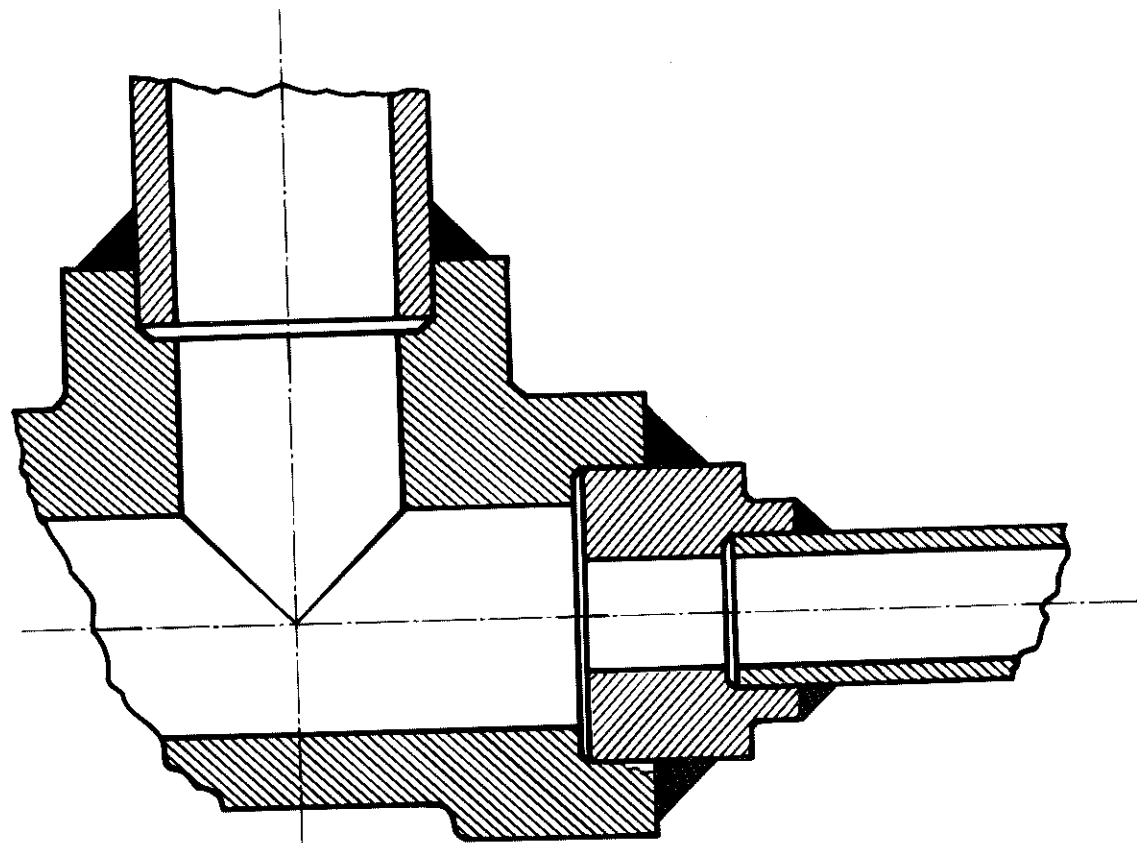
From 1/4" to 2" L = 0.375 in

Socket welding end according to ANSI B 16-11 — 1980

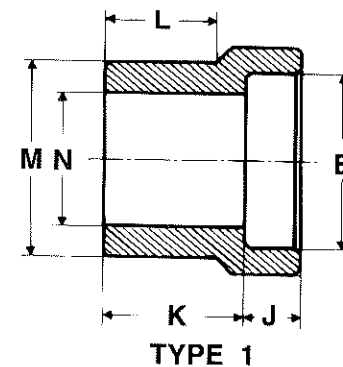
Diamètre nominal Nominal pipe size	3000 — 6000					
	K (1)		M (1)		N (1)	
	mm	inches	mm	inches	mm	inches
1/4	30,5	1.20	28,0	1.10	14,0	0.55
3/8	30,5	1.20	32,0	1.26	17,4	0.69
1/2	33,5	1.32	38,0	1.50	21,6	0.85
3/4	35,0	1.38	44,5	1.75	26,9	1.06
1	43,0	1.69	57,5	2.26	33,6	1.32
1 1/4	48,0	1.89	63,5	2.50	42,4	1.67
1 1/2	51,0	2.00	76,1	3.00	48,5	1.91
2	57,5	2.26	92,0	3.62	60,9	2.40

Dimensions not listed in ANSI B 16.11 - 1980 and BS 3799 - 1974 may vary according to the manufacturer.

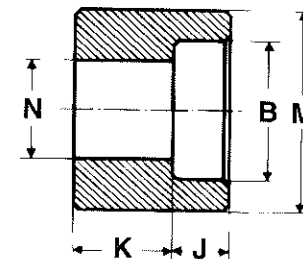
application of reducer insert



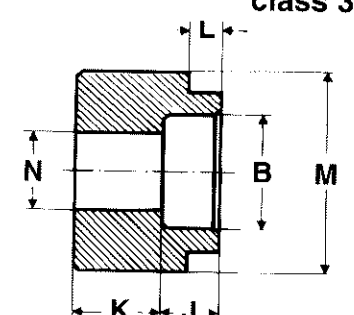
class 3000 lb



TYPE 1



TYPE 2



TYPE 3

Socket welding end according to ANSI B 16-11 - 1980

Diamètres nominaux Nominal pipe sizes	T Y P E	M (1)		N (1)		K (1)		L (1)	
		mm	inches	mm	inches	mm	inches	mm	inches
1/2 × 3/8	1	21,6	0.850	11	0.44	24	0.94	20	0.78
1/2 × 1/4	2	21,6	0.850	7,5	0.30	15,5	0.62		
1/2 × 1/8	3	21,6	0.850	5,5	0.22	15,5	0.62	7	0.28
3/4 × 1/2	1	26,9	1.060	14	0.56	27	1.06	22	0.87
3/4 × 3/8	2	26,9	1.060	11	0.44	15,5	0.62		
3/4 × 1/4	3	26,9	1.060	7,5	0.30	15,5	0.62	7	0.28
3/4 × 1/8	3	26,9	1.060	5,5	0.22	15,5	0.62	7	0.28
1 × 3/4	1	33,6	1.325	19	0.75	28,5	1.12	23	0.91
1 × 1/2	2	33,6	1.325	14	0.56	24	0.94		
1 × 3/8	3	33,6	1.325	11	0.44	23	0.90	7	0.28
1 × 1/4	3	33,6	1.325	7,5	0.30	24	0.94	7	0.28
1 1/4 × 1	1	42,4	1.670	24,5	0.97	31,5	1.25	24,5	0.97
1 1/4 × 3/4	2	42,4	1.670	19	0.75	22	0.87		
1 1/4 × 1/2	3	42,4	1.670	14	0.56	24,5	0.97	7	0.28
1 1/2 × 1 1/4	1	48,5	1.910	32,5	1.28	33,5	1.31	27	1.06
1 1/2 × 1	2	48,5	1.910	24,5	0.97	33,5	1.31		
1 1/2 × 3/4	3	48,5	1.910	19	0.75	22	0.87	8	0.32
1 1/2 × 1/2	3	48,5	1.910	14	0.56	26	1.03	7	0.28
2 × 1 1/2	2	60,9	2.400	38	1.50	27	1.06		
2 × 1 1/4	3	60,9	2.400	32,5	1.28	25,5	1.00	8	0.32
2 × 1	3	60,9	2.400	24,5	0.97	25,5	1.00	8	0.32
2 × 3/4	3	60,9	2.400	19	0.75	25,5	1.00	8	0.32
2 × 1/2	3	60,9	2.400	14	0.56	29,5	1.16	7	0.28
2 1/2 × 2	1	73,6	2.900	49	1.93	41,5	1.63	30	1.19
2 1/2 × 1 1/2	3	73,6	2.900	38	1.50	27,5	1.09	8	0.32
2 1/2 × 1 1/4	3	73,6	2.900	32,5	1.28	29,5	1.16	8	0.32
2 1/2 × 1	3	73,6	2.900	24,5	0.97	29,5	1.16	8	0.32
3 × 2 1/2	1	89,6	3.530	59	2.32	46	1.81	33,5	1.32
3 × 2	3	89,6	3.530	49	1.93	41,5	1.63	10	0.40
3 × 1 1/2	3	89,6	3.530	38	1.50	42	1.66	8	0.32
3 × 1 1/4	3	89,6	3.530	32,5	1.28	42,5	1.67	8	0.32
3 × 1	3	89,6	3.530	24,5	0.97	39	1.53	8	0.32

Dimension not listed in ANSI B 16.11 - 1980 and BS 3799 - 1974 may vary according to the manufacturer.