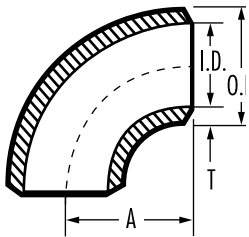
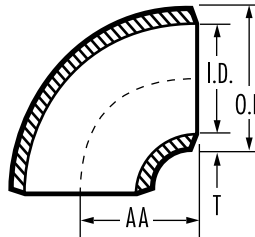


NOMINAL PIPE SIZE	OUTSIDE DIAMETER O.D.	SCHEDULE 10S		SCHEDULE 40S		SCHEDULE 80S		90° ELBOW	90° ELBOW	45° ELBOW	TEE
		WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.	LONG RADIUS A	SHORT RADIUS AA	LONG RADIUS B	C
1/2	0.840	.083	.674	.109	.622	.147	.546	1½	—	5/8	1
3/4	1.050	.083	.884	.113	.824	.154	.742	1⅝	—	7/16	1⅛
1	1.315	.109	1.097	.133	1.049	.179	.957	1½	1	7/8	1½
1¼	1.660	.109	1.442	.140	1.380	.191	1.278	1⅞	1¼	1	1⅞
1½	1.900	.109	1.682	.145	1.610	.200	1.500	2¼	1½	1⅛	2¼
2	2.375	.109	2.157	.154	2.067	.218	1.939	3	2	1⅜	2½
2½	2.875	.120	2.635	.203	2.469	.276	2.323	3¾	2½	1¾	3
3	3.500	.120	3.260	.216	3.068	.300	2.900	4½	3	2	3⅜
3½	4.000	.120	3.760	.226	3.548	.318	3.364	5¼	3½	2¼	3¾
4	4.500	.120	4.260	.237	4.026	.337	3.826	6	4	2½	4⅞
5	5.563	.134	5.295	.258	5.047	.375	4.813	7½	5	3⅛	4⅞
6	6.625	.134	6.357	.280	6.065	.432	5.761	9	6	3¾	5⅝
8	8.625	.148	8.329	.322	7.981	.500	7.625	12	8	5	7
10	10.750	.165	10.420	.365	10.020	.500	9.750	15	10	6¼	8½
12	12.750	.180	12.390	.375	12.000	.500	11.750	18	12	7½	10
14	14.000	.188	13.624	.375	13.250	.500	13.000	21	14	8¾	11
16	16.000	.188	15.624	.375	15.250	.500	15.000	24	16	10	12
18	18.000	.188	17.624	.375	17.250	.500	17.000	27	18	11¼	13½
20	20.000	.218	19.564	.375	19.250	.500	19.000	30	20	12½	15
24	24.000	.250	23.500	.375	23.250	.500	23.000	36	24	15	17

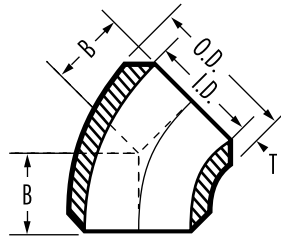
**90° ELBOW
LONG RADIUS**



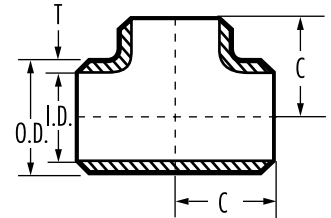
**90° ELBOW
SHORT RADIUS**



**45° ELBOW
LONG RADIUS**



TEE

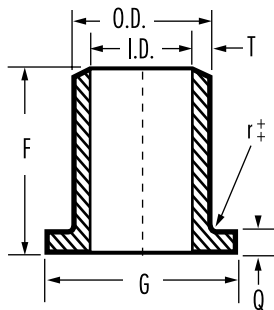


FITTING SPECIFICATION SUMMARY AND COMPARISON

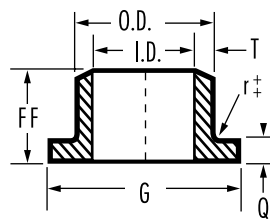
CLASS	WP-S	WP-W	WP-WX	CR
APPLICABLE STANDARDS	ANSI B16.9, B16.11, OR B16.28	ANSI B16.9 OR B16.28	ANSI B16.9 OR B16.28	MSS SP-43
PRESSURE RATINGS	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED
X-RAYS OF WELDS	SEAMLESS OR B16.28	ALL MADE BY FITTING MANUFACTURER PER UW-51	ALL PER UW-51	NONE REQUIRED
WELDING PROCEDURES	ASME SECTION IX	ASME SECTION IX	ASME SECTION IX	ASME SECTION IX
CLEANING	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED

NOMINAL PIPE SIZE	LAP JOINT STUD ENDS - ASA LENGTH & MSS LENGTH							FLANGED NIPPLE	CAP
	F	FF	Q*			G	r \ddagger	QQ	E
			LAP THICKNESS					LAP THICKNESS	TANGENT LENGTH
LONG	LONG	SCH. 10	SCH. 40	SCH. 80	DIAMETER	RADIUS			
1/2	3	2	.095	.109	.187	1 $\frac{3}{8}$	$\frac{1}{8}$		1
3/4	3	2	.097	.113	.187	1 $\frac{11}{16}$	$\frac{1}{8}$		1
1	4	2	.120	.133	.187	2	$\frac{1}{8}$		1 $\frac{1}{2}$
1 $\frac{1}{4}$	4	2	.124	.140	.191	2 $\frac{1}{2}$	$\frac{3}{16}$		1 $\frac{1}{2}$
1 $\frac{1}{2}$	4	2	.126	.145	.200	2 $\frac{7}{8}$	$\frac{1}{4}$		1 $\frac{1}{2}$
2	6	2 $\frac{1}{2}$	.130	.154	.218	3 $\frac{5}{8}$	$\frac{5}{16}$		1 $\frac{1}{2}$
2 $\frac{1}{2}$	6	2 $\frac{1}{2}$	.156	.203	.276	4 $\frac{1}{8}$	$\frac{5}{16}$		1 $\frac{1}{2}$
3	6	2 $\frac{1}{2}$	.161	.216	.300	5	$\frac{3}{8}$	Slightly Less Than Nominal Pipe Wall Thickness	2
3 $\frac{1}{2}$	6	3	.165	.226	.318	5 $\frac{1}{2}$	$\frac{3}{8}$		2 $\frac{1}{2}$
4	6	3	.169	.237	.337	6 $\frac{3}{16}$	$\frac{7}{16}$		2 $\frac{1}{2}$
5	8	3	.186	.258	.375	7 $\frac{5}{16}$	$\frac{7}{16}$		3
6	8	3 $\frac{1}{2}$	.194	.280	.432	8 $\frac{1}{2}$	$\frac{1}{2}$		3 $\frac{1}{2}$
8	8	4	.218	.322	.500	10 $\frac{5}{8}$	$\frac{1}{2}$		4
10	10	5	.245	.365	.500	12 $\frac{3}{4}$	$\frac{1}{2}$		5
12	10	6	.260	.375	.500	15	$\frac{1}{2}$		6
14	12	6	.375	.375	.500	16 $\frac{1}{4}$	$\frac{1}{2}$		6 $\frac{1}{2}$
16	12	6	.375	.375	.500	18 $\frac{1}{2}$	$\frac{1}{2}$		7
18	12	6	.375	.375	.500	21	$\frac{1}{2}$	8	
20	12	6	.375	.375	.500	23	$\frac{1}{2}$	9	
24	12	6	.375	.375	.500	27 $\frac{1}{4}$	$\frac{1}{2}$	10 $\frac{1}{2}$	

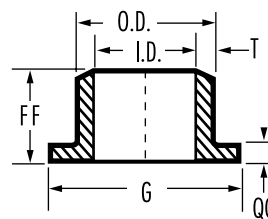
LAP JOINT STUD ENDS (ASA - TYPE A)



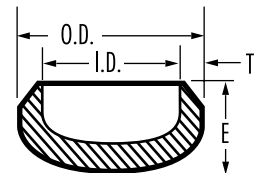
LAP JOINT STUD ENDS (MSS - TYPE A)



FLARED NIPPLE (TYPE C)



CAP



FITTING SPECIFICATION SUMMARY AND COMPARISON

CLASS	WP-S	WP-W	WP-WX	CR
APPLICABLE STANDARDS	ANSI B16.9, B16.11, OR B16.28	ANSI B16.9 OR B16.28	ANSI B16.9 OR B16.28	MSS SP-43
PRESSURE RATINGS	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED
X-RAYS OF WELDS	SEAMLESS OR B16.28	ALL MADE BY FITTING MANUFACTURER PER UW-51	ALL PER UW-51	NONE REQUIRED
WELDING PROCEDURES	ASME SECTION IX	ASME SECTION IX	ASME SECTION IX	ASME SECTION IX
CLEANING	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED

*Lap Thickness Q for Schedule 40s and 80s in sizes through 12" equal to wall thickness T. In sizes 14" and larger, the Lap Thickness for Schedule 40s and 80s is .375" and .500" respectively.

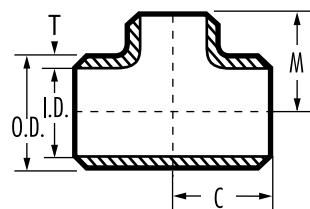
• For O.D., I.D., and wall thickness T, see facing page.

NOMINAL PIPE SIZE	REDUCING TEE		REDUCERS CONCENTRIC ECCENTRIC H LENGTH
	C RUN	M OUTLET	
3/4 x 1/2	1 1/8	1 1/8	1 1/2
1 x 1/2	1 1/2	1 1/2	2
	1 1/2	1 1/2	2
1 1/4 x 3/4	1 1/8	1 1/8	2
	1 1/8	1 1/8	2
1 1/2 x 1	2 1/4	2 1/4	2 1/2
	2 1/4	2 1/4	2 1/2
	2 1/4	2 1/4	2 1/2
	2 1/4	2 1/4	2 1/2
2 x 1	2 1/2	1 3/4	3
	2 1/2	2	3
	2 1/2	2 1/4	3
	2 1/2	2 3/8	3
2 1/2 x 1 1/4	3	2 1/4	3 1/2
	3	2 1/2	3 1/2
	3	2 5/8	3 1/2
	3	2 3/4	3 1/2
3 x 1 1/2	3 3/8	2 3/4	3 1/2
	3 3/8	2 7/8	3 1/2
	3 3/8	3	3 1/2
	3 3/8	3 1/4	3 1/2
3 1/2 x 2	—	—	4
	3 3/4	3 1/8	4
	3 3/4	3 1/4	4
	3 3/4	3 1/2	4
4 x 2 1/2	4 1/8	3 3/8	4
	4 1/8	3 1/2	4
	4 1/8	3 3/4	4
	4 1/8	3 7/8	4
5 x 3 1/2	4 7/8	4	5
	4 7/8	4 1/4	5
	4 7/8	4 3/8	5
	4 7/8	4 1/2	5

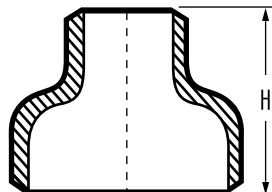
NOMINAL PIPE SIZE	REDUCING TEE		REDUCERS CONCENTRIC ECCENTRIC H LENGTH
	C RUN	M OUTLET	
6 x 2 1/2	5 5/8	4 3/4	5 1/2
	5 5/8	4 7/8	5 1/2
	5 5/8	5	5 1/2
	5 5/8	5 1/8	5 1/2
	5 5/8	5 3/8	5 1/2
8 x 3 1/2	7	6	6
	7	6 1/8	6
	7	6 3/8	6
10 x 4	8 1/2	7 1/4	7
	8 1/2	7 1/2	7
	8 1/2	7 5/8	7
12 x 5	10	8 1/2	8
	10	8 5/8	8
	10	9	8
14 x 6	11	9 3/4	13
	11	10 1/8	13
	11	10 5/8	13
16 x 8	12	10 3/4	14
	12	11 1/8	14
	12	11 5/8	14
18 x 10	13 1/2	12 1/8	15
	13 1/2	12 5/8	15
	13 1/2	13	15
20 x 12	15	13 1/8	20
	15	13 3/8	20
	15	14	20
24 x 16	17	15 5/8	20
	17	16	20
	17	16 1/2	20

NOMINAL PIPE SIZE	OUTSIDE DIAMETER O.D.	SCHEDULE 10S		SCHEDULE 40S		SCHEDULE 80S	
		WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.
1/2	0.840	.083	.674	.109	.622	.147	.546
3/4	1.050	.083	.884	.113	.824	.154	.742
1	1.315	.109	1.097	.133	1.049	.179	.957
1 1/4	1.660	.109	1.442	.140	1.380	.191	1.278
1 1/2	1.900	.109	1.682	.145	1.610	.200	1.500
2	2.375	.109	2.157	.154	2.067	.218	1.939
2 1/2	2.875	.120	2.635	.203	2.469	.276	2.323
3	3.500	.120	3.260	.216	3.068	.300	2.900
3 1/2	4.000	.120	3.760	.226	3.548	.318	3.364
4	4.500	.120	4.260	.237	4.026	.337	3.826
5	5.563	.134	5.295	.258	5.047	.375	4.813
6	6.625	.134	6.357	.280	6.065	.432	5.761
8	8.625	.148	8.329	.322	7.981	.500	7.625
10	10.750	.165	10.420	.365	10.020	.500	9.750
12	12.750	.180	12.390	.375	12.000	.500	11.750
14	14.000	.188	13.624	.375	13.250	.500	13.000
16	16.000	.188	15.624	.375	15.250	.500	15.000
18	18.000	.188	17.624	.375	17.250	.500	17.000
20	20.000	.218	19.564	.375	19.250	.500	19.000
24	24.000	.250	23.500	.375	23.250	.500	23.000

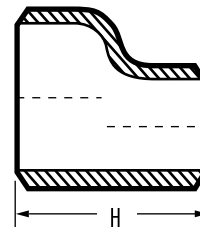
REDUCING TEE



CONCENTRIC REDUCER



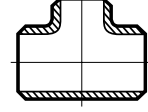
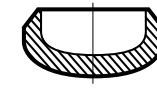
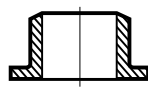
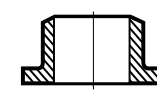
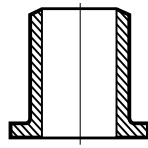
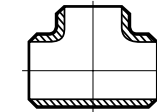
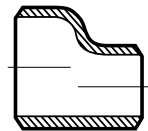
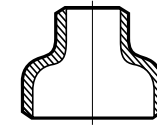
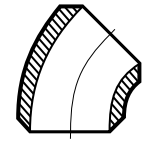
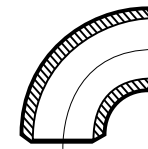
ECCENTRIC REDUCER



FITTING SPECIFICATION SUMMARY AND COMPARISON

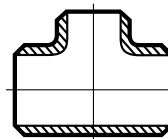
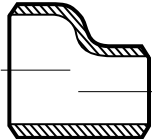
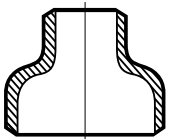
CLASS	WP-S	WP-W	WP-WX	CR
APPLICABLE STANDARDS	ANSI B16.9, B16.11, OR B16.28	ANSI B16.9 OR B16.28	ANSI B16.9 OR B16.28	MSS SP-43
PRESSURE RATINGS	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED	SAME AS PIPE WITH WHICH USED
X-RAYS OF WELDS	SEAMLESS OR B16.28	ALL MADE BY FITTING MANUFACTURER PER UW-51	ALL PER UW-51	NONE REQUIRED
WELDING PROCEDURES	ASME SECTION IX	ASME SECTION IX	ASME SECTION IX	ASME SECTION IX
CLEANING	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED	FREE FROM SCALE AND PASSIVATED

NOMINAL PIPE SIZE	90° ELBOW		45° ELBOW	TEE	LAP JOINT STUB ENDS			CAP
	LONG RADIUS	SHORT RADIUS	LONG RADIUS		ASA LENGTH	MSS LENGTH	FLARED NIPPLE (TYPE C)	
SCHEDULE 10S								
1/2	.13	—	.06	.20	—	.17	.12	.03
3/4	.16	—	.08	.28	—	.21	.15	.03
1	.38	.23	.25	.60	—	.33	.27	.10
1¼	.50	.38	.33	1.10	—	.45	.36	.13
1½	.75	.49	.47	1.50	—	.57	.43	.23
2	1.10	.81	.60	1.80	—	.91	.68	.30
2½	1.80	1.36	1.00	3.00	—	1.05	.91	.40
3	2.50	2.17	1.30	3.90	—	1.61	1.16	.72
3½	3.40	3.05	1.70	4.90	—	2.07	1.55	.83
4	4.30	3.79	2.20	5.70	—	2.52	1.79	1.16
5	7.40	6.12	3.80	12.00	—	3.44	2.50	1.61
6	11.00	9.15	5.50	17.00	—	4.79	3.42	1.93
8	21.00	17.63	11.00	25.00	—	7.62	5.57	2.78
10	36.00	35.00	18.00	37.00	—	12.10	9.32	4.66
12	57.00	40.00	29.00	54.00	—	17.90	14.80	7.05
14	78.00	52.00	39.40	59.60	—	22.30	18.60	9.20
16	102.00	68.00	51.00	75.90	—	27.50	24.90	11.50
18	129.00	86.00	64.50	94.70	—	35.20	31.40	14.50
20	185.00	143.00	92.50	130.00	—	49.80	44.50	20.50
24	306.00	202.00	153.00	200.00	—	77.40	71.90	32.90
SCHEDULE 40S								
1/2	.18	—	.09	.35	.30	.25	—	.12
3/4	.19	—	.09	.45	.40	.34	—	.16
1	.40	.26	.25	.75	.68	.43	—	.20
1¼	.60	.45	.38	1.30	.93	.60	—	.30
1½	.90	.63	.40	2.00	1.14	.75	—	.40
2	1.60	1.13	.81	3.50	2.22	1.22	—	.60
2½	3.25	2.25	1.75	6.00	3.51	1.82	—	.90
3	5.00	3.31	2.63	7.00	4.70	2.49	—	1.50
3½	6.75	4.54	3.50	9.00	5.65	3.36	—	2.00
4	9.00	6.88	4.50	12.00	6.81	4.12	—	2.50
5	15.50	11.63	7.50	21.00	11.80	5.69	—	4.50
6	24.50	17.50	12.00	34.00	15.30	8.28	—	6.50
8	50.00	37.60	23.00	55.00	23.10	13.60	—	12.00
10	88.00	63.40	43.00	85.00	39.90	23.00	—	20.00
12	125.00	80.00	62.00	120.00	49.20	32.70	—	30.00
14	160.00	101.00	80.00	165.00	63.80	37.60	—	36.00
16	206.00	131.00	100.00	195.00	73.90	46.30	—	40.00
18	260.00	175.00	126.00	249.00	85.20	64.00	—	54.00
20	320.00	215.00	160.00	342.00	94.70	74.20	—	75.00
24	460.00	302.00	238.00	528.00	116.00	116.00	—	96.00
SCHEDULE 80S								
1/2	.25	—	.19	.45	.38	—	—	.15
3/4	.25	—	.19	.60	.51	—	—	.20
1	.50	.38	.31	.88	.87	—	—	.30
1¼	.90	.63	.50	1.60	1.24	—	—	.40
1½	1.15	.88	.69	2.25	1.51	—	—	.50
2	2.20	1.55	1.19	4.00	3.10	—	—	.75
2½	4.00	2.88	2.13	7.00	4.64	—	—	1.00
3	6.50	4.20	3.50	8.50	6.36	—	—	1.75
3½	8.35	5.35	4.50	12.00	7.71	—	—	2.50
4	13.50	9.06	6.10	15.70	9.37	—	—	3.00
5	22.00	16.10	10.70	26.00	16.70	—	—	5.50
6	35.00	26.00	17.50	40.00	23.00	—	—	9.00
8	71.00	54.80	35.00	75.00	34.90	—	—	16.00
10	107.00	99.80	53.00	105.00	53.60	—	—	25.00
12	160.00	125.00	84.00	160.00	64.70	—	—	36.00
14	205.00	135.00	100.00	240.00	84.00	—	—	45.00
16	276.00	175.00	135.00	280.00	97.40	—	—	54.00
18	340.00	228.00	167.00	332.00	112.00	—	—	72.00
20	420.00	285.00	206.00	480.00	126.00	—	—	86.00
24	600.00	401.00	300.00	610.00	152.00	—	—	130.00

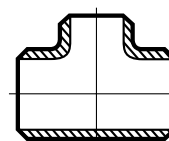
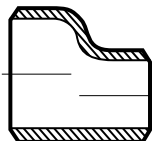
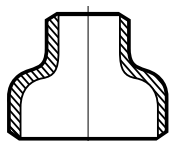


WEIGHTS MAY VARY DEPENDING UPON THE MANUFACTURER.

NOMINAL PIPE SIZE	SCHEDULE 10S		SCHEDULE 40S		SCHEDULE 80S	
	REDUCING TEE	REDUCERS	REDUCING TEE	REDUCERS	REDUCING TEE	REDUCERS
$\frac{3}{4}$ x $\frac{1}{2}$	.28	.16	.50	.17	.50	.22
1 x $\frac{1}{2}$ x $\frac{3}{4}$	.56	.37	.88	.40	1.00	.45
	.60	.38	.93	.40	1.00	.45
1 $\frac{1}{4}$ x $\frac{1}{2}$ x $\frac{3}{4}$ x 1	1.06	.39	1.50	.40	1.75	.50
	1.10	.42	1.50	.40	1.75	.50
	1.15	.44	1.50	.50	1.75	.50
1 $\frac{1}{2}$ x $\frac{1}{2}$ x $\frac{3}{4}$ x 1 x 1 $\frac{1}{4}$	1.33	.49	2.00	.50	2.50	.65
	1.41	.53	2.13	.54	2.50	.70
	1.45	.56	2.18	.62	2.50	.75
	1.50	.59	2.25	.70	2.50	.78
2 x $\frac{3}{4}$ x 1 x 1 $\frac{1}{4}$ x 1 $\frac{1}{2}$	1.37	.71	3.25	.70	4.00	1.00
	1.67	.78	3.50	.76	4.10	1.10
	1.72	.82	3.60	.84	4.13	1.15
	1.80	.85	3.75	.90	4.25	1.20
2 $\frac{1}{2}$ x 1 x 1 $\frac{1}{4}$ x 1 $\frac{1}{2}$ x 2	2.49	1.04	5.00	1.25	7.00	1.75
	2.62	1.09	5.25	1.25	7.06	1.85
	2.74	1.12	5.50	1.38	7.13	1.90
	3.00	1.18	6.00	1.50	7.19	2.00
3 x $\frac{1}{4}$ x 1 $\frac{1}{2}$ x 2 x 2 $\frac{1}{2}$	3.61	1.33	6.25	1.60	7.60	2.40
	3.65	1.39	6.25	1.70	7.68	2.50
	3.75	1.45	6.50	1.80	8.00	2.60
	3.90	1.53	6.75	2.00	8.25	2.75
3 $\frac{1}{2}$ x 1 $\frac{1}{2}$ x 2 x 2 $\frac{1}{2}$ x 3	4.20	1.73	8.00	2.50	11.5	3.25
	4.49	1.86	8.30	2.75	11.8	3.50
	4.73	1.96	8.50	2.88	12.2	3.50
	4.90	2.12	8.80	3.15	12.6	4.00
4 x 1 $\frac{1}{2}$ x 2 x 2 $\frac{1}{2}$ x 3 x 3 $\frac{1}{2}$	5.38	2.06	11.1	2.88	15.2	4.00
	5.43	2.16	11.2	3.00	15.5	4.25
	5.45	2.22	11.3	3.25	15.5	4.38
	5.60	2.28	11.6	3.38	15.6	4.50
	5.70	2.41	11.8	3.50	15.6	4.75
5 x 2 x 2 $\frac{1}{2}$ x 3 x 3 $\frac{1}{2}$ x 4	10.8	3.35	19.0	5.00	23.5	6.50
	11.1	3.64	19.5	5.25	24.0	7.00
	11.4	3.90	20.0	5.50	24.5	7.50
	11.7	4.03	20.5	5.75	25.0	7.75
	12.0	4.29	21.0	6.00	25.5	8.25



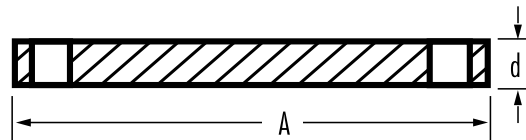
NOMINAL PIPE SIZE	SCHEDULE 10S		SCHEDULE 40S		SCHEDULE 80S		
	REDUCING TEE	REDUCERS	REDUCING TEE	REDUCERS	REDUCING TEE	REDUCERS	
6	x 2½	15.7	4.79	32.0	7.25	36.0	10.0
	x 3	16.0	5.04	32.5	8.00	37.0	10.5
	x 3½	16.2	5.28	33.0	8.25	38.2	11.0
	x 4	16.5	5.52	33.5	8.25	39.2	11.5
	x 5	17.0	5.76	34.5	8.50	40.0	12.0
8	x 3½	23.4	6.88	50.7	11.0	70.5	16.5
	x 4	23.9	7.10	51.7	11.0	71.7	17.0
	x 5	24.5	7.51	53.0	12.0	73.0	18.0
	x 6	25.0	7.80	54.0	13.2	74.0	18.7
10	x 4	30.1	10.5	80.0	20.0	104.	25.5
	x 5	32.3	12.6	81.0	21.0	106.	28.0
	x 6	36.3	13.3	83.0	21.5	108.	29.5
	x 8	37.0	14.0	84.5	22.0	109.	29.5
12	x 5	49.8	18.7	110.	30.0	160.	39.0
	x 6	51.7	19.2	114.	31.0	165.	40.0
	x 8	53.0	20.4	117.	32.0	175.	42.0
	x 10	54.0	20.9	119.	34.0	184.	43.5
14	x 8	52.5	29.8	155.	58.5	225.	78.5
	x 10	53.5	30.5	158.	59.2	233.	79.2
	x 12	54.3	31.2	160.	60.0	237.	80.0
16	x 8	67.1	33.6	180.	68.5	260.	88.5
	x 10	69.3	34.1	186.	69.5	266.	89.0
	x 12	71.2	34.6	191.	70.0	270.	90.0
	x 14	72.4	35.7	194.	71.0	275.	91.0
18	x 10	83.5	45.6	222.	82.0	296.	112.
	x 12	86.5	46.6	230.	83.0	307.	113.
	x 14	88.7	47.5	236.	84.0	315.	114.
	x 16	90.2	48.5	241.	85.0	321.	115.
20	x 10	126.	83.2	332.	117.	466.	164.
	x 12	126.	84.6	334.	120.	469.	167.
	x 14	126.	85.5	336.	122.	472.	168.
	x 16	127.	86.3	338.	124.	475.	169.
	x 18	128.	87.6	340.	125.	477.	170.
24	x 12	191.	107.	510.	139.	592.	179.
	x 14	192.	121.	513.	141.	595.	185.
	x 16	193.	125.	516.	145.	598.	190.
	x 18	194.	128.	519.	148.	601.	195.
	x 20	195.	132.	522.	150.	604.	200.



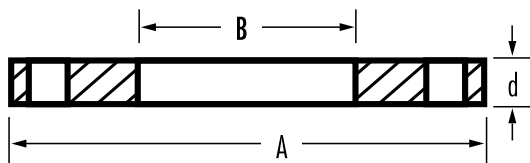
ASTM A351

NOMINAL PIPE SIZE	COMMON DIMENSIONS		NO. OF BOLT HOLES	DIA. OF BOLT HOLES	BOLT CIRCLE	SLIP-ON TUBE "O.D."	SLIP-ON PIPE "IPS"
	A	d				B	C
1/2	3½	½	4	5/8	2¾	.530	.88
3/4	3¾	½	4	5/8	2¾	.780	1.09
1	4¼	½	4	5/8	3⅛	1.030	1.36
1¼	4⅝	½	4	5/8	3½	1.280	1.70
1½	5	½	4	5/8	3⅞	1.530	1.95
2	6	½	4	¾	4¾	2.030	2.44
2½	7	½	4	¾	5½	2.530	2.94
3	7½	½	4	¾	6	3.030	3.57
4	9	½	8	¾	7½	4.030	4.57
5	10	½	8	7/8	8½	5.030	5.66
6	11	½	8	7/8	9½	6.030	6.63
8	13½	½	8	7/8	11¾	8.030	8.72
10	16	½	12	1	14¼	10.030	10.88
12	19	½	12	1	17	12.030	12.88
14	21	½	12	1	18¾	14.030	14.10
16	23½	½	16	1	21¼	16.030	16.12
18	25	½	16	1	22¾	18.030	18.17

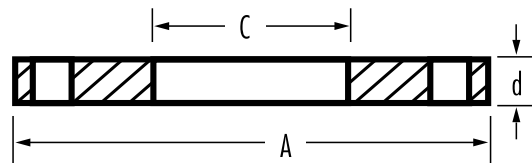
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SLIP-ON TUBE "O.D."

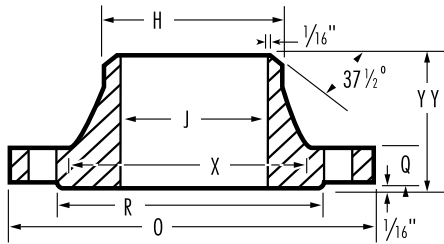


SLIP-ON PIPE "IPS"

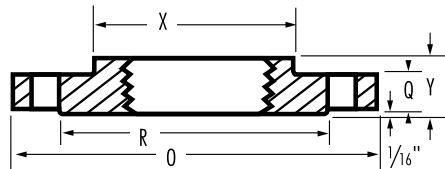


NOMINAL PIPE SIZE	COMMON DIMENSIONS				NO. OF BOLT HOLES	DIA. OF BOLT HOLES	BOLT CIRCLE	WELD NECK			SLIP-ON & THREADED	SLIP-ON	LAP JOINT		
	O	Q	R	X				YY	H	J	Y	B	r	YV	BB
1/2	3½	7/16	1¾	1¾	4	5/8	2¾	1¾	.84	.62	5/8	.88	1/8	5/8	.90
3/4	3¾	½	1½	1½	4	5/8	2¾	2¼	1.05	.82	5/8	1.09	1/8	5/8	1.11
1	4¼	9/16	2	1½	4	5/8	3¾	2¾	1.32	1.05	11/16	1.36	1/8	11/16	1.38
1¼	4¾	5/8	2½	2½	4	5/8	3½	2¼	1.66	1.38	13/16	1.70	3/16	13/16	1.72
1½	5	11/16	2¾	2¾	4	5/8	3¾	2¼	1.90	1.61	7/8	1.95	¼	7/8	1.97
2	6	¾	3½	3¼	4	¾	4¾	2½	2.38	2.07	1	2.44	5/16	1	2.46
2½	7	7/8	4¼	3¾	4	¾	5½	2¾	2.88	2.47	1½	2.94	5/16	1½	2.97
3	7½	15/16	5	4¼	4	¾	6	2¾	3.50	3.07	1¾	3.57	3/8	1¾	3.60
3½	8½	15/16	5½	4¾	8	¾	7	2¾	4.00	3.55	1¾	4.07	3/8	1¾	4.10
4	9	15/16	6¾	5½	8	¾	7½	3	4.50	4.03	15/16	4.57	7/16	15/16	4.60
5	10	15/16	7½	6¾	8	7/8	8½	3½	5.56	5.05	17/16	5.66	7/16	17/16	5.69
6	11	1	8½	7¾	8	7/8	9½	3½	6.63	6.07	19/16	6.72	½	19/16	6.75
8	13½	1½	10½	9¼	8	7/8	11¾	4	8.63	7.98	1¾	8.72	½	1¾	8.75
10	16	1¾	12¾	12	12	1	14¼	4	10.75	10.02	15/16	10.88	½	15/16	10.92
12	19	1¾	15	14¾	12	1	17	4½	12.75	12.00	23/16	12.88	½	23/16	12.92
14	21	1¾	16¼	15¾	12	1½	18¾	5	14	As Specified by Purchaser	2¼	14.14	½	3/8	14.18
16	23½	17/16	18½	18	16	1½	21¼	5	16		2½	16.16	½	37/16	16.19
18	25	19/16	21	19¾	16	1¾	22¾	5½	18		211/16	18.18	½	313/16	18.20
20	27½	111/16	23	22	20	1¾	25	511/16	20		27/8	20.20	½	41/16	20.25
24	32	17/8	27¼	261/8	20	13/8	29½	6	24		3¼	24.25	½	43/8	24.25

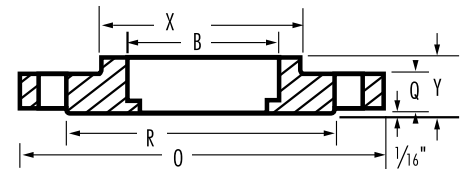
WELD NECK



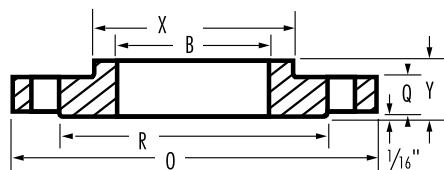
THREADED



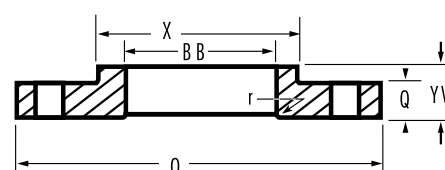
SOCKET-WELD



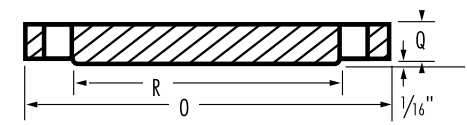
SLIP-ON



LAP JOINT

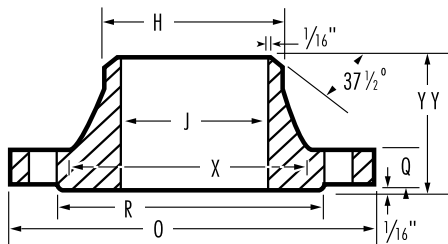


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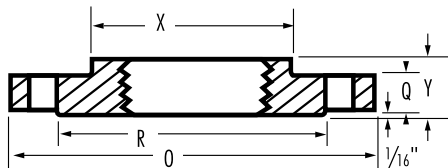


NOMINAL PIPE SIZE	COMMON DIMENSIONS				NO. OF BOLT HOLES	DIA. OF BOLT HOLES	BOLT CIRCLE	WELD NECK			SLIP-ON & THREADED	SLIP-ON	LAP JOINT		
	O	Q	R	X				YY	H	J	Y	B	r	YV	BB
1/2	3 ³ / ₄	9 ¹ / ₁₆	1 ³ / ₈	1 ¹ / ₂	4	5 ⁵ / ₈	2 ⁵ / ₈	2 ¹ / ₁₆	.84	.62	7 ⁷ / ₈	.88	1 ¹ / ₈	7 ⁷ / ₈	.90
3/4	4 ⁵ / ₈	5 ⁵ / ₈	1 ¹¹ / ₁₆	1 ⁷ / ₈	4	3 ³ / ₄	3 ³ / ₄	2 ¹ / ₄	1.05	.82	1	1.09	1 ¹ / ₈	1	1.11
1	4 ⁷ / ₈	1 ¹¹ / ₁₆	2	2 ¹ / ₈	4	3 ³ / ₄	3 ¹ / ₂	2 ⁷ / ₁₆	1.32	1.05	1 ¹ / ₁₆	1.36	1 ¹ / ₈	1 ¹ / ₁₆	1.38
1 ¹ / ₄	5 ¹ / ₄	3 ³ / ₄	2 ¹ / ₂	2 ¹ / ₂	4	3 ³ / ₄	3 ³ / ₈	2 ⁹ / ₁₆	1.66	1.38	1 ¹ / ₁₆	1.70	3 ³ / ₁₆	1 ¹ / ₁₆	1.72
1 ¹ / ₂	6 ¹ / ₈	1 ³ / ₁₆	2 ⁷ / ₈	2 ³ / ₄	4	7 ⁷ / ₈	4 ¹ / ₂	2 ¹¹ / ₁₆	1.90	1.61	1 ³ / ₁₆	1.95	1 ¹ / ₄	1 ³ / ₁₆	1.97
2	6 ¹ / ₂	7 ⁷ / ₈	3 ⁵ / ₈	3 ⁵ / ₁₆	8	3 ³ / ₄	5	2 ³ / ₄	2.38	2.07	1 ⁵ / ₁₆	2.44	5 ⁵ / ₁₆	1 ⁵ / ₁₆	2.46
2 ¹ / ₂	7 ¹ / ₂	1	4 ¹ / ₈	3 ¹⁵ / ₁₆	8	7 ⁷ / ₈	5 ⁷ / ₈	3	2.88	2.47	1 ¹ / ₂	2.94	5 ⁵ / ₁₆	1 ¹ / ₂	2.97
3	8 ¹ / ₄	1 ¹ / ₈	5	4 ⁵ / ₈	8	7 ⁷ / ₈	6 ⁵ / ₈	3 ¹ / ₈	3.50	3.07	1 ¹¹ / ₁₆	3.57	3 ³ / ₈	1 ¹¹ / ₁₆	3.60
3 ¹ / ₂	9	1 ³ / ₁₆	5 ¹ / ₂	5 ¹ / ₄	8	7 ⁷ / ₈	7 ¹ / ₄	3 ³ / ₁₆	4.00	3.55	1 ³ / ₄	4.07	3 ³ / ₈	1 ³ / ₄	4.10
4	10	1 ¹ / ₄	6 ³ / ₁₆	5 ³ / ₄	8	7 ⁷ / ₈	7 ⁷ / ₈	3 ³ / ₈	4.50	4.03	1 ⁷ / ₈	4.57	7 ⁷ / ₁₆	1 ⁷ / ₈	4.60
5	11	1 ³ / ₈	7 ⁵ / ₁₆	7	8	7 ⁷ / ₈	9 ¹ / ₄	3 ⁷ / ₈	5.56	5.05	2	5.66	7 ⁷ / ₁₆	2	5.69
6	12 ¹ / ₂	1 ⁷ / ₁₆	8 ¹ / ₂	8 ¹ / ₈	12	7 ⁷ / ₈	10 ⁵ / ₈	3 ⁷ / ₈	6.63	6.07	2 ⁷ / ₁₆	6.72	1 ¹ / ₂	2 ⁷ / ₁₆	6.75
8	15	1 ⁵ / ₈	10 ⁵ / ₈	10 ¹ / ₄	12	1	13	4 ³ / ₈	8.63	7.98	2 ⁷ / ₁₆	8.72	1 ¹ / ₂	2 ⁷ / ₁₆	8.75
10	17 ¹ / ₂	1 ⁷ / ₈	12 ³ / ₄	12 ⁵ / ₈	16	1 ¹ / ₈	15 ¹ / ₄	4 ⁵ / ₈	10.75	10.02	2 ⁵ / ₈	10.88	1 ¹ / ₂	3 ³ / ₄	10.92
12	20 ¹ / ₂	2	15	14 ³ / ₄	16	1 ¹ / ₄	17 ³ / ₄	5 ¹ / ₈	12.75	12.00	2 ⁷ / ₈	12.88	1 ¹ / ₂	4	12.92
14	23	2 ¹ / ₈	16 ¹ / ₄	16 ³ / ₄	20	1 ¹ / ₄	20 ¹ / ₄	5 ⁵ / ₈	14.00	As Specified by Purchaser	3	14.14	1 ¹ / ₂	4 ³ / ₈	14.18
16	25 ¹ / ₂	2 ¹ / ₄	18 ¹ / ₂	19	20	1 ³ / ₈	22 ¹ / ₂	5 ³ / ₄	16.00		3 ¹ / ₄	16.16	1 ¹ / ₂	4 ³ / ₄	16.19
18	28	2 ³ / ₈	21	21	24	1 ³ / ₈	24 ³ / ₄	6 ¹ / ₄	18.00		3 ¹ / ₂	18.18	1 ¹ / ₂	5 ¹ / ₈	18.20
20	30 ¹ / ₂	2 ¹ / ₂	23	23 ¹ / ₈	24	1 ³ / ₈	27	6 ³ / ₈	20.00		3 ³ / ₄	20.20	1 ¹ / ₂	5 ¹ / ₂	20.25
24	36	2 ³ / ₄	27 ¹ / ₄	27 ⁵ / ₈	24	1 ⁵ / ₈	32	6 ⁵ / ₈	24.00		4 ³ / ₁₆	24.25	1 ¹ / ₂	6	24.25

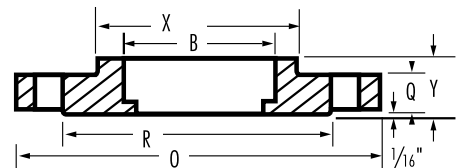
WELD NECK



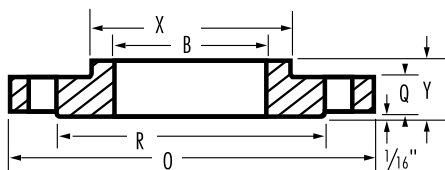
THREADED



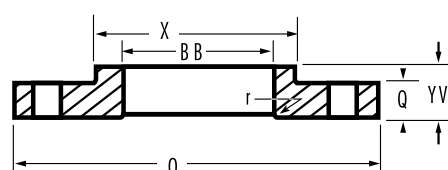
SOCKET-WELD



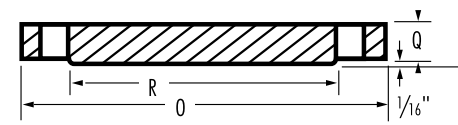
SLIP-ON



LAP JOINT

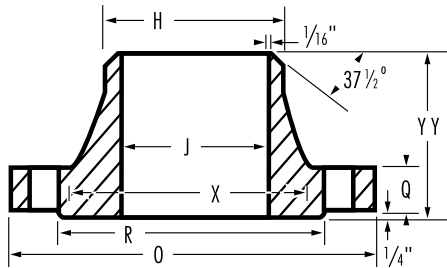


BLIND

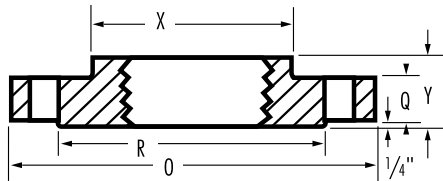


NOMINAL PIPE SIZE	COMMON DIMENSIONS				NO. OF BOLT HOLES	DIA. OF BOLT HOLES	BOLT CIRCLE	WELD NECK			SLIP-ON & THREADED Y	SLIP-ON B	LAP JOINT		
	O	Q	R	X				YY	H	J			r	YV	BB
1/2	3 ³ / ₄	9 ⁹ / ₁₆	1 ³ / ₈	1 ¹ / ₂	4	5 ⁵ / ₈	2 ⁵ / ₈	2 ¹ / ₁₆	.84	.55	7 ⁷ / ₈	.88	1 ¹ / ₈	7 ⁷ / ₈	.90
3/4	4 ⁵ / ₈	5 ⁵ / ₈	1 ¹¹ / ₁₆	1 ⁷ / ₈	4	3 ³ / ₄	3 ³ / ₄	2 ¹ / ₄	1.05	.74	1	1.09	1 ¹ / ₈	1	1.11
1	4 ⁷ / ₈	1 ¹¹ / ₁₆	2	2 ¹ / ₈	4	3 ³ / ₄	3 ¹ / ₂	2 ⁷ / ₁₆	1.32	.96	1 ¹ / ₁₆	1.36	1 ¹ / ₈	1 ¹ / ₁₆	1.38
1 ¹ / ₄	5 ¹ / ₄	1 ¹³ / ₁₆	2 ¹ / ₂	2 ¹ / ₂	4	3 ³ / ₄	3 ³ / ₈	2 ⁵ / ₈	1.66	1.28	1 ¹ / ₈	1.70	3 ³ / ₁₆	1 ¹ / ₈	1.72
1 ¹ / ₂	6 ¹ / ₈	7 ⁷ / ₈	2 ⁷ / ₈	2 ³ / ₄	4	7 ⁷ / ₈	4 ¹ / ₂	2 ³ / ₄	1.90	1.50	1 ¹ / ₄	1.95	1 ¹ / ₄	1 ¹ / ₄	1.97
2	6 ¹ / ₂	1	3 ⁵ / ₈	3 ⁵ / ₁₆	8	3 ³ / ₄	5	2 ⁷ / ₈	2.38	1.94	1 ¹ / ₁₆	2.44	5 ⁵ / ₁₆	1 ⁷ / ₁₆	2.46
2 ¹ / ₂	7 ¹ / ₂	1 ¹ / ₈	4 ¹ / ₈	3 ¹⁵ / ₁₆	8	7 ⁷ / ₈	5 ⁵ / ₈	3 ¹ / ₈	2.88	2.32	1 ⁵ / ₈	2.94	5 ⁵ / ₁₆	1 ⁵ / ₈	2.97
3	8 ¹ / ₄	1 ¹ / ₄	5	4 ⁵ / ₈	8	7 ⁷ / ₈	6 ⁵ / ₈	3 ¹ / ₄	3.50	2.90	1 ¹³ / ₁₆	3.57	3 ³ / ₈	1 ¹³ / ₁₆	3.60
3 ¹ / ₂	9	1 ³ / ₈	5 ¹ / ₂	5 ¹ / ₄	8	1	7 ¹ / ₄	3 ³ / ₈	4.00	3.36	1 ¹⁵ / ₁₆	4.07	3 ³ / ₈	1 ¹⁵ / ₁₆	4.10
4	10 ³ / ₄	1 ¹ / ₂	6 ³ / ₁₆	6	8	1	8 ¹ / ₂	4	4.50	3.83	2 ¹ / ₈	4.57	7 ⁷ / ₁₆	2 ¹ / ₈	4.60
5	13	1 ³ / ₄	7 ⁵ / ₁₆	7 ⁷ / ₁₆	8	1 ¹ / ₈	10 ¹ / ₂	4 ¹ / ₂	5.56	4.81	2 ³ / ₈	5.66	7 ⁷ / ₁₆	2 ³ / ₈	5.69
6	14	1 ⁷ / ₈	8 ¹ / ₂	8 ³ / ₄	12	1 ¹ / ₈	11 ¹ / ₂	4 ⁵ / ₈	6.63	5.76	2 ⁵ / ₈	6.72	1 ¹ / ₂	2 ⁵ / ₈	6.75
8	16 ¹ / ₂	2 ³ / ₁₆	10 ⁵ / ₈	10 ³ / ₄	12	1 ¹ / ₄	13 ³ / ₄	5 ¹ / ₄	8.63	7.63	3	8.72	1 ¹ / ₂	3	8.75
10	20	2 ¹ / ₂	12 ³ / ₄	13 ¹ / ₂	16	1 ³ / ₈	17	6	10.75	9.75	3 ³ / ₈	10.88	1 ¹ / ₂	4 ³ / ₈	10.92
12	22	2 ⁵ / ₈	15	15 ³ / ₄	20	1 ³ / ₈	19 ¹ / ₄	6 ¹ / ₈	12.75	11.75	3 ⁵ / ₈	12.88	1 ¹ / ₂	4 ⁵ / ₈	12.92
14	23 ³ / ₄	2 ³ / ₄	16 ¹ / ₄	17	20	1 ¹ / ₂	20 ³ / ₄	6 ¹ / ₂	14.00	As Specified by Purchaser	3 ¹¹ / ₁₆	14.14	1 ¹ / ₂	5	14.18
16	27	3	18 ¹ / ₂	19 ¹ / ₂	20	1 ⁵ / ₈	23 ³ / ₄	7	16.00		4 ³ / ₁₆	16.16	1 ¹ / ₂	5 ¹ / ₂	16.19
18	29 ¹ / ₄	3 ¹ / ₄	21	21 ¹ / ₂	20	1 ³ / ₄	25 ³ / ₄	7 ¹ / ₄	18.00		4 ⁵ / ₈	18.18	1 ¹ / ₂	6	18.20
20	32	3 ¹ / ₂	23	24	24	1 ³ / ₄	28 ¹ / ₂	7 ¹ / ₂	20.00		5	20.20	1 ¹ / ₂	6 ¹ / ₂	20.25
24	37	4	27 ¹ / ₄	28 ¹ / ₄	24	2	33	8	24.00		5 ¹ / ₂	24.25	1 ¹ / ₂	7 ¹ / ₄	24.25

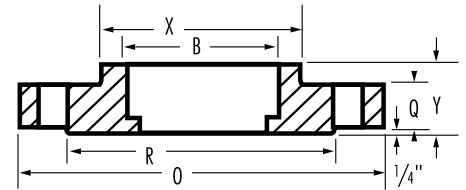
WELD NECK



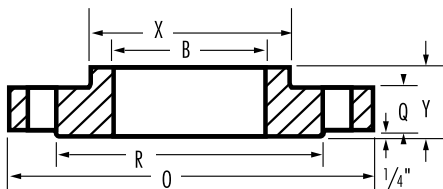
THREADED



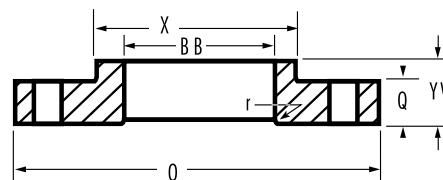
SOCKET-WELD



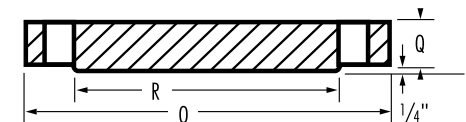
SLIP-ON



LAP JOINT



BLIND



1/2" THICK FLANGES

NOMINAL PIPE SIZE	BLIND	SLIP-ON TUBE "O.D."	SLIP-ON PIPE "IPS"
1/2	1	1	-
3/4	2	1.35	-
1	2	1.6	1.6
1 1/4	3	2	1.85
1 1/2	3	2.15	2
2	4	3	2.80
2 1/2	-	4.3	3.85
3	6	4.8	4.15
4	7	6.2	6.10
5	-	6.55	6.65
6	11	7.65	8.2
8	18	10.75	9.80
10	25	12.15	11.90
12	39	20.10	18.80
14	49	25	26
16	50	28.30	28
18	64	29.75	30

150 POUND FORGED ANSI FLANGES

NOMINAL PIPE SIZE	WELD NECK	SOCKET WELD & SLIP-ON	THREADED	LAP JOINT	BLIND
1/2	2	1	1	1	2
3/4	2	1.5	1.5	1.5	2
1	2.5	2	2	2	2
1 1/4	2.5	2.5	2.5	2.5	3
1 1/2	4	3	3	3	3
2	6	5	5	5	4
2 1/2	10	8	8	8	7
3	11.5	9	10	9	9
3 1/2	12	11	12	11	13
4	16.5	13	13	12	17
5	21	15	15	13	20
6	26	17	19.5	18	27
8	42	28	30	28	47
10	54	40	41	36	67
12	88	61	65	60	123
14	114	83	85	77	139
16	142	95	93	104	187
18	165	120	120	146	217
20	197	148	155	159	283
24	268	204	210	195	415

300 POUND FORGED ANSI FLANGES

NOMINAL PIPE SIZE	WELD NECK	SOCKET WELD & SLIP-ON	THREADED	LAP JOINT	BLIND
1/2	2	1.5	1.5	1.5	2
3/4	3	2.5	2.5	2.5	3
1	4	3	3	3	4
1 1/4	5	4.5	4.5	4.5	6
1 1/2	7	6.5	6.5	6.5	7
2	8	7	7	7	8
2 1/2	12	10	10	10	12
3	18	13	14	14.5	16
3 1/2	20	16	16	16	21
4	26.5	23.5	24	24	28
5	36	29	31	26	37
6	45	36	36	38	48
8	69	56	56	55	79
10	100	77	80	88	122
12	142	113	110	139	183
14	206	159	164	184	241
16	249	210	220	234	315
18	306	253	280	305	414
20	369	307	325	375	515
24	519	490	490	530	800

600 POUND FORGED ANSI FLANGES

NOMINAL PIPE SIZE	WELD NECK	SOCKET WELD & SLIP-ON	THREADED	LAP JOINT	BLIND
1/2	3	2	2	2	2
3/4	3.5	3	3	3	3
1	4	3.5	3.5	3.5	4
1 1/4	5.5	4.5	4.5	4.5	6
1 1/2	8	6.5	6.5	6.5	8
2	10	8	8	8	10
2 1/2	14	12	12	11	15
3	18	15	15	14	20
3 1/2	26	21	21	20	29
4	37	33	33	31	41
5	68	63	63	63	68
6	73	80	80	78	86
8	112	97	97	112	139
10	189	177	177	195	231
12	226	215	215	240	295
14	347	259	259	290	378
16	481	366	366	400	527
18	555	476	476	469	665
20	690	612	612	604	855
24	977	876	876	866	1175

WEIGHTS MAY VARY DEPENDING UPON THE MANUFACTURER.

STAINLESS

SPECIFICATION	APPLICATION	GRADE	UNS DESIGNATION	CHEMICAL REQUIREMENTS (%)								TENSILE REQUIREMENTS	
				C	Si	Mn	P	S	Cr	Ni	Mo	TENSILE STRENGTH MIN.	YIELD STRENGTH MIN.
ASTM A312	HIGH TEMPERATURE & GENERAL CORROSIVE SERVICE	304	S30400	0.08 MAX.	0.75 MAX.	2.00 MAX.	0.04 MAX.	0.03 MAX.	18.0-20.0	8.0-11.0	—	75,000 PSI	30,000 PSI
		304L	S30403	0.035 MAX.	0.75 MAX.	2.00 MAX.	0.04 MAX.	0.03 MAX.	18.0-20.0	8.0-13.0	—	70,000 PSI	25,000 PSI
		316	S31600	0.08 MAX.	0.75 MAX.	2.00 MAX.	0.04 MAX.	0.03 MAX.	16.0-18.0	11.0-14.0*	2.0-3.0	75,000 PSI	30,000 PSI
		316L	S31603	0.035 MAX.	0.75 MAX.	2.00 MAX.	0.04 MAX.	0.03 MAX.	16.0-18.0	10.0-15.0	2.0-3.0	70,000 PSI	25,000 PSI

*For Welded Type 316 and Type 316H pipe, the nickel range shall be 10.0-14.0%.

SEAMLESS PIPE	ASTM A312/SA312 ASTM A376/SA376	ANSI B36.19, B36.10	BUTT WELD FITTINGS	ASTM A403 MSS SP43	ANSI B16.9, B16.28
WELDED PIPE	ASTM A312/SA312	ANSI B36.19, B36.10	THREADED CAST FITTINGS	ASTM A351	ANSI B16.3, B1.20.1
SEAMLESS TUBING	ASTM A213/SA213 ASTM A269 ASTM A632		FORGED FLANGES	ASTM A182	ANSI B16.5, B120.1
WELDED TUBING	ASTM A269 ASTM A249/SA249 ASTM A632		MSS CAST FLANGES	ASTM A351 MSS SP-51	ANSI B16.5 ANSI B1.20.1
FORGED FITTINGS	ASTM A182 ASTM A479	ANSI B16.11, B1.20.1	CAST VALVES	ASTM A351 API 603	ANSI B16.34, B16.10 ANSI B1.20.1
			FORGED VALVES	ASTM A182 API 602	ANSI B1.20.1 (THRD) ANSI B16.11 (SW)

CARBON

SPECIFICATION	APPLICATION	GRADE	CHEMICAL REQUIREMENTS (%)										TENSILE REQUIREMENTS	
			C	Si	Mn	P	S	Cr	Ni	Mo	Cu	V	TENSILE STRENGTH MIN.	TENSILE STRENGTH MIN.
ASTM A53	ORDINARY USES	A	0.25 MAX.	—	0.95 MAX.	0.05 MAX.	0.06 MAX.	0.40 MAX.	0.40 MAX.	0.15 MAX.	0.40 MAX.	0.08 MAX.	48,000 PSI (33.7 KG/MM ²)	30,000 PSI (21.1 KG/MM ²)
		B	0.30 MAX.	—	1.20 MAX.	0.05 MAX.	0.06 MAX.	0.40 MAX.	0.40 MAX.	0.15 MAX.	0.40 MAX.	0.18 MAX.	60,000 PSI (42.2 KG/MM ²)	35,000 PSI (24.6 KG/MM ²)
ASTM A106	HIGH TEMPERATURE SERVICE	A	0.25 MAX.	0.10 MIN.	0.27 MIN. 0.93 MAX.	0.025 MAX.	0.025 MAX.	0.40 MAX.	0.40 MAX.	0.15 MAX.	0.40 MAX.	0.08 MAX.	48,000 PSI (33.7 KG/MM ²)	30,000 PSI (21.1 KG/MM ²)
		B	0.30 MAX.	0.10 MIN.	0.29 MIN. 1.06 MAX.	0.025 MAX.	0.025 MAX.	0.40 MAX.	0.40 MAX.	0.15 MAX.	0.40 MAX.	0.08 MAX.	60,000 PSI (42.2 KG/MM ²)	35,000 PSI (24.6 KG/MM ²)
		C	0.35 MAX.	0.10 MIN.	0.29 MIN. 1.06 MAX.	0.025 MAX.	0.025 MAX.	0.40 MAX.	0.40 MAX.	0.15 MAX.	0.40 MAX.	0.08 MAX.	70,000 PSI (49.2 KG/MM ²)	40,000 PSI (28.1 KG/MM ²)

ANSI FLANGES

NOMINAL SIZE	ALL TYPES OF FLANGES								WELD NECK FLANGES		LONG NECKS	SLIP-ON & LAP JOINT FLANGES	THREADED FLANGES
	OUTSIDE DIAMETER	DIAMETER OF CONTACT FACE	DIAMETER OF BOLT CIRCLE	BOLT HOLE SPACING	BOLT CIRCLE ECCENTRICITY WITH BORE	FLANGE THICKNESS	OVERALL HEIGHT	OUTSIDE DIAMETER AT POINT OF WELD	HUB THICKNESS AT POINT OF WELD	INSIDE DIAMETER	OUTSIDE DIAMETER OF NECK	INSIDE DIAMETER	DIAM. OF COUNTER-BORE
1/2 - 5	±1/16" FOR FLANGES WITH O.D. OF 24" OR LESS	±1/32" FOR 1/16" HEIGHT RAISED FACES ±1/64" FOR 1/4" HGT. RAISED FACES, TONGUE, GROOVE, MALE & FEMALE FACES	±1/16" FOR SPECIAL DRILLING	±1/32" FOR SPECIAL DRILLING	1/32" MAX.	+1/8"	±1/16"	+3/32"	NOT LESS THAN 87 1/2% OF NOMINAL THICKNESS OF PIPE TO WHICH FLANGE IS TO BE WELDED	±1/32"	+3/32"	+1/32"	+1/32"
						-0"		-1/32"			-0"		
6 - 10						+1/8"		+5/32"			+1/32"	+1/32"	
						-0"		-1/32"			-0"	-0"	
12 - 18	±1/8" FOR FLANGES WITH O.D. OF OVER 24"		±1/32" FOR STANDARD DRILLING	±1/64" FOR STANDARD DRILLING		+1/8"	±1/8"	+5/32"		±1/16"	+3/32"	+1/16"	+1/16"
20 - 24						+3/16"	±1/8"	+5/32"		+1/8"	+3/32"	+1/16"	+1/16"
						-0"		-1/32"		-1/16"	-1/16"	-0"	-0"

FORGED THREADED & SOCKET WELD FITTINGS

NOMINAL SIZE	ALL FITTINGS						ELLS, TEES, & LATERALS	COUPLINGS	HALF-COUPLINGS
	INSIDE DIAMETER OF SOCKET	SOCKET WALL THICKNESS	BORE DIAMETER OF FITTING	FITTING WALL THICKNESS	CONCENTRICITY OF BORES	COINCIDENCE OF AXES	CENTER TO BOTTOM OF SOCKET	BOTTOM TO BOTTOM OF SOCKETS	BOTTOM OF SOCKET TO OPPOSITE FACE
1/8 - 1/4	+ .010"	NOT LESS THAN 125% OF NOMINAL PIPE THICKNESS NOR LESS THAN 1/8"	± .015"	NOT LESS THAN NOMINAL PIPE WALL THICKNESS	SOCKET AND FITTING BORES WITHIN ± .030	MAXIMUM VARIATION IN ALIGNMENT OF SOCKET AND FITTING BORES 1/16" IN 12"	± 0.03"	± 0.06"	± 0.03"
3/8 - 3/4	+ .010"		± .015"				± 0.06"	± 0.12"	± 0.06"
1 - 2	+ .010"		± .015"				± 0.08"	± 0.16"	± 0.08"
2 1/2 - 3	+ .015"		± .030"				± 0.10"	± 0.20"	± 0.10"
	- .000"								

BUTT WELD FITTINGS

NOMINAL SIZE	ALL FITTINGS				90°/45° ELLS TEES	REDUCERS, LAP JOINT STUB ENDS	180° RETURNS			CAPS	LAP JOINT STUB ENDS			
	OUTSIDE DIAM. AT BEVEL		INSIDE DIAMETER AT END	WALL THICKNESS	CENTER-TO-END	OVERALL LENGTH	CENTER-TO-CENTER	BACK TO FACE	ALIGNMENT OF ENDS	OVERALL LENGTH	OUTSIDE DIAMETER OF LAP	THICKNESS OF LAP	FILLET RADIUS OF LAP	OUTSIDE DIAMETER OF BARREL
	SCHEDULES 5S & 10S & TUBE O.D.	SCHEDULES HEAVIER THAN SCH. 10S												
1/2 - 1 1/2	+ 1/64	+ 1/16	± 1/32	NOT LESS THAN 87 1/2% OF NOMINAL THICKNESS	± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+ 0	+ 1/16	+ 0	TOLERANCES ASSURE SLIP FIT INTO LAP JOINT FLANGE OF MINIMUM PERMISSIBLE INSIDE DIAMETER
	- 1/32	- 1/32									- 1/32	- 0	- 1/32	
2 - 2 1/2	± 1/32	+ 1/16	± 1/32		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+ 0	+ 1/16	+ 0	
		- 1/32									- 1/32	- 0	- 1/32	
3 - 3 1/2	± 1/32	± 1/16	± 1/16		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+ 0	+ 1/16	+ 0	
											- 1/32	- 0	- 1/32	
4	± 1/32	± 1/16	± 1/16		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+ 0	+ 1/16	+ 0	
											- 1/32	- 0	- 1/16	
5 - 8	+ 1/16	+ 3/32	± 1/16	± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/4	+ 0	+ 1/16	+ 0		
	- 1/32	- 1/32								- 1/32	- 0	- 1/16		
10 - 12	+ 3/32	+ 5/32	± 1/8	± 3/32	± 3/32	± 3/8	± 1/4	± 1/16	± 1/4	+ 0	+ 1/16	+ 0		
	- 1/32	- 1/8								- 1/16	- 0	- 1/16		
14 - 18	+ 3/32	+ 5/32	± 1/8	± 3/32	± 3/32	± 3/8	± 1/4	± 1/16	± 1/4	+ 0	+ 1/16	+ 0		
	- 1/32	- 1/8								- 1/16	- 0	- 1/16		
20 - 24	+ 1/8	+ 1/4	± 3/16	± 3/32	± 3/32	± 3/8	± 1/4	± 1/16	± 1/4	+ 0	+ 1/16	+ 0		
	- 1/32	- 3/16								- 1/16	- 0	- 1/16		