



Ametric®

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STAINLESS STEEL GRADE COMPARISON TABLE

No.	ASTM	UNS	JIS	IS	GB	CSA	DGN	AS	CNS	KS
				Austenite						
1	201	S20100	SUS201	10Cr17Mn6Ni4N	1Cr17Mn6Ni5N	201		201-2	201	STS201
2	202	S20200	SUS202		1Cr18Mn8Ni5N	202			202	STS202
3	301	S30100	SUS301	10Cr17Ni7	1Cr17Ni7	301		301	301	STS301
4	302	S30200	SUS302		1Cr18Ni9	302	302	302	302	STS302
5	303	S30300	SUS303		Y1Cr18Ni9	303	303	303	303	STS303
6	303Se	S30323	SUS303Se		Y1Cr18Ni9se	303Se	303Se		303Si	STS303Se
7	304	S30400	SUS304	07Cr18Ni9	0Cr19Ni9	304	304	304	304	STS304
	304H				(0Cr18Ni9)					
8	304L	S30403	SUS304L	02Cr18Ni11	00Cr19Ni10	304L		304L	304L	STS304L
					(00Cr18Ni10)					
9	304N	S30451	SUS304N1		0Cr19Ni9				304N1	STS304N1
10	Xm21	S30452	SUS304N2		0Cr19Ni10NbN				304N2	STS304N2
11	304LN	S30453	SUS304LN		00Cr18Ni10N				304LN	STS304LN
12	305	S30500	V305		1Cr18Ni12	305	305		305	STS305
					(1Cr18Ni12Ti)					
13	309S	S30908	SUS309S		0Cr23Ni13	309S	309S		309S	STS309S
14	310S	S31008	SUS310S		0Cr25Ni20	310S	310S	310S	310S	STS310S
	310S				(1Cr25Ni20Si2)					
15	316	S31600	SUS316	04Cr17Ni12Mo2	0Cr17Ni12Mo2	316	316	316	316	STS316
16	316Ti	S31635		04Cr17Ni12Mo2Ti	0Cr18Ni12Mo2Ti			316Ti		
17	316L	S31603	SUS316L	02Cr17Ni12Mo2	00Cr17Ni14Mo2	316L		316L	316L	STS316L
18	316N	S31651	SUS316N		00Cr17Ni12Mo2	316N			316N	STS316N
19	316LN	S31653	SUS316LN		00Cr17Ni13Mo2				316N	STS316LN
20			SUS316JI		0Cr18Ni12Mo2Cu2				316JI	STS316JI
21			SUS316JIL		0Cr18Ni14Mo2Cu2				316JIL	STS316JIL
22	317	S31700	SUS317		0Cr19Ni13Mo3	317	317	317	317	STS317
23					1Cr18Ni12Mo3Ti					
24					0Cr18Ni12Mo3Ti					
25	317L	S31703	SUS317L		00Cr19Ni13Mo3	317L	3172		317L	STS317L
					(00Cr17Ni14Mo3)					
26			SUS317L		0Cr18Ni16Mo5				317L	STS317L
27	321	S32100	SUS321		1 Cr18Ni9Ti	321	321	321	321	STS321
28	321	S32100	SUS321	04Cr18Ni10Ti	0Cr18Ni11Ti	321	321	321	321	STS321
	347				(0Cr18Ni9Ti)					
29		S34700	SUS347	04Cr18Ni0Nb	0Cr18Ni11Nb	347			347	STS347
30	Xm7		SUSXm7		0Cr18Ni9Cu3				Xm7	STSXm7
31	Xm15	S36100	SUSXm1511		0Cr18Ni13Si4				Xm1511	STSXm1511
				Ferrities						
32	405	S40500	SUS405	04Cr13	OCR 13 Al	405	405	405	405	STS405
33			SUS410L		0Cr12				410L	STS410L
34	430	S43000	SUS430	05Cr17	1Cr17	430	430	430	430	STS430
35	430F	S43020	SUS430F		1Cr17	430F	430F		430F	STS430F
36	434	S43400	SUS434		1Cr17Mo	434			434	STS434
37			SUS447J		00XC30Mo2				447JT	STS447J
38	Xm27	S44625	SUSXm27		00Cr37Mo				Xm27	STSXm27
39	403	S40300	SUS403		1Cr12405	403	403		403	ST403
40	405	S40500	SUS405	04Cr13	0Cr113410	405	405	405	406	ST405
41	410	S41000	SUS410	12Cr13	1Cr13	410	410	410	410	STS410
42			SUS410J1		1Cr13416Mo				410J1	STS410J1
43	416	S41600	SUS416		Y1 Cr13420	416	416	416	416	STS416
44	420	S42000	SUS420J1	20Cr13	2Cr13	420	420	420	420J1	STS420J1
45			SUS420J2	30Cr13	3Cr13				420J2	STS420J2
46				40Cr13	4Cr13					
47	420	S42000	SUS420F		Y3Cr13				420F	STS420F
48	431	S43100	SUS431	15Cr16Ni2	1Cr17Ni2	431	431	431	431	STS431
49	440A	S44002	SUS440A		7 Cr 17	440A	440A		440A	STS440A
50	440B	S44003	SUS440B		8Cr17	440B	440B		440B	STS40B
51	440C	S44004	SUS440C	10S/Cr18Mo	11Cr17(9Cr16)	440C	440C	440C	440C	STS440C
52	440F	S44020	SUS440F		Y11CM7				440F	STS440F

CHEMICAL COMPOSITION OF STAINLESS STEEL

Grade	UNS Designation	Composition %															
		Carbon Max	Manganese max	Sulfur max	Phosphorus max	Silicon	Nickel	Chromium	Niobium	Titanium	Columbium plus Tantalum	Tantalum max	Nitrogen°	Vanadium	Copper	Cerium	Boron
TP304	S30400	0.08	2.00	0.045	0.030	0.75 max	8.00-11.0	18.0-20.0	•	•	•	•	•	•	•	•	•
TP304H	S30409	0.04-0.10	2.00	0.045	0.030	0.75 max	8.00-11.0	18.0-20.0	•	•	•	•	•	•	•	•	•
TP304L	S30403	0.035	2.00	0.045	0.030	0.75 max	8.00-13.0	18.0-20.0	•	•	•	•	•	•	•	•	•
TP304N	S30451	0.08	2.00	0.045	0.030	0.75 max	8.00-11.0	18.0-20.0	•	•	•	•	0.10-0.16	•	•	•	•
TP304LN	S30453	0.035	2.00	0.045	0.030	0.75 max	8.00-11.0	18.0-20.0	•	•	•	•	0.10-0.18	•	•	•	•
TP309Cb	S30940	0.08	2.00	0.045	0.030	0.75 max	12.0-16.0	22.0-24.0	0.75 max	•	10xC min 1.10 max	•	•	•	•	•	•
TP309H	S30909	0.04-0.10	2.00	0.045	0.030	0.75 max	12.0-15.0	22.0-24.0	•	•	•	•	•	•	•	•	•
TP309HCb	S3041	0.04-0.10	2.00	0.045	0.030	0.75 max	12.0-16.0	22.0-24.0	0.75 max	•	10 x C min 1.10 max	•	•	•	•	•	•
TP309S	S30908	0.08	2.00	0.045	0.030	0.75 max	12.0-15.0	22.0-24.0	0.75 max	•	•	•	•	•	•	•	•
TP310Cb	S31040	0.08	2.00	0.045	0.030	0.75 max	19.0-22.0	24.0-26.0	0.75 max	•	10xC min 1.10 max	•	•	•	•	•	•
TP310H	S31009	0.04-0.10	2.00	0.045	0.030	0.75 max	19.0-22.0	24.0-26.0	•	•	•	•	•	•	•	•	•
TP310HCb	S31041	0.04-0.10	2.00	0.045	0.030	0.75 max	19.0-22.0	24.0-26.0	0.75 max	•	10 x C min 1.10 max	•	•	•	•	•	•
TP310S	S31008	0.08	2.00	0.045	0.030	0.75 max	19.0-22.0	24.0-26.0	0.75 max	•	•	•	•	•	•	•	0.04 0.00
	S31272	0.08-0.12	1.5 2.00	0.030	0.015	0.3-0.7	14.0-16.0	14.0-16.0	1.0-1.4	0.3-0.6	•	•	•	•	•	•	•
TP316	S30600	0.018	2.00	0.020	0.020	3.7-4.3	14.0-15.5	17.0-18.5	0.20 max	•	•	•	•	•	0.50 max	•	•
TP316H	S31600	0.08	2.00	0.045	0.030	0.75 max	11.0-14.0	16.0-18.0	2.00-3.00	•	•	•	•	•	•	•	•
TP316L	S31609	0.04-0.10	2.00	0.045	0.030	0.75 max	11.0-14.0	16.0-18.0	2.00-3.00	•	•	•	•	•	•	•	•
TP316L	S31603	0.035	2.00	0.045	0.030	0.75 max	10.0-15.0	16.0-18.0	2.00-3.00	•	•	•	•	•	•	•	•
TP316N	S31651	0.08	2.00	0.045	0.030	0.75 max	11.0-14.0	16.0-18.0	2.00-3.00	•	•	•	0.10-0.16	•	•	•	•
TP316LN	S31653	0.035	2.00	0.045	0.030	0.75 max	11.0-14.0	16.0-18.0	2.00-3.00	•	•	•	0.10-0.18	•	•	•	•
TP317	S31700	0.08	2.00	0.045	0.030	0.75 max	11.0-14.0	18.0-20.0	3.00-4.00	•	•	•	•	•	•	•	•
TP317L	S31703	0.035	2.00	0.045	0.030	0.75 max	11.0-15.0	18.0-20.0	3.00-4.00	•	•	•	•	•	•	•	•
TP321	S32100	0.08	2.00	0.045	0.030	0.75 max	9.00-13.0	17.0-20.0	•	F	•	•	•	•	•	•	•
TP321H	S32109	0.04-0.10	2.00	0.045	0.030	0.75 max	9.00-13.0	17.0-20.0	•	G	•	•	•	•	•	•	•
TP347	S34700	0.08	2.00	0.045	0.030	0.75 max	9.0U-13.0	17.0-20.0	•	•	H •	•	•	•	•	•	•
TP347H	S34709	0.04-0.10	2.00	0.045	0.030	0.75 max	9.00-13.0	17.0-20.0	•	•	I •	•	•	•	•	•	•
TP347LN	S34751	0.005-0.020	2.00	0.045	0.030	0.75 max	9.00-13.0	17.0-20.0	•	•	0.2-0.5H	•	0.06-0.10	•	•	•	•
TP348	S34800	0.08	2.00	0.045	0.030	0.75 max	9.00-13.0	17.0-20.0	•	•	H •	0.10	•	•	•	•	•
TP348H	S34809	0.04-0.10	2.00	0.045	0.030	0.75 max	9.00-13.0	17.0-20.0	•	•	I •	0.10	•	•	•	•	•
TPXM 10	S21900	0.08-10.00	8.00-10.00	0.045	0.030	1.00 max	5.50-7.50	19.0-21.5	•	•	•	•	0.15-0.40	•	•	•	•
TPXM 11	S21904	0.04-10.00	8.00-10.00	0.045	0.030	1.00 max	5.50-7.50	19.0-21.5	•	•	•	•	0.15-0.40	•	•	•	•
TPXM-15	S38100	0.08	2.00	0.030	0.030	1.50-2.50	17.5-18.5	17.0-19.0	•	•	•	•	•	•	•	•	•
TPXM-19	S20910	0.060	4.00-6.00	0.040	0.030	1.00 max	11.5-13.5	20.5-3.00	1.50-3.00	•	0.10-0.30	•	0.20-0.40	0.10-0.30	•	•	•
TPXM-29	S24000	0.080	11.5-14.5	0.060	0.030	1.00 max	2.25-3.75	17.0-19.0	•	•	•	•	0.20-0.40	•	•	•	•
—	S31254	0.020	1.00	0.030	0.010	0.80 max	17.5-18.5	19.5-20.5	6.00-6.50	•	•	•	0.18-0.22	•	0.50-1.00	•	•
—	S30615	0.16-0.24	2.00	0.030	0.030	3.2-4.0	13.5-16.0	17.0-19.5	•	•	•	•	•	•	•	•	•
—	S30815	0.05-0.10	0.80	0.040	0.030	1.40-2.00	10.0-12.0	20.0-22.0	•	•	•	•	0.14-0.20	•	•	0.03-0.08	•
Urea25-22-2	S31050	0.025	2.00	0.020	0.015	0.4	20.5-23.5	24.0-26.0	1.6-2.6	•	•	•	0.09-0.15	•	•	•	•
TP310L	S30600	0.018	2.00	0.020	0.020	3.7-4.3	14.0-15.5	17.0-18.5	0.20 max	•	•	•	•	•	0.50 max	•	•
—	S31725	0.03	2.00	0.040J	0.030	0.75	13.5-17.5	18.0-20.0	4.0-5.0	•	•	•	0.10 max	•	0.75 max	•	•
—	S31726	0.03	2.00	0.040J	0.030	0.75	13.5-17.5	17.0-20.0	4.0-5.0	•	•	•	0.10-0.20	•	0.75 max	•	•
—	S32615	0.07	2.00	0.045	0.030	4.8-6.0	19.0-22.0	16.5-19.5	0.3-1.5	•	•	•	•	•	1.5-2.5	•	•
—	S33228	0.04-0.08	1.00	0.020	0.015	0.30 max	31.0-33.0	26.0-28.0	•	•	0.6-1.0	•	•	•	•	0.05-0.10	•
—	S24565	0.03	5.0-7.0	0.030	0.010	1.00max	16.0-18.0	23.0-25.0	4.0-5.0	•	0.1 max	•	0.04-0.6	•	•	•	•
—	S30415	0.4-0.06	0.80	0.045	0.030	1.00-2.00	9.00-10.0	18.0-19.0	•	•	•	•	0.12-0.16	•	•	0.03-0.08	•
—	S32654	0.020	2.00-4.00	0.030	0.005	0.50 max	21.0-23.0	24.0-25.0	7.00-8.00	•	•	•	0.45-0.55	•	0.030-0.60	•	•
—	S35315	0.04-0.08	2.00	0.045	0.030	0.75	34.0-36.0	24.0-26.0	•	•	•	•	0.12-0.18	•	•	0.03-0.08	•
—	N08367	0.030	2.00	0.030	0.030	1.00 max	23.50-25.50	20.00-22.00	6.00-7.00	•	•	•	0.18-0.25	•	0.75 max	•	•
—	N08904	0.020	2.00	0.045	0.035	1.00	23.0-28.0	19.0-23.0	4.0-5.0	•	•	•	0.10 max	•	1.0-2.0	•	•

STAINLESS STEEL MECHANICAL PROPERTIES

UNS Designation	Type	Tensile Strength, min		Yield Strength, min		Elongation in 2 in. Or 50 mm, min, %	Hardness, max°	
		Ksi	Mpa	Ksi	Mpa		Brinell	Rockwell B
N08020	•	80	550	35	240	30.0	217	95
N08367								
Sheet and Strip								
Plate		100	690	45	310	30.0		100
N08800	800F	95	655	45	310	30.0	241	
N08810	800HF	75	520	30	205	30.0		
N08811	•	65	450	25	170	30.0	•	•
N08904	904LF	65	450	25	170	30.0	•	90
N08926	•	71	490	31	220	35.0	•	•
N08926	•	94	650	43	295	35.0		
S20100	201-1'	75	515	38	260	40.0		95
S20100	201-2'	95	655	45	310	40.0	217	100
S20103	201LF	95	655	38	260	40.0	217	95
S20153	201LNF	95	655	45	310	45.0	241	100
S20161	•	125	860	50	345	40.0	255	25
S20200	202	90	620	38	260	40.0	241	
S20400	•	95	655	48	330	35.0	241	100
S30100	301	75	515	30	205	40.0	217	95
S30103	301LF	80	550	32	220	45.0	241	100
S30153	301NF	80	550	35	240	45.0	241	100
S30200	302	75	515	30	205	40.0	201	92
S30400	304	75	515	30	205	40.0	201	92
S30403	304L	70	485	25	170	40.0	201	92
S30409	304H	75	515	30	205	40.0	201	92
S30415	•	87	600	42	290	40.0	217	95
S30451	304N	80	550	35	240	30.0	201	92
S30453	304LN	75	515	30	205	40.0	201	92
S30500	305	70	485	25	170	40.0	183	88
S30600	•	78	540	35	240	40.0		
S30601	•	78	540	37	255	30.0	•	•
S30615	•	90	620	40	275	35.0	217	95
S30815	•	87	600	45	310	40.0	217	95
S30908	309S	75	515	30	205	40.0	217	95
S30909	309HF	75	515	30	205	40.0	217	95
S30940	309CbF	75	515	30	205	40.0	217	95
S30941	309HCbF	75	515	30	205	40.0	217	95
S31008	31 OS	75	515	30	205	40.0	217	95
S31009	310HF	75	515	30	205	40.0	217	95
S31040	310CbF	75	515	30	205	40.0	217	95
S31.41	310HCbF	75	515	30	205	40.0	217	95
S31254								
Sheet and Strip		100	690	45	310	35.0	223	96
Plate		95	655	45	310	35.0	223	96
S31266		109	750	61	420	35.0		•
S31600	316	75	515	30	205	40.0	217	95
S31603	316L	70	485	25	170	40.0	217	95
S31653	316LN	75	515	30	205	40.0	217	95
S31609	316H	75	515	30	205	40.0	217	95
S31635	316TiF	75	515	30	205	30.0	217	95
S31640	316CbF	75	515	30	205	30.0	217	95
S31651	316N	80	550	35	240	35.0	217	95
S31700	317	75	515	30	205	35.0	217	95

STAINLESS STEEL MECHANICAL PROPERTIES

UNS Designation	Type	Tensile Strength, min			Yield Strength, min			Elongation in 2 in. Or 50 mm, min, %	Hardness, max°	
		Ksi	Mpa		Ksi	Mpa			Brinell	Rockwell B
S31725	317Lm ^F	75	515		30	205		40.0	217	95
S31726	317LMN ^F	80	550		35	240		40.0	223	96
S31703	317L	75	515		30	205		40.0	217	95
S31753	317LN	80	550		35	240		40.0	217	95
S32050		98	675		48	330		40.0	250	
S32100	321	75	515		30	205		40.0	217	95
S32109	321H	75	515		30	205		40.0	217	95
S32615		80	550		32	220		25.0		
S32654		109	750		62	430		40.0	250	
S33228		73	500		27	185		30.0	217	95
S33400	334	70	485		25	170		30.0		
S34565		115	765		60	415		35.0	241	100
S34700	347	75	515		30	205		40.0	201	92
S34709	347H	75	515		30	205		40.0	201	92
S34800	348	75	515		30	205		40.0	201	92
S34809	348H	75	515		30	205		40.0	201	92
S35045		70	485		25	170		35.0		
S35135										
Sheet and strip		80	550		30	205		30.0		
Plate		75	515		30	205		30.0		
S35315		94	650		39	270		40.0	217	95
S38100	XM-15	75	515		30	205		40.0	217	95
S30452	XM-21									
Sheet and Strip		90	620		50	345		30.0	241	100
Plate		85	585		40	275		30.0	241	100
S31050										
	310MoLN ^F	84	580		39	270		25.0	217	95
	t < 0.25 in.	78	540		37	255		25.0		
	t > 0.25 in.									
S21600	XM-17 ^c									
Sheet and Strip		100	690		60	415		40.0	241	100
Plate		90	620		50	345		40.0	241	100
S21603	XM-18 ^c									
Sheet and Strip		100	690		60	415		40.0	241	100
Plate		90	620		50	345		40.0	241	100
S20910	XM-19 ^c									
Sheet and Strip		105	725		60	415		30.0	241	100
Plate		100	690		55	380		35.0	241	100
S24000	XM-29 ^c									
Sheet and Strip		100	690		60	415		40.0	241	100
Plate		100	690		55	380		40.0	241	100
S21400	XM-31 ^c									
Sheet		125	860		70	485		40.0		
Strip		105	725		55	380		40.0		
S21800		95	655		50	345		35.0	241	100
DUPLEX & SUPER DUPLEX SERIES										
S31200		100	690		65	450		25.0	293	31 ^c
S31260		100	690		70	485		20.0	290	
S31803		90	620		65	450		25.0	293	31 ^c
S32001		90	620		65	450		25.0		
S32205	2205 ^F	90	620		65	450		25.0	293	25 ^c
S32304	2304 ^F	87	600		58	400		25.0	290	31 ^c
S32520		112	760		80	550		25.0	310	32 ^c
S32550	255 ^F	110	760		80	550		15.0	302	32 ^c
S32750	2507 ^F	116	795		80	550		15.0	310	32 ^c



Pipes & Tubes

MATERIAL SPECIFICATION FOR PIPES & TUBES OF ALLOY STEEL, CARBON STEEL & MILD STEEL.

PIPES & TUBES ASTM / API / BS / DIN / IS

PIPE SPECIFICATION	CHEMICAL PROPERTIES						MECHANICAL PROPERTIES			OTHERS			
	C%	Mn%	P% (Max)	S% (Max)	Si%	Cr%	Ni%	Mo%	U.T.S. (Min) Mpa		Y.S. (Min) Mpa	E LONG (Min)	
												L	T
ASTM A 106													
ASTM A 106 Gr. A	0.25 Max	0.27-0.93	0.035	0.035	0.10 Min	0.40 Max	0.40 Max	0.15 Max	330	205	35	25	Cu%:0.40 Max, Va%: 0.08
ASTM A 106 Gr. B	0.30 Max	0.29-1.06	0.035	0.035	0.10 Min	0.40 Max	0.40 Max	0.15 Max	415	240	30	16.5	Cu%:0.40 Max, Va%: 0.08
ASTM A 106 Gr. C	0.35 Max	0.29-1.06	0.035	0.035	0.10 Min	0.40 Max	0.40 Max	0.15 Max	485	275	30	16.5	Cu%:0.40 Max, Va%: 0.08
ASTM A 53													Cu%:0.40 Max, Va%: 0.08
ASTM A 53 Gr. A	0.25 Max	0.95 Max	0.050	0.045	-	0.40 Max	0.40 Max	0.15 Max	330	205	30	16.5	Cu%:0.40 Max, Va%: 0.08
ASTM A 53 Gr. B	0.30 Max	1.20 Max	0.050	0.045	-	0.40 Max	0.40 Max	0.15 Max	415	240	30	16.5	
ASTM A 333													
ASTM A 333 Gr. 1	0.30 Max	0.40-1.06	0.025	0.025	-	-	-	-	380	205	35	25	Impact Test= -45 °C, J=18 Min, HRB=85 Max
ASTM A 333 Gr. 6	0.30 Max	0.29-1.06	0.025	0.025	0.10 Min	-	-	-	415	240	30	16.5	Impact Test=-45 DC, J=18 Min, HRB=85 Max
ASTM A 335													
ASTM A 335 Gr. P1	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	-	-	0.44-0.65	380	205	30	20	
ASTM A 335 Gr. P2	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	-	0.44-0.65	380	205	30	20	
ASTM A 335 Gr. P5	0.15 Max	0.30-0.60	0.025	0.025	0.50 Max	4.00-6.00	-	0.45-0.65	415	205	30	20	
ASTM A 335 Gr. P9	0.15 Max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	-	0.90-1.10	415	205	30	20	
ASTM A 335 Gr. P11	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	-	0.44-0.65	415	205	30	20	
ASTM A 335 Gr. P12	0.05-0.15	0.30-0.61	0.025	0.025	0.50 Max	0.80-1.25	-	0.44-0.65	415	220	30	20	
ASTM A 335 Gr. P22	0.05-0.15	0.30-0.60	0.025	0.025	0.50 Max	1.90-2.60	-	0.87-1.13	415	205	30	20	
ASTM A 335 Gr. P91	0.08-0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.00-9.50	0.40 Max	0.85-1.05	620	440	20	-	V%=-0.18-0.25, N%=-0.030-0.070, Al%=-0.02 Max Cb%=-0.06-0.10
ASTM A 213													
ASTM A 213 Gr. T2	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	-	0.44-0.65	415	205	30		HRB=85 Max
ASTM A 213 Gr. T5	0.15 Max	0.30-0.60	0.025	0.025	0.50 Max	4.00-6.00	-	0.45-0.65	415	205	30		HRB=85 Max
ASTM A 213 Gr. T11	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	-	0.44-0.65	415	205	30		HRB=85 Max
ASTM A 213 Gr. T12	0.05-0.15	0.30-0.61	0.025	0.025	0.50 Max	0.80-1.25	-	0.44-0.65	415	220	30		HRB=85 Max
ASTM A 213 Gr. T22	0.05-0.15	0.30-0.60	0.025	0.025	0.50 Max	1.90-2.60	-	0.87-1.13	415	205	30		HRB=85 Max
ASTM A 179													
ASTM A 179	0.06-0.18	0.27-0.63	0.035	0.035	-	-	-	-	325	180	35		HRB=72 Max
ASTM A 210													
ASTM A 210 Gr. A1	0.27 Max	0.93 Max	0.035	0.035	0.10 Min	-	-	-	415	255	30		HRB=79 Max
API 5L													
API 5L Gr. A	0.22 Max	0.90 Max	0.030	0.030	-	-	-	-	331	207	For Seamless: C% Will be 0.028 for Gr. B to x 70 Mn% will be 1.40 for Gr. X65 to X 70		
API 5L Gr. B	0.26 Max	1.20 Max	0.030	0.030	-	-	-	-	414	241			
API 5L Gr. X 42	0.26 Max	1.30 Max	0.030	0.030	-	-	-	-	414	290			
API 5L Gr. X 46	0.26 Max	1.40 Max	0.030	0.030	-	-	-	-	434	317			
API 5L Gr. X 52	0.26 Max	1.40 Max	0.030	0.030	-	-	-	-	455	359			
API 5L Gr. X 56	0.26 Max	1.40 Max	0.030	0.030	-	-	-	-	490	386			
API 5L Gr. X 60	0.26 Max	1.45 Max	0.030	0.030	-	-	-	-	517	414			
API 5L Gr. X 65	0.26 Max	1.65 Max	0.030	0.030	-	-	-	-	531	448			
API 5L Gr. X 70	0.26 Max	1.65 Max	0.030	0.030	-	-	-	-	565	483			

PIPES & TUBES ASTM / API / BS / DIN / IS

MATERIAL SPECIFICATION FOR PIPES & TUBES OF ALLOY STEEL, CARBON STEEL & MILD STEEL.

PIPE SPECIFICATION	CHEMICAL PROPERTIES							MECHANICAL PROPERTIES			OTHERS	
	C%	Mn%	P% (Max)	S% (Max)	Si%	Cr%	Ni%	Mo%	U.T.S. (Mpa)	Y.S. (Mpa)		
												E.LONG (Min)
										L	T	
BS 3059												
BS 3059 PT-I Gr. 320	0.16 Max	0.30-0.70	0.040	0.040	0.35 Max				320-480	195		
BS 3059 PT-II Gr. 360	0.17 Max	0.40-0.80	0.035	0.035	0.10-0.35	-	-	-	360-500	235	24	
BS 3059 PT-II Gr. 440	0.12-0.18	0.90-1.20	0.035	0.035	0.10-0.35	-	-	-	440-580	245	21	
BS 3059 PT-I Gr. 620	0.10-0.15	0.40-0.70	0.030	0.030	0.10-0.35	0.70-0.10	-	0.45-0.65	460-610	180	22	
BS 6323												
BS 6323 Gr. 1	0.13 Max	0.60 Max	0.050	0.050	-	-	-	-	300	200	20	
BS 6323 Gr. 2	0.16 Max	0.70 Max	0.050	0.050	-	-	-	-	340	250	15	
BS 6323 Gr. 3	0.20 Max	0.90 Max	0.050	0.050	0.35 Max	-	-	-	400	300	12	
BS 1387											25	
BS 1387	0.20 Max	1.20 Max	0.045	0.045	-	-	-	-	320-460	195	20	
DIN 17175												
DIN 17175 Gr. St 35.8	0.17 Max	0.40-0.80	0.040	0.040	0.10-0.35	-	-	-	225	360-480	25	
DIN 17175 Gr. St 45.8	0.21 Max	0.40-1.20	0.040	0.040	0.10-0.35	-	-	-	245	410-530	21	
DIN 17175 Gr. 17Mn4	0.14-0.20	0.90-1.20	0.040	0.040	0.20-0.40	0.30 Max	-	-	275	460-580	23	
DIN 17175 Gr. 19Mn5	0.17-0.22	1.00-1.30	0.040	0.040	0.30-0.36	0.30 Max	-	-	315	510-610	19	
DIN 17175 Gr. 15Mo3	0.12-0.20	0.40-0.80	0.035	0.035	0.10-0.35	-	-	0.25-0.35	275	550-600	22	
DIN 17175 Gr. 13CrMo44	0.10-0.18	0.40-0.80	0.035	0.035	0.10-0.35	0.70-1.10	-	0.45-0.65	295	440-590	22	
DIN 17175 Gr. 10CrMo910	0.08-0.15	0.40-0.70	0.035	0.035	0.50 Max	2.00-2.50	-	0.90-1.20	385	550-600	20	V: 0.22-0.32
DIN 17175 Gr. 13CrMo910	0.10-0.18	0.40-0.70	0.035	0.035	0.10-0.35	0.70-1.10	-	0.45-0.65	295	440-590	22	V: 0.25-0.35
DIN 17175 Gr. 14MoV63	0.10-0.18	0.40-0.70	0.035	0.035	0.10-0.35	0.50-0.70	-	0.50-0.70	325	460-610	20	
DIN 17175 Gr.X20CrMoV121	0.17-0.23	1.00 Max	0.030	0.030	0.50 Max	0.80-1.20	0.30-0.80	0.80-1.20	490	690-850	17	
IS 1230												
IS 1239 Parti	-	-	0.050	0.050	-	-	-	-	320	-	20	
IS 3589												
IS 3589 Gr. Fe 380	0.16 Max	1.20 Max	0.040	0.040	-	-	-	-	330	195	20	
IS 3589 Gr. Fe410	0.20 Max	1.30 Max	0.040	0.040	-	-	-	-	410	235	18	
IS 1979												
IS 1979 Gr. YST290	0.28 Max	1.25 Max	0.040	0.050	-	-	-	-	410	290		
IS 1979 Gr. YST 320	0.30 Max	1.35 Max	0.040	0.050	-	-	-	-	430	320		
IS 1979 Gr. YST 360	0.30 Max	1.35 Max	0.040	0.050	-	-	-	-	450	360		
IS 1979 Gr. YST 390	0.26 Max	1.35 Max	0.040	0.050	-	-	-	-	490	390		
IS 1979 Gr. YST 410	0.26 Max	1.35 Max	0.040	0.050	-	-	-	-	520	410		
IS 1979 Gr. YST 450	0.26 Max	1.40 Max	0.040	0.050	-	-	-	-	530	450		
IS 1979 Gr. YST 480	0.26 Max	1.60 Max	0.040	0.040	-	-	-	-	565	480		
IS 1978												
IS 1978 Gr. YST 210	0.22 Max	0.90 Max	0.040	0.050	-	-	-	-	330	210		
IS 1978 Gr. YST 240	0.27 Max	1.15 Max	0.040	0.050	-	-	-	-	410	240		

e=1942 57 A_{0.2} / U_{0.8}

STAINLESS STEEL PIPE DIMENSION ANSI B 36.19

Nominal Pipe Size		Outside Diameter	Schedule 5S		Schedule 10S		Schedule 20S		Schedule 40S		Schedule 80S		Schedule 160S		Schedule XXS	
MM	INCH	MM	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M
3	1/8	10.3	1.2	0.26	1.24	0.28	1.5	0.33	1.73	0.37	2.41	0.47	-	-	-	-
6	1/4	13.7	1.2	0.37	1.65	0.49	2.00	0.58	2.24	0.630	3.02	0.80	-	-	-	-
10	3/8	17.1	1.2	0.47	1.65	0.63	2.00	0.74	2.31	0.840	3.20	1.10	-	-	-	•
15	1/2	21.3	1.65	0.80	2.11	1.00	2.30	1.07	2.77	1.27	3.73	1.62	4.78	1.94	7.47	2.55
20	3/4	26.7	1.65	1.02	2.11	1.28	2.55	1.52	2.87	1.69	3.91	2.20	5.56	2.90	7.82	3.64
25	1	33.4	1.65	1.30	2.77	2.09	2.55	1.94	3.38	2.50	4.55	3.24	6.35	4.24	9.09	5.45
32	1 1/4	42.2	1.65	1.65	2.77	2.70	3.00	2.90	3.56	3.39	4.85	4.47	6.35	5.61	9.70	7.77
40	1 1/2	48.3	1.65	1.90	2.77	3.11	3.00	3.35	3.68	4.05	5.08	5.41	7.14	7.25	10.15	9.55
50	2	60.3	1.65	2.39	2.77	3.93	3.00	4.24	3.91	5.44	5.54	7.48	8.74	11.11	11.07	13.44
65	2 1/2	73.0	2.11	3.69	3.05	5.26	4.00	6.81	5.16	8.63	7.01	11.41	9.53	14.91	14.02	20.39
80	3	88.9	2.11	4.51	3.05	6.45	4.00	8.37	5.49	11.29	7.62	15.27	11.1	21.30	15.24	27.68
100	4	114.3	2.11	5.84	3.05	8.36	4.50	12.18	6.02	16.07	8.56	22.32	13.49	33.54	17.12	41.03
125	5	141.3	2.77	9.47	3.40	11.57	5.00	16.80	6.55	21.8	9.53	30.97	15.88	49.11	19.05	57.43
150	6	168.3	2.77	11.32	3.40	13.82	6.35	25.36	7.11	28.26	10.97	42.56	18.25	67.53	21.95	79.22
200	8	219.1	2.77	14.78	3.76	19.96	6.35	33.31	8.18	42.55	12.7	64.64	23.01	111.27	22.23	107.92
250	10	273.1	3.40	22.61	4.19	27.78	6.35	41.77	9.27	60.31	12.7	81.55	28.58	172.33	25.40	155.15
300	12	323.8	3.96	31.24	4.57	36.00	6.35	49.7	9.53	73.85	12.7	97.43	33.32	238.68	25.40	186.90
350	14	355.6	3.96	34.34	4.78	41.30	7.92	67.90	11.13	94.54						
400	16	406.4	4.19	41.56	4.78	47.34	7.92	77.82	12.7	123.30						
450	18	457.2	4.19	46.81	4.78	53.32	7.92	87.74	14.27	155.86						
500	20	508.0	4.78	59.31	5.54	68.64	9.53	117.14	15.09	183.42						
600	24	610.0	5.54	82.57	6.35	94.52	9.53	141.11	17.48	255.41						

All Dimensions in millimeters. W.T. = Wall Thickness. KG/M = Kilograms per Meter.

DIMENSION TOLERANCE ANSI B 36.10 / B 36.19

Tubes Specification ASTM	Nominal Pipe Size (mm)	Permissible variations in Outside Diameter (mm)		Permissible variations in THK	Permissible variations in Length (mm)		Straight tolerance
		Over	Under		Over	Under	
A 106 CS Seamless Pipe for High Temp. A 312 Seamless & Welded Austenitic SS Pipes A333 Seamless & Welded pipe for LT Service A 335 Seamless Ferritic Alloy Steel Pipe for High Temp. Service	3 to 40 Incl	0.4	0.8	-12.5%	6	0	Up to 125 mm O/D and 12 mm THK Pipe -0.76 mm Over 125 mm O/D to 200 mm O/D Inclusive -1.15 mm
	Over 40 to 100 Incl.	0.8	0.8				
	Over 100 to 200 Incl.	1.6	0.8				
	Over 200 to 450 Incl.	2.4	0.8				
	Over 450 to 650 Incl.	3.2	0.8				Over 200 mm O/D to 324 mm O/D Inclusive -1.52 mm
	Over 650 to 850 Incl.	4.0	0.8				
A 358 ERW Austenitic Cr-NiAs pipe for High Temp. serv.	All Sizes (upto 200 NB)	+0.5% -0.5%	-0.5%	+0.3 mm			3 mm / 3 meters
A409 ERW Large Dia Austenitic Steel Pipes	450 to 750 (SCH 5 S & 10 S)	+0.2% +0.4% Based on Circumferential Measurement	+0.2% (For T<4.8 mm) -0.4 (For T 4.8 mm)	+0.46 mm			4.8 mm / 3 meters

CARBON STEEL & ALLOY STEEL PIPE DIMENSIONS ANSI B 36.10

Nominal Pipe Size	O/D	Schedule 10	Schedule 20	Schedule 30	Schedule STD	Schedule 40	Schedule 60	Schedule XS	Schedule 80	Schedule 100	Schedule 120	Schedule 140	Schedule 160	Schedule XXS
MM	INCH	MM	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M	W.T.	KG/M
3	1/8	10.3			1.73	0.37	1.73	0.47	2.41	0.47				
6	1/4	13.7			2.24	0.63	2.24	0.80	3.02	0.80				
10	3/8	17.1			2.31	0.84	2.31	1.10	3.20	1.10				
15	1/2	21.3			2.77	1.27	2.77	1.62	3.73	1.62			4.78	1.95
20	3/4	26.7			2.87	1.69	2.87	2.20	3.91	2.20			5.56	2.90
25	1	33.4			3.38	2.50	3.38	2.50	4.55	3.24			6.35	4.24
32	VA	42.2			3.56	3.39	3.56	3.39	4.85	4.47			6.35	5.61
40	1 1/2	48.3			3.68	4.05	3.68	4.05	5.08	5.41			7.14	7.25
50	2	60.3			3.91	5.44	3.91	5.44	5.54	7.48			8.74	11.11
65	2 1/2	73.0			5.16	8.63	5.16	8.63	7.01	11.41			9.53	14.92
80	3	88.9			5.49	11.3	5.49	11.3	7.62	15.3			11.13	21.35
90	3 1/2	101.6			5.74	13.57	5.74	13.57	8.08	18.63			-	
100	4	114.3			6.02	16.07	6.02	16.07	8.56	22.3	11.13	28.32	13.5	33.5
125	5	141.3			6.55	21.77	6.55	21.77	9.53	30.9	12.7	40.2	15.9	49.11
150	6	168.3			7.11	28.26	7.11	28.26	10.97	42.5	14.3	54.2	18.3	67.5
200	8	219.1	6.35	33.3	8.18	42.5	8.18	42.5	12.7	64.6	18.3	90.4	20.6	100.9
250	10	273.0	6.35	41.7	9.27	60.3	9.27	60.3	15.1	96.0	21.44	133.0	25.4	155
300	12	323.8	6.35	49.7	9.53	73.8	10.31	79.7	17.5	132.0	25.4	187.0	28.6	208
350	14	355.6	6.35	54.7	9.53	81.3	11.13	94.6	19.0	158.0	27.8	224.0	31.8	253.5
400	16	406.4	6.35	62.6	7.92	77.9	9.53	93.3	20.3	26.2	245.0	30.9	286.0	333
450	18	457.2	6.35	70.6	7.92	87.7	11.13	122.0	23.8	254.6	29.36	310.0	34.0	363.0
500	20	508.0	6.35	78.5	9.53	117.2	12.7	155.1	26.2	311.0	32.5	381.0	38.1	441.0
550	22	558.8	6.35	86.6	9.53	129.0	12.7	171.0	28.6	373.0	34.9	451.0	41.3	527.0
600	24	610.0	6.35	94.5	9.53	141.0	14.3	210.0	30.9	142.08	38.8	547.7	46.0	640.0
650	26	660.0	7.92	127.3	9.53	153.0			12.7	202			52.4	720.15
700	28	711.0	7.92	137.4	12.7	218.0	15.88	272.0						
750	30	762.0	7.92	147.9	12.7	234.6	15.88	292.2						
800	32	812.8	7.92	157.9	12.7	250.6	15.88	312.0						
850	34	863.6	7.92	167.9	12.7	266.5	15.88	331.7						
900	36	914.4	7.92	176.9	12.7	282.4	15.88	352.2						

All Dimensions in millimeters. W.T. = Wall Thickness. KG/M = Kilograms per Meter.



Nickle Alloy



CHEMICAL & PHYSICAL PROPERTIES OF NICKEL BASE ALLOYS

Grade	C	Cr	Co	Fe	Mn	Mo	Ni	P	Si	S	W	V	Al	B	Cu	Nb	Ti
Hastalloy B-2 Alloy	0.02max	1 max	1 max	2 max	1 max	27-29	Bal	0.04 max	0.1 max	0.03 max	-	-	-	-	-	-	-
Hastalloy C-22 Composition	0.015max	20-22.5	2.5 min	2-6	0.5 max	12.5-14.5	Bal	0.02 max	0.08 max	0.02 max	2.5-3.5	0.35 min	-	-	-	-	-
Hastalloy C-276	0.02 max	14.5-16.5	2.5 max	4-7	1 max	15-17	Bal	0.03 max	0.08 max	0.03 max	3-4.5	0.35 max	-	-	-	-	-
Hastalloy X Alloy	0.05-0.15	20.5-23	0.5-2.5	17-20	1 max	8-10	Bal	0.04 max	1 max	0.05 max	0.2-1	-	0.5 max	0.008 max	0.5 max	-	0.15 max
Hastalloy G-30 Alloy	0.03 max	28-31.5	5 max	13-17	1.5 max	4-6	Bal	0.04 max	0.8 max	0.02 max	1.5-4	-	-	-	1-2.4	-	-
Incoloy 825 Composition	0.05max	19.5-23.5	-	Bal	1 max	2.5-3.5	38-46	0.03 max	0.5 max	0.03 max	-	-	0.2 max	-	1.5-3	-	0.6-1.2
Inconel 600	0.15 max	14-17	-	6-10	1 max	-	Bal	-	0.5 max	0.015 max	-	-	-	-	0.5 max	-	-
Inconel 601 composition	0.1 max	21-25	-	Balan	1 max	-	58-63	-	0.5 max	0.015 max	-	-	1-1.7	-	-	-	-
Inconel 625	0.1 max	20-23	1 max	5 max	0.5 max	8-10	Balance	0.15 max	0.5 max	0.015 max	-	-	0.4 max	-	-	-	0.4 max
Inconel 718	0.08 max	17-21	1 max	Balance	0.35 max	2.8-3.3	50-55	0.015 max	0.35 max	0.015 max	-	-	0.2-0.8	0.006 max	0.3 max	4.75-5.5	0.65-1.15
Inconel X-750 Composition	0.08 max	14-17	-	5-9	1 max	-	Balance	-	0.5 max	0.01 min	-	-	0.4-1	-	0.5 max	0.7-1.2	2.25-2.75
Monel Alloy 400	0.3 max	-	-	2.5 max	2 max	-	Balance	-	0.5 max	0.024 max	-	-	-	-	-	-	-
Alloy 29 (20Cb3) Composition	0.07 max	19-21	-	Balance	2 max	2-3	32-38	0.045 max	1 max	0.035 max	-	-	-	-	3-4	-	-
Alloy 904L	0.02 max	19-23	Balance	-	2 max	3-5	23-28	0.045 max	1 max	0.035 max	-	-	-	-	1-2	-	-
Nickel 200 Composition	0.15 max	-	-	0.4 max	0.35 max	-	Balance	-	0.35 max	0.01 max	-	-	-	-	0.25 max	-	-

PHYSICAL & MECHANICAL PROPERTIES

Grade	Density (lb/Cu.in)	Specific Gravity	Specific Heat (Btu/lb/Deg F. [32-212 Deg F])	Electrical Resistivity (microhm-cm)	Melting Point (Deg F) (at 68 Deg F))	Thermal Conductivity Expansion	Mean Coeff Thermal Tension	Modulus of Elasticity	Poissons Ratio	Magnetic Permeability	Reduction of Area
Hastalloy B-2 Alloy	0.33	9.22	0.093	825	2600	85	5.7	31.4	-	-	-
Hastalloy C-22 Composition	0.314	8.69	0.1	-	2550	70	6.9	29.9	-	-	-
Hastalloy C-276	0.321	8.89	0.102	779	2500	78	6.2	29.8	-	-	-
Hastalloy X Alloy	0.297	8.22	0.116	712	2400	63	7.729.8	0.328	1.002	-	-
Hastalloy G-30 Alloy	0.297	8.22	0.109	698	2500	71	7.1	29.3	-	-	-
Incoloy 825 Composition	0.294	8.14	0.105	678	2525	78.5	7.8	29.8	0.42	1.005	-
Inconel 600	0.306	8.47	0.106	620	2550	103	5.8	31.1	-	1.01	60
Inconel 601 composition	0.293	8.11	0.107	710	2460	87	7.6	29.95	-	1.003	-
Inconel 625	0.305	-	0.107	-	2425	74	7.3	29.2	0.312	-	70
Inconel 718	0.29	7.98	0.104	753	2420	77	7.3	29	0.284	1.001	-
Inconel X-750 Composition	0.298	8.25	0.103	731	2575	83	7	31	-	1	42
Monel Alloy 400	0.318	8.8	0.105	307	2425	167	7.7	26	0.32	-	-
Alloy 29 (20Cb3) Comp.	0.292	8.055	0.12	651	-	-	-	28	-	1.002	-
Alloy 904L Composition	0.285	7.9	0.12	480	-	-	-	28.4	-	-	-
Nickel 200 Composition	Hardening : Hardens due to cold working only.										



Flanges



DIMENSIONAL TOLERANCES OF FORGED FLANGES ANSI B 16.5

Welding Neck

Threaded, Slipon, Lapjoint Socket Welding & Blind

Outside Diameter	O.D. is 600 or smaller O.D. over 600	±1.6 ±3.1	Outside Diameter	O.D. is 50 or smaller O.D. over 600	±1.6 ±3.1
Inside Diameter (bore)	250 and smaller 12 through 450 500 and larger	+ 0.7 + 1.6 -1.6 ±3.1	Inside Diameter slip lap joint:	threaded: to standard gauge limits socket-welding: 250 and larger 300 and larger	(bore) ±0.7 ±1.6 -0.0 -0.0
Diameter of contact face	1.6 raise face 6.3 raised face: tongue & grooved male & female	±0.7 ±0.4	Diameter of counter bore	threaded 250 and smaller 300 and larger	±0.7 ±1.6 -0.0 -0.0
Diameter of hub at base	When E is 600 or smaller When E is over 600	±1.6 ±3.1	Outside diameter hub	300 and smaller 350 and larger	±2.3 -1.6 ±3.1 ±0.7
Diameter hub at point of welding	125 and smaller 150 and larger	±0.7 ±4.0 +0.7 +0.0	Diameter of contact face	1.6 raised face 6.3 raised: tongue & grooved male & female	±0.4
Thickness	450 and smaller 500 and larger	±3.1 ±4.7 +0.0 +0.0	Thickness	450 and smaller 500 and larger	±3.1 ±4.1 -0.0 -0.0
Length through hub	250 and smaller 300 and larger	+ 1.6 ±3.1	Length through hub	250 and smaller 300 and larger	±1.6 ±3.1
Drilling	bolt circle bolt hole spacing	+ 1.6 ±0.7	Drilling	bolt circle bolt hole spacing	±1.6 ±0.7
	essentricity with respect to bore	0.7 max		essentricity with respect to bore	0.7 max

WELDING NECK FLANGE BORE

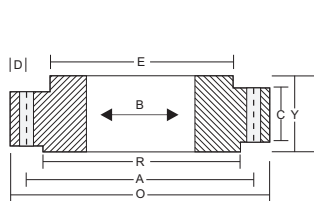
NPS (NB)	O.D. (MM)	Sch. 10	Sch. 20	Sch. 30	Sch. Std	Sch. 40	Sch. XS	Sch. 80	Sch. 120	Sch. 160	Sch. XXS
15	21.33	17.1	-	-	15.7	15.7	13.8	13.8	-	11.7	6.4
20	26.67	22.5	-	-	20.8	20.8	18.8	18.8	-	15.5	11.0
25	33.40	27.9	-	-	26.6	25.4	24.3	24.3	-	20.7	15.2
32	42.16	36.6	-	-	35.0	35.0	32.4	32.4	-	29.4	22.7
40	48.26	42.7	-	-	40.8	40.8	38.1	38.1	-	33.7	27.9
50	60.31	54.8	-	-	52.3	52.3	49.2	49.2	-	42.8	38.1
65	73.02	66.9	-	-	62.4	62.4	59.0	59.0	-	53.9	44.9
80	88.90	82.8	-	-	77.9	77.9	73.6	73.6	-	66.6	58.4
100	114.30	108.2	-	-	102.2	102.2	97.1	97.1	92.0	87.3	80.0
125	141.30	134.5	-	-	128.1	128.1	122.2	122.2	115.9	109.5	103.2
150	168.27	161.5	-	-	154.0	154.0	146.3	146.3	139.7	131.7	124.3
200	219.07	211.6	206.2	204.9	202.7	202.7	193.6	193.6	182.5	173.0	174.6
250	273.05	264.7	260.3	257.4	254.5	254.5	247.6	242.8	230.1	215.9	222.2
300	323.85	314.7	311.1	307.0	304.8	303.2	298.4	288.8	273.0	257.2	273.0
350	355.60	346.2	337.8	336.5	336.5	333.3	330.2	317.5	300.0	284.1	-
400	406.40	396.7	390.3	387.3	387.3	381.0	381.0	363.5	344.5	325.4	-
450	457.20	447.5	441.1	434.9	438.1	428.6	431.8	409.5	387.3	366.7	-
500	508.00	497.3	488.9	482.6	488.9	477.8	482.6	455.6	431.8	407.9	-
600	609.60	596.9	590.5	581.0	590.5	574.6	584.2	547.6	517.5	490.5	-

FORGED FITTINGS & FLANGES ASTM

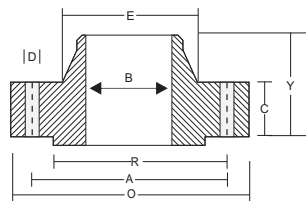
MATERIAL SPECIFICATION FORGED FITTINGS & FLANGES

SPECIFICATION (ASTM - 2002)		CHEMICAL PROPERTIES					MECHANICAL PROPERTIES					OTHERS	
		C%	Mn%	P% (Max)	S% (Max)	Si%	Cr%	Ni%	Mo%	U.T.S. (Min) Mpa	Y.S. (Min) Mpa		ELONG (Min) %
STAINLESS STEEL													
A 182 Gr. F 304	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-11.0	-	515	205	30	50	-
A 182 Gr. F 304L	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-13.0	-	485	170	30	50	-
A 182 Gr. F 304H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-11.0	-	515	205	30	50	-
A 182 Gr. F 304LN	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-10.5	-	515	205	30	50	N%=0.10-0.16
A 182 Gr. F 309H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	22.0-24.0	12.0-15.0	-	515	205	30	50	-
A 182 Gr. F 310	0.25 Max	2.00 Max	0.045	0.030	1.00 Max	24.0-26.0	19.0-22.0	-	515	205	30	50	-
A 182 Gr. F 316	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-14.0	2.0-3.0	515	205	30	50	-
A 182 Gr. F 316L	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-15.0	2.0-3.0	485	170	30	50	-
A 182 Gr. F 316H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-14.0	2.0-3.0	515	205	30	50	-
A 182 Gr. F 316LN	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	11.0-14.0	2.0-3.0	515	205	30	50	N%=0.10-0.16
A 182 Gr. F 317	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	11.0-15.0	3.0-4.0	515	205	30	50	-
A 182 Gr. F 317L	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	11.0-15.0	3.0-4.0	485	170	30	50	-
A 182 Gr. F 321	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	17.0-19.0	9.0-12.0	-	515	205	30	50	TT%=(5xC)-0.70
A 182 Gr. F 321H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	17.0-19.0	9.0-13.0	-	515	205	30	50	TT%=(4xC)-0.70
A 182 Gr. F 347	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	17.0-20.0	9.0-13.0	-	515	205	30	50	Cb%=(10xC)-1.10
A 182 Gr. F 347H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	17.0-20.0	9.0-13.0	-	515	205	30	50	O X O II -P o -O O
CARBON STEEL													
A 105	0.035 Max	0.60-1.05	0.035	0.040	0.10-0.35	0.30 Max	0.40 Max	0.12 Max	485	250	22	30	187 Cu%≤0.40 Max, Va %≤0.08 Max
LOW TEMPERATURE CARBON STEEL													
A 350 Gr. LF 1	0.30 Max	0.60-1.35	0.035	0.040	0.15-0.30	0.30 Max	0.40 Max	0.12 Max	415-585	205	25	38	197 Cu%≤0.40Max, Cb%≤0.02 Max, Va %≤0.05 Max, Impact Test =28.9°C, J=18 Min
A 350 Gr. LF 2	0.30 Max	0.60-1.35	0.035	0.040	0.15-0.30	0.30 Max	0.40 Max	0.12 Max	485-655	250	22	30	197 Cu%≤0.40Max, Cb%≤0.02 Max, Va %≤0.05 Max, Impact Test =46.6°C, J=18 Min
A 350 Gr. LF 3	0.20 Max	0.90 Max	0.035	0.040	0.20-0.35	0.30 Max	3.30-3.70	0.12 Max	485-655	260	22	35	197 Cu%≤0.40Max, Cb%≤0.02 Max, Va %≤0.03 Max, Impact Test =101°C, J=20 Min
ALLOY STEEL													
A 182 Gr. F1	0.28 max	0.60-0.90	0.045	0.045	0.15-0.35	-	-	0.44-0.65	485	275	20	30	143-192 -
A 182 Gr. F 2	0.05-0.21	0.60-0.90	0.045	0.045	0.15-0.35	-	-	0.44-0.65	485	275	20	30	143-192 -
A 182 Gr. F 5	0.15 max	0.30-0.60	0.030	0.030	0.50 Max	4.0-6.0	0.5 Max	0.44-0.65	485	275	20	35	143-217 -
A 182 Gr. F 9	0.15 max	0.30-0.60	0.030	0.030	0.50-1.00	8.0-10.0	-	0.90-1.10	585	380	20	40	179-217 -
A 182 Gr. F 11 CL1	0.05-0.15	0.30-0.60	0.030	0.030	0.50-1.00	1.0-1.50	-	0.44-0.65	415	205	20	45	121-174 -
A 182 Gr. F 11 CL2	0.10-0.20	0.30-0.80	0.040	0.040	0.50-1.0	1.0-1.50	-	0.40-0.65	485	275	20	30	143-207 -
A 182 Gr. F 11 CL3	0.10-0.20	0.30-0.80	0.040	0.040	0.50-1.0	1.0-1.50	-	0.44-0.65	515	310	20	30	156-207 -
A 182 Gr. F12CL1	0.05-0.15	0.30-0.60	0.045	0.045	0.50 Max	0.80-1.25	-	0.44-0.65	415	220	20	45	121-174 -
A 182 Gr. F 12 CL2	0.10-0.20	0.30-0.80	0.040	0.040	0.10-0.60	0.80-1.25	-	0.44-0.65	485	275	20	30	143-207 -
A 182 Gr. F 22 CL1	0.05-0.15	0.30-0.60	0.040	0.040	0.50 Max	2.0-2.5	-	0.87-1.13	415	205	20	35	170 -
A 182 Gr. F 22 CL3	0.05-0.15	0.30-0.60	0.040	0.040	0.50 Max	2.0-2.50	-	0.87-1.13	515	310	20	30	156-207 -
A 182 Gr. F 91	0.08-0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.0-9.5	0.40 Max	0.85-1.05	585	415	20	40	248 Cb%≤0.06-0.10, Ni%≤0.03-0.07, Va %≤0.08-0.25

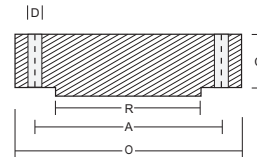
DIMENSIONS OF FORGED FLANGES ANSI B 16.5



SLIP-ON FLANGE



WELDING NECK FLANGE



BLIND FLANGE

ASA 150 CLASS

Nominal Pipe Size	Flange Dia	Dia of Bolt Circle	Dia of Bolt Holes	No. of Holes	Thk. of Flange	Dia of Hub	Length through Hub			Dia of Bore		Dia of R/F	Depth of Socket	Pipe Dia
							S/O & S/W	W/N	L/J	S/O & S/W	L/J			
(MM) (INCH)	O	A	D		C	E	Y	Y	Y	B	B	R	F	X
15	1/2	88.9	60.3	15.9	4	11.1	15.9	47.6	15.9	22.3	22.9	34.9	9.5	21.33
20	3/4	98.4	69.8	15.9	4	12.7	15.9	52.4	15.9	27.7	28.2	42.9	11.1	26.67
25	1	107.9	79.4	15.9	4	14.3	17.5	55.6	17.5	34.5	35.0	50.8	12.7	33.40
32	1 1/4	117.5	88.9	15.9	4	15.9	20.6	57.1	20.6	43.2	43.7	63.5	14.3	42.16
40	1 1/2	127.0	98.4	15.9	4	17.5	22.2	61.9	22.2	49.5	50.0	73.0	15.9	48.26
50	2	152.4	120.6	19.0	4	19.0	25.4	63.5	25.4	62.0	62.5	92.1	17.5	60.31
65	2 1/2	177.8	139.7	19.0	4	22.2	28.6	69.8	28.6	74.7	75.4	104.8	19.0	73.02
80	3	190.5	152.4	19.0	4	23.8	30.2	69.8	30.2	90.7	91.4	127.0	20.6	88.90
100	4	228.6	190.5	19.0	8	23.8	33.3	76.2	33.3	116.1	116.8	157.2	23.8	114.30
125	5	254.0	215.9	22.2	8	23.8	36.5	88.9	36.5	143.8	144.5	185.7	23.8	141.30
150	6	279.4	241.3	22.2	8	25.4	39.7	88.9	39.7	170.7	171.4	215.9	27.0	168.27
200	8	342.9	298.4	22.2	8	28.6	44.4	101.6	44.4	221.5	222.2	269.9	31.7	219.07
250	10	406.4	361.9	25.4	12	30.2	49.2	101.6	49.2	276.3	277.4	323.8	33.3	273.05
300	12	482.6	431.8	25.4	12	31.8	55.6	114.3	55.6	327.1	328.2	381.0	39.7	323.85
350	14	533.4	476.2	28.6	12	34.9	57.1	127.0	79.4	359.1	360.2	412.7	41.3	355.60
400	16	596.9	539.7	28.6	16	36.5	63.5	127.0	87.3	410.5	411.2	469.9	44.4	406.40
450	18	635.0	577.8	31.7	16	39.7	68.3	139.7	96.8	461.8	462.3	533.4	49.2	457.20
500	20	698.5	635.0	31.7	20	42.9	73.0	144.5	103.2	513.1	514.3	584.2	54.0	508.00
600	24	812.8	749.3	34.9	20	47.6	82.5	152.4	111.1	615.9	615.9	692.1	63.5	609.60

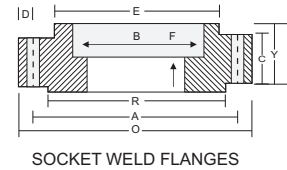
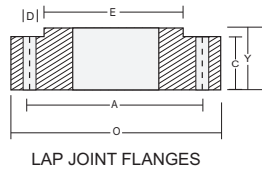
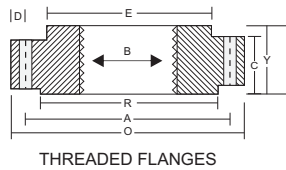
All Dimensions are in Millimeters • Flanges except Lap Joint will be furnished with (1.6mm) Raised Face, which is included in Thickness(C) and Length through Hub(Y).

ASA 300 CLASS

Nominal Pipe Size	Flange Dia	Dia of Bolt Circle	Dia of Bolt Holes	No. of Holes	Thk. of Flange	Dia of Hub	Length through Hub			Dia of Bore		Dia of R/F	Depth of Socket	Pipe Dia
							S/O & S/W	W/N	L/J	S/O & S/W	L/J			
(MM) (INCH)	O	A	D		C	E	Y	Y	Y	B	B	R	F	X
15	1/2	95.2	66.7	15.9	4	14.3	22.2	52.4	22.2	22.3	22.9	34.9	9.5	21.33
20	3/4	117.5	82.5	19.0	4	15.9	25.4	57.1	25.4	27.7	28.2	42.9	11.1	26.67
25	1	123.8	88.9	19.0	4	17.5	27.0	61.9	27.0	34.5	35.0	50.8	12.7	33.40
32	1 1/4	133.3	98.4	19.0	4	19.0	27.0	65.1	27.0	43.2	43.7	63.5	14.3	42.16
40	1 1/2	155.6	114.3	22.2	4	20.6	30.2	68.3	30.2	49.5	50.0	73.0	15.9	48.26
50	2	165.1	127.0	19.0	8	22.2	33.3	69.8	33.3	62.0	62.5	92.1	17.5	60.31
65	2 1/2	190.5	149.2	22.2	8	25.4	38.1	76.2	38.1	74.7	75.4	104.8	19.0	73.02
80	3	209.5	168.3	22.2	8	28.6	42.9	79.4	42.9	90.7	91.4	127.0	20.6	88.90
100	4	254.0	200.0	22.2	8	31.8	47.6	85.7	47.6	116.1	116.8	157.2	23.8	114.30
125	5	279.4	234.9	22.2	8	34.9	50.8	98.4	50.8	143.8	144.5	185.7	-	141.30
150	6	317.5	269.9	22.2	12	36.5	52.4	98.4	52.4	170.7	171.4	215.9	-	168.27
200	8	381.0	330.2	25.4	12	41.3	61.9	111.1	61.9	221.5	222.2	269.9	-	219.07
250	10	444.5	387.3	28.6	16	47.6	66.7	117.5	95.2	276.3	277.4	323.8	-	273.05
300	12	520.7	450.8	31.7	16	50.8	73.0	130.2	101.6	327.1	328.2	381.0	-	323.85
350	14	584.2	514.3	31.7	20	54.0	76.2	142.9	111.1	359.1	360.2	412.7	-	355.60
400	16	647.7	571.5	34.9	20	57.2	82.5	146.0	120.6	410.5	411.2	469.9	-	406.40
450	18	711.2	628.5	34.9	24	60.3	88.9	158.7	130.2	461.8	462.3	533.4	-	457.20
500	20	774.7	685.8	34.9	24	63.5	95.2	161.9	139.7	513.1	514.3	584.2	-	508.00
600	24	914.4	812.8	41.3	24	69.8	106.4	168.3	152.4	615.9	615.9	692.1	-	609.60

All Dimensions are in Millimeters • Flanges except Lap Joint will be furnished with (1.6mm) Raised Face, which is included in Thickness(C) and Length through Hub(Y).

DIMENSIONS OF FORGED FLANGES ANSI B 16.5



ASA 600 CLASS

Nominal Pipe Size (MM)	Flange Dia O	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk. of Flange C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F	Pipe Dia X
							S/O & S/W Y	W/N Y	L/J Y	S/O & S/W B	L/J B			
15	95.2	66.7	15.9	4	14.3	38.1	22.2	52.4	22.3	22.3	22.8	34.9	9.5	21.33
20	117.5	82.5	19.0	4	15.9	47.6	25.4	57.1	25.4	27.7	28.1	42.9	11.1	26.67
25	123.8	88.9	19.0	4	17.5	54.0	27.0	61.9	26.9	34.5	35.0	50.8	12.7	33.40
32	133.3	98.4	19.0	4	20.6	63.5	28.6	66.7	28.4	43.2	43.6	63.5	14.2	42.16
40	155.6	114.3	22.2	4	22.2	69.8	31.7	69.8	31.7	49.5	50.0	73.0	15.8	48.26
50	165.1	127.0	19.0	8	25.4	84.1	36.5	73.0	36.5	62.0	62.4	92.1	17.4	60.31
65	190.5	149.2	22.2	8	28.6	100.0	41.3	79.4	41.1	74.7	75.4	104.8	19.0	73.02
80	209.5	168.3	22.2	8	31.8	117.5	46.0	82.5	45.9	90.7	91.4	127.0	-	88.90
100	273.0	215.9	25.4	8	38.1	152.4	54.0	101.6	53.8	116.1	116.8	157.2	-	114.30
125	330.2	266.7	28.6	8	44.4	188.9	60.3	114.3	60.4	143.8	144.5	185.7	-	141.30
150	355.6	292.1	28.6	12	47.6	222.2	66.7	117.5	66.5	170.7	171.4	215.9	-	168.27
200	419.1	349.2	31.7	12	55.6	273.0	76.2	133.3	76.2	221.5	222.2	269.9	-	219.07
250	508.0	431.8	34.9	16	63.5	342.9	85.7	152.4	111.2	276.3	277.4	323.8	-	273.05
300	558.8	488.9	34.9	20	66.7	400.0	92.1	155.6	117.3	327.1	328.2	381.0	-	323.85
350	603.2	527.0	38.1	20	69.9	431.8	93.7	165.1	127.0	359.1	360.1	412.7	-	355.60
400	685.8	603.2	41.3	20	76.2	495.3	106.4	177.8	139.7	410.5	411.2	469.9	-	406.40
450	742.9	654.0	44.4	20	82.6	546.1	117.5	184.1	152.4	461.8	462.3	533.4	-	457.20
500	812.8	723.9	44.4	24	88.9	609.9	127.0	190.5	165.1	513.1	514.3	584.2	-	508.00
600	939.8	838.2	50.8	24	101.6	717.5	139.7	203.2	184.1	615.9	615.9	692.1	-	609.60

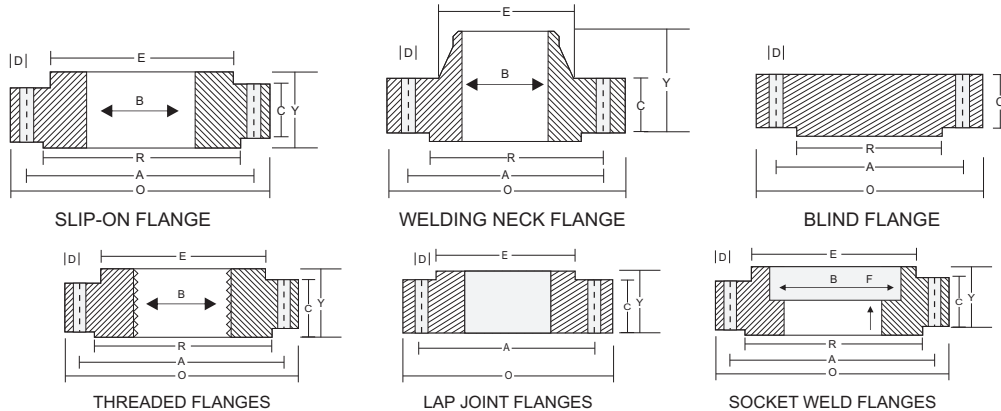
All Dimensions are in Millimeters • Flanges except Lap Joint will be furnished with(6.35mm) Raised Face, which is not included in Thickness(C) and Length through Hub(Y).

ASA 900 CLASS

Nominal Pipe Size (MM)	Flange Dia O	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk. of Flange C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F	Pipe Dia X
							S/O & S/W Y	W/N Y	L/J Y	S/O & S/W B	L/J B			
15	120.6	82.5	22.2	4	22.2	38.1	31.7	60.3	31.7	22.3	22.8	34.9	9.5	21.33
20	130.2	88.9	22.2	4	25.4	44.4	34.9	69.8	35.0	27.7	28.1	42.9	11.1	26.67
25	149.2	101.6	25.4	4	28.6	52.4	41.3	73.0	41.1	34.5	35.0	50.8	12.7	33.40
32	158.7	111.1	25.4	4	28.6	63.5	41.3	73.0	41.1	43.2	43.6	63.5	14.2	42.16
40	177.8	123.8	28.6	4	31.8	69.8	44.4	82.5	44.4	49.5	50.0	73.0	15.8	48.26
50	215.9	165.1	25.4	8	38.1	104.8	57.1	101.6	57.1	62.0	62.4	92.1	17.4	60.31
65	244.5	190.5	28.6	8	41.3	123.8	63.5	104.8	63.5	74.7	75.4	104.8	19.0	73.02
80	241.3	190.5	25.4	8	38.1	127.0	53.9	101.6	53.8	90.7	91.4	127.0	-	88.90
100	292.1	234.9	31.7	8	44.4	158.7	69.8	114.3	69.8	116.0	116.8	157.2	-	114.30
125	349.2	279.4	35.0	8	50.8	190.5	79.3	127.0	79.2	143.7	144.5	185.7	-	141.30
150	381.0	317.5	31.7	12	55.6	234.9	85.8	139.7	85.8	170.6	171.4	215.9	-	168.27
200	469.9	393.7	38.1	12	63.5	298.4	101.6	162.0	114.3	221.4	222.2	269.9	-	219.07
250	546.1	469.9	38.1	16	69.8	368.3	107.9	184.1	127.0	276.3	277.3	323.8	-	273.05
300	609.6	533.4	38.1	20	79.3	419.1	117.4	200.0	142.7	327.1	328.1	381.0	-	323.85

All Dimensions are in Millimeters • Flanges except Lap Joint will be furnished with(6.35mm) Raised Face, which is not included in Thickness(C) and Length through Hub(Y).

DIMENSIONS OF FORGED FLANGES ANSI B 16.5



ASA 1500 CLASS

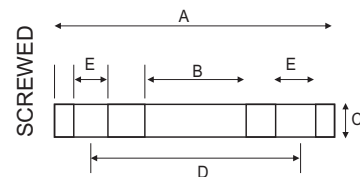
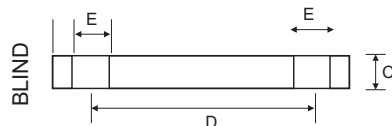
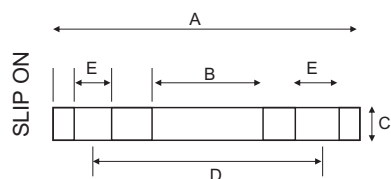
Nominal Pipe Size		Flange Dia	Dia of Bolt Circle	Dia of Bolt Holes	No. of Holes	Thk. of Flange	Dia of Hub	Length through Hub			Dia of Bore		Dia of R/F	Depth of Socket	Pipe Dia
								S/O & S/W	W/N	L/J	S/O & S/W	L/J			
(MM)	(INCH)	O	A	D		C	E	Y	Y	Y	B	B	R	F	X
For Dimensions from 1/2" to 2 1/2" kindly refer ASA 900 LBS Table.															
80	3	266.7	203.2	31.7	8	47.6	133.3	73.0	117.5	73.0	90.7	91.4	127.0	-	88.90
100	4	311.1	241.3	34.9	8	54.0	161.9	90.5	123.0	90.4	116.1	116.8	157.2	-	114.30
125	5	374.6	292.1	41.3	8	73.0	196.8	104.8	155.6	104.8	143.8	144.5	185.7	-	141.30
150	6	393.7	317.5	38.1	12	82.6	228.6	119.1	171.4	119.1	170.7	171.4	215.9	-	168.27
200	8	482.6	393.7	44.4	12	92.1	292.1	142.9	212.7	142.8	221.5	222.2	269.9	-	219.07
250	10	584.2	482.6	50.8	12	107.9	368.3	158.7	254.0	177.8	276.3	277.3	323.8	-	273.05
300	12	673.1	571.5	54.0	16	123.8	450.8	181.0	282.5	218.9	327.1	328.1	381.0	-	323.85

All Dimensions are in Millimeters • Flanges except Lap Joint will be furnished with (6.35mm) Raised Face, which is not included in Thickness(C) and Length through Hub(Y).

ASA 2500 CLASS

Nominal Pipe Size		Flange Dia	Dia of Bolt Circle	Dia of Bolt Holes	No. of Holes	Thk. of Flange	Dia of Hub	Length through Hub			Dia of Bore		Dia of R/F	Depth of Socket	Pipe Dia
								S/O & S/W	W/N	L/J	S/O & S/W	L/J			
(MM)	(INCH)	O	A	D		C	E	Y	Y	Y	B	B	R	F	X
15	1/2	133.3	88.9	22.2	4	30.2	42.9	39.7	73.0	39.7	22.3	22.3	34.9	-	21.33
20	3/4	139.7	95.3	22.2	4	31.7	50.8	42.9	79.4	42.9	27.7	27.7	42.9	-	26.67
25	1	158.7	107.9	25.4	4	34.9	57.1	47.7	88.9	47.7	34.5	34.5	50.8	-	33.40
32	1 1/4	184.1	130.2	28.6	4	38.1	73.0	52.4	95.2	52.4	43.2	43.2	63.5	-	42.16
40	1 1/2	203.2	146.0	31.7	4	44.4	79.4	60.3	111.1	60.3	49.5	49.5	73.0	-	48.26
50	2	234.9	171.4	28.6	8	50.8	95.2	69.8	127.0	69.8	62.4	62.0	92.1	-	60.31
65	2 1/2	266.7	196.8	31.7	8	57.1	114.3	79.4	142.9	79.4	74.7	74.7	104.8	-	73.02
80	3	304.8	228.6	34.9	8	66.7	133.3	92.1	168.3	92.1	90.7	90.7	127.0	-	88.90
100	4	355.6	273.0	41.2	8	76.2	165.1	107.9	190.5	107.9	116.1	116.1	157.2	-	114.30
125	5	419.1	323.8	47.6	8	92.1	203.2	130.0	228.6	130.0	143.8	143.8	185.7	-	141.30
150	6	482.6	368.3	54.0	8	107.9	234.9	152.4	273.0	152.4	170.7	170.7	215.9	-	168.27
200	8	552.4	438.1	54.0	12	127.0	304.8	177.8	317.5	177.8	221.5	221.5	269.9	-	129.07
250	10	673.1	539.7	66.7	12	165.1	374.6	228.6	419.1	228.6	276.3	276.3	323.8	-	273.05
300	12	762.0	619.1	73.0	12	184.1	441.3	254.0	463.5	254.0	327.1	327.1	381.0	-	323.85

All Dimensions are in Millimeters • Flanges except Lap Joint will be furnished with (6.35mm) Raised Face, which is not included in Thickness(C) and Length through Hub(Y).



BS 10 Pipes

N.B. Size	Table	Dia of Flange A	Bore of Slip-on B	Thickness of Flange C	Pitch circle Dia D (PCD)	Dia of Bolt Holes E	No. of Bolts
1/2"	D	95	22.3	4.7	67	14.3	4
	E	95	22.3	6	67	14.3	4
	F	95	22.3	9.5	67	14.3	4
	H	114	22.3	13	83	17.5	4
3/4"	D	102	27.7	4.7	73	14.3	4
	E	102	27.7	6	73	14.3	4
	F	102	27.7	9.5	73	14.3	4
	H	114	27.7	13	83	17.5	4
1"	D	114	34.6	5	83	14.3	4
	E	114	34.6	7	83	14.3	4
	F	120	34.6	10	87	17.5	4
	H	120	34.6	14	87	17.5	4
1 1/4"	D	120	43.2	6	87	14.3	4
	E	120	43.2	8	87	14.3	4
	F	133	43.2	13	98	17.5	4
	H	133	43.2	17	98	17.5	4
1 1/2"	D	133	49.5	6	98	14.3	4
	E	133	49.5	9	98	14.3	4
	F	140	49.5	13	105	17.5	4
	H	140	49.5	17	105	17.5	4
2"	D	152	62	8	114	17.5	4
	E	152	62	10	114	17.5	4
	F	165	62	16	127	17.5	4
	H	165	62	19	127	17.5	4
2 1/2"	D	165	75	8	127	17.5	4
	E	165	75	10	127	17.5	4
	F	184	75	16	145	17.5	8
	H	184	75	19	145	17.5	8
3"	D	184	90.5	9.5	145	17.5	4
	E	184	90.5	11	145	17.5	4
	F	203	90.5	16	165	17.5	8
	H	203	90.5	22	165	17.5	8
4"	D	215	116	9.5	178	17.5	4
	E	215	116	13	178	17.5	8
	F	228	116	19	191	17.5	8
	H	228	116	25	191	17.5	8
5"	D	254	144	12.7	210	17.5	8
	E	254	144	14	210	17.5	8
	F	279	144	22	235	22.2	8
	H	279	144	25	235	22.2	8

BS 10 Pipes

N.B. Size	Table	Dia of Flange A	Bore of Slip-on B	Thickness of Flange C	Pitch circle Dia D (PCD)	Dia of Bolt Holes E	No. of Bolts
	D	279	171	12.7	235	17.5	8
	E	279	171	17	235	22.2	8
	F	305	171	22	260	22.2	12
	H	305	171	29	260	22.2	12
	D	336	221.5	13	292	17.5	8
	E	336	221.5	19	292	22.2	8
	F	368	221.5	25	324	22.2	12
	H	368	221.5	32	324	22.2	12
	D	406	276.5	16	356	22.2	8
	E	406	276.5	25	356	22.2	12
	F	431	276.5	22	381	25.4	12
	H	431	276.5	35	381	25.4	12
	D	457	327	16	406	22.2	12
	E	457	327	29	406	25.4	12
	F	488	327	25	438	25.4	16
	H	488	327	38	438	25.4	16
	D	527	359	19	470	25.4	12
	E	527	359	32	470	25.4	12
	F	552	359	25	495	28.7	16
	H	552	359	41	495	28.7	16
	D	578	410.5	19	521	25.4	12
	E	578	410.5	32	521	25.4	12
	F	610	410.5	25	552	28.7	20
	H	610	410.5	44	552	32	20
	D	641	461.5	22	584	25.4	12
	E	641	461.5	35	584	25.4	16
	F	673	461.5	29	610	32	20
	H	673	461.5	48	610	32	20
	D	705	513	25	641	25.4	16
	E	705	513	38	641	25.4	16
	F	737	513	32	673	32	24
	H	737	513	51	673	32	24
	D	826	616	29	756	28.7	16
	E	826	616	38	756	32.3	16
	F	851	616	38	781	32	24
	H	851	616	57	781	35	24

**DIMENSION OF PIPE FLANGES AS PER
ND. 6 DIN 2631**

Nominal in Inches	Pipe size MM	O.D.of Flange MM	Flange Thickness MM	Dia. of Bolt Circle MM	No. of Bolts MM	Dia. of Holes MM
1/2"	15	80	12	55	4	12
3/4"	20	90	12	65	4	12
1.0"	25	100	14	75	4	12
1.1/4"	32	120	14	90	4	14
1.1/2"	40	130	14	100	4	14
2.0"	50	140	14	110	4	14
2.1/2"	65	160	14	130	4	14
3.0"	80	190	16	150	4	18
4.0"	100	210	16	170	4	18
5.0"	125	240	18	200	8	18
6.0"	150	265	18	225	8	18
8.0"	200	320	20	280	8	18
10.0"	250	375	22	335	12	18
12.0"	300	440	22	395	12	23
14.0"	350	490	22	445	12	23
16.0"	400	540	22	495	16	23
20.0"	500	645	24	600	20	23
24.0"	600	755	24	705	20	27

**DIMENSION OF PIPE FLANGES AS PER
ND. 10 DIN 2632**

Nominal in Inches	Pipe size MM	O.D.of Flange MM	Flange Thickness MM	Dia. of Bolt Circle MM	No. of Bolts MM	Dia. of Holes MM
1/2"	15	95	14	65	4	14
3/4"	20	105	16	75	4	14
1.0"	25	115	16	85	4	14
1.1/4"	32	140	16	100	4	18
1.1/2"	40	150	16	110	4	18
2.0"	50	165	18	125	4	18
2.1/2"	65	185	18	145	4	18
3.0"	80	200	20	160	4	18
4.0"	100	220	20	180	8	18
5.0"	125	250	22	210	8	18
6.0"	150	285	22	240	8	23
O od	200	340	24	295	8	23
o o	250	395	26	350	12	23
12.0"	300	445	26	400	12	23
14.0"	350	505	26	460	16	23
16.0"	400	565	26	515	16	27
20.0"	500	670	28	620	20	27
24.0"	600	780	28	725	20	30

**DIN.2633 FLANGES STANDARD NENNDRUCK16
(Nominal Pressure 16Kg/Cm2)
All dimension in mm**

Nominal Bore	Pipe		Out- side Dia.	Flange		Bolting			Height H
	Out- side Dia.	Thick- ness		Thick- ness	Bolt Circle Dia.	No. of Bolts	Thread	Bolt hole Dia.	
10	22	6	90	14	60	4	M12	14	35
15	25	6	95	14	65	4	M12	14	35
20	33	6.5	105	16	75	4	M12	14	38
25	39	7	115	16	85	4	M12	14	38
32	46	7	140	16	100	4	M16	18	40
40	55	7.5	150	16	110	4	M16	18	42
50	65	7.5	165	18	125	4	M16	18	45
65	86	8	185	18	145	4	M16	18	45
80	97	8.5	200	20	160	8	M16	18	50
100	119	9.5	220	20	180	8	M16	18	52
125	145	10	250	22	210	8	M16	18	55
150	172	11	285	22	240	8	M20	23	55
175	199	12	315	24	270	8	M20	23	60
200	224	12	340	24	295	12	M20	23	62
250	278	14	405	26	355	12	M24	27	70
300	330	15	460	28	410	12	M24	27	78
350	382	16	520	30	470	16	M24	27	82
400	436	18	580	35	525	16	M27	30	85
500	542	21	715	36	650	20	M30	33	90
600	646	23	840	40	770	20	M30	36	95

**DIN. 2635 FLANGES STANDARSD NENNDRUCK 40
(Nominal Pressure 40 Kg/Cm2)
All dimension in mm**

Nominal Bore	Pipe			Flange		Bolting			Height H
	Out- side Dia.	Thick- ness	Out- side Dia.	Thick- ness	Bolt Circle Dia.	No. of Bolts	Thread	Bolt hole Dia.	
10	22	6	90	16	60	4	M12	14	35
15	25	6	95	16	65	4	M12	14	38
20	33	6.5	105	18	75	4	M12	14	40
25	39	7	115	18	85	4	M12	14	40
32	46	7	140	18	100	4	M16	18	42
40	55	7.5	150	18	110	4	M16	18	45
50	65	8	165	20	125	4	M16	18	48
65	87	8.5	185	22	145	8	M16	18	52
80	98	9	200	24	160	8	M16	18	58
100	120	10	235	24	190	8	M20	23	63
125	147	11	270	26	220	8	M24	27	68
150	172	11	285	22	240	8	M24	27	75
175	201	13	350	32	295	12	M27	30	82
200	228	14	375	34	320	12	M27	30	88
250	282	16	450	38	385	12	M30	33	105
300	334	17	515	42	450	16	M30	33	115
350	388	19	580	46	510	16	M33	36	125
400	442	21	660	50	585	16	M36	39	135
500	542	21	755	52	670	20	M30	42	140
600	646	24	890	60	795	20	M45	48	



Pipe Fittings

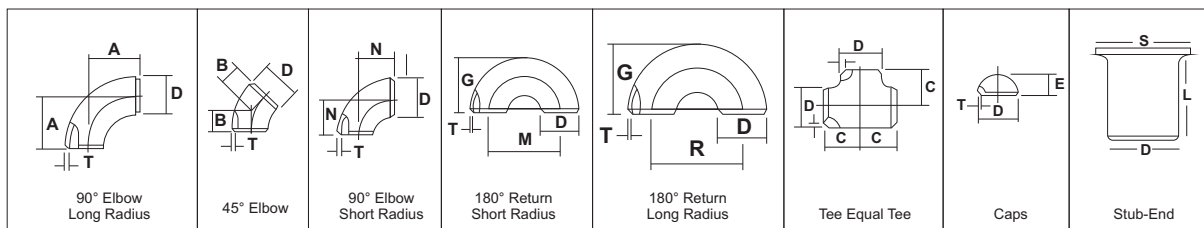


MATERIAL SPECIFICATION FOR SEAMLESS / WELDED BUTT-WELDING PIPE - FITTINGS

BUTT-WELDING FITTINGS ASTM

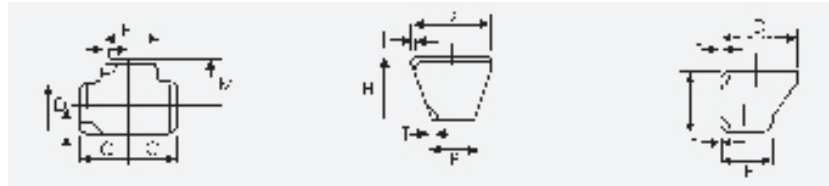
SPECIFICATION (ASTM - 2002)	CHEMICAL PROPERTIES					MECHANICAL PROPERTIES					OTHERS		
	C%	Mn%	P% (Max)	S% (Max)	Si%	Cr%	Ni%	Mo%	U.T.S. (Min) Mpa	Y.S. (Min) Mpa		ELONG (Min) %	RED. AREA %
STAINLESS STEEL													
A 403 Gr. WP 304	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-11.0	-	515	205	28	20	-
A 403 Gr. WP 304L	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-12.0	-	485	170	28	20	-
A 403 Gr. WP 304H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-11.0	-	515	205	28	20	-
A 403 Gr. WP 304LN	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	8.0-11.0	-	515	205	28	20	-
A 403 Gr. WP 309	0.20 Max	2.00 Max	0.045	0.030	1.00 Max	22.0-24.0	12.0-15.0	-	515	205	28	20	-
A 403 Gr. WP 31 OS	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	24.0-26.0	19.0-22.0	-	515	205	28	20	-
A 403 Gr. WP 316	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-14.0	2.0-3.0	515	205	28	20	-
A 403 Gr. WP 316L	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-14.0	2.0-3.0	485	170	28	20	-
A 403 Gr. WP 316H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-14.0	2.0-3.0	515	205	28	20	-
A 403 Gr. WP 316LN	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	16.0-18.0	10.0-13.0	2.0-3.0	515	205	28	20	-
A 403 Gr. WP 317	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	11.0-15.0	3.0-4.0	515	205	28	20	-
A 403 Gr. WP 317L	0.030 Max	2.00 Max	0.045	0.030	1.00 Max	18.0-20.0	11.0-15.0	3.0-4.0	515	205	28	20	-
A 403 Gr. WP 321	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	17.0-19.0	9.0-12.0	-	515	205	28	20	-
A 403 Gr. WP 321H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	17.0-19.0	9.0-12.0	-	515	205	28	20	-
A 403 Gr. WP 347	0.080 Max	2.00 Max	0.045	0.030	1.00 Max	17.0-19.0	9.0-12.0	-	515	205	28	20	-
A 403 Gr. WP 347H	0.04-0.10	2.00 Max	0.045	0.030	1.00 Max	17.0-19.0	9.0-12.0	-	515	205	28	20	-
CARBON STEEL													
A 234 Gr. WPB	0.30 Max	0.29-1.06	0.050	0.058	0.10 Min	0.40 Max	0.40 Max	0.15 Max	415-655	240	30	20	197
A 234 Gr. WPC	0.35 Max	0.29-1.06	0.050	0.058	0.10 Min	0.40 Max	0.40 Max	0.15 Max	485-655	275	30	20	197
LOW TEMPERATURE CARBON STEEL													
A 420 Gr. WPL6	0.30 Max	0.50-1.35	0.035	0.040	0.15-0.40	0.30 Max	0.40 Max	0.12 Max	415-655	240	30	16.5	197
A 420 Gr. WPL 3	0.20 Max	0.31-0.64	0.050	0.050	0.13-0.37	-	3.20-3.80	-	450-620	240	30	20	197
ALLOY STEEL													
A 234 Gr. WP 1	0.28 Max	0.30-0.90	0.045	0.045	0.10-0.50	-	-	0.44-0.65	380-550	205	30	20	197
A 234 Gr. WP 5	0.15 Max	0.30-0.60	0.040	0.030	0.50 Max	4.0-6.0	-	0.44-0.65	415-585	205	30	20	217
A 234 Gr. WP 9	0.15 Max	0.30-0.60	0.030	0.030	1.00 Max	8.0-10.0	-	0.90-1.10	415-585	205	30	20	217
A 234 Gr. WP 11 CL1	0.05-0.15	0.30-0.60	0.030	0.030	0.50-1.0	1.0-1.5	-	0.44-0.65	415-585	205	30	20	197
A 234 Gr. WP 11 CL2	0.05-0.20	0.30-0.80	0.040	0.040	0.50-1.0	1.0-1.5	-	0.44-0.65	485-655	275	30	20	197
A 234 Gr. WP 11 CL3	0.05-0.20	0.30-0.80	0.040	0.040	0.50-1.0	1.0-1.5	-	0.44-0.65	520-690	310	30	20	197
A 234 Gr. WP 12CL1	0.05-0.20	0.30-0.80	0.045	0.045	0.60 Max	0.80-1.25	-	0.44-0.65	415-585	220	30	20	197
A 234 Gr. WP 12 CL2	0.05-0.20	0.30-0.80	0.045	0.045	0.60 Max	0.80-1.25	-	0.44-0.65	485-655	275	30	20	197
A 234 Gr. WP 22 CL1	0.05-0.15	0.30-0.60	0.040	0.040	0.50 Max	1.90-2.60	-	0.87-1.13	415-585	205	30	20	197
A 234 Gr. WP 22 CL3	0.05-0.15	0.30-0.60	0.040	0.040	0.50 Max	1.90-2.60	-	0.87-1.13	520-690	310	30	20	197
A 234 Gr. WP 91	0.08-0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.0-9.5	0.40 Max	0.85-1.05	585-760	415	20	-	248
									</				

DIMENSIONS OF BUTT-WELDING FITTING ANSI B-16.9 / B-16.28



Nominal Pipe Size		Outside Diameter	Center to Face				Back to Face			Center to Center			Length 'L' MMS SP 43 B16.9	
INCH	MM	D	A R=1.5D	B	C	N R=1D	E	F	G	R	M	S	Short L	Long L
1/2	15	21.3	38.00	16.0	25.0	-	25.0	48.0	-	76.0		35.0	50.8	76.2
3/4	20	26.7	29.00	11.0	29.0	-	25.0	43.0	-	57.0		43.0	50.8	76.2
1	25	33.4	38.00	22.0	38.0	25.0	38.0	56.0	41.0	76.0	51.0	51.0	50.8	101.6
1.1/4	32	42.2	48.00	25.0	48.0	32.0	38.0	70.0	52.0	95.0	64.0	64.0	50.8	101.6
1.1/2	40	48.3	57.15	29.0	57.0	38.0	38.0	83.0	62.0	114.0	76.0	73.0	50.8	101.6
2	50	60.3	76.00	35.0	64.0	51.0	38.0	106.0	81.0	152.0	102.0	93.0	63.5	152.4
2.1/2	65	73.0	95.25	44.0	76.0	64.0	38.0	132.0	100.0	191.0	127.0	105.0	63.5	152.4
3	80	88.9	114.30	51.0	86.0	76.0	51.0	159.0	121.0	229.0	152.0	127.0	63.5	152.4
3.1/2	90	101.6	133.35	57.0	95.0	89.0	64.0	184.0	140.0	267.0	178.0	140.0	76.2	152.4
4	100	114.3	152.0	64.0	105.0	102.0	64.0	210.0	159.0	305.0	203.0	157.0	76.2	152.4
5	125	141.3	190.0	79.0	123.0	127.0	76.0	262.0	197.0	381.0	254.0	186.0	76.2	203.2
6	150	168.3	229.0	95.0	143.0	152.0	102.0	313.0	237.0	457.0	305.0	218.0	88.9	203.2
8	200	219.1	305.0	127.0	178.0	203.0	89.0	414.0	313.0	610.0	406.0	270.0	101.6	203.2
10	250	273.1	381.0	159.0	216.0	254.0	102.0	515.0	391.0	762.0	508.0	324.0	127.0	254.0
12	300	323.8	457.0	190.0	254.0	305.0	127.0	619.0	467.0	914.0	610.0	381.0	152.4	254.0
14	350	355.6	533.0	222.0	279.0	356.0	152.0	711.0	533.0	1067.0	711.0	413.0	152.4	305.0
16	400	406.4	610.0	254.0	305.0	406.0	165.0	813.0	610.0	1219.0	813.0	470.0	152.4	305.0
18	450	457.2	686.0	286.0	343.0	457.0	178.0	914.0	686.0	1372.0	914.0	533.0	152.4	305.0
20	500	508.0	762.0	318.0	381.0	508.0	203.0	1016.0	762.0	1524.0	1016.0	584.0	152.4	305.0
22	550	559.0	838.0	343.0	419.0	559.0	229.0	1118.0	838.0	1676.0	1118.0	614.4	152.4	305.0
24	600	610.0	914.0	381.0	432.0	610.0	254.0	1219.0	914.0	1829.0	1219.0	692.0	152.4	305.0
26	650	660.0	991.0	405.0	495.0	660.0	267.0							
28	700	711.0	1067.0	438.0	521.0	771.0	267.0							
30	750	762.0	1143.0	470.0	559.0	762.0	267.0							
32	800	813.0	1219.0	502.0	597.0	813.0	267.0							
34	850	864.0	1295.0	533.0	635.0	864.0	267.0							
36	900	914.4	1372.0	565.0	673.0	914.0	267.0							

DIMENSION OF BUTT-WELDING FITTING ANSI B-16.9 / B-16.28



REDUCING TEES

CONCENTRIC REDUCERS

EXCENTRIC REDUCERS

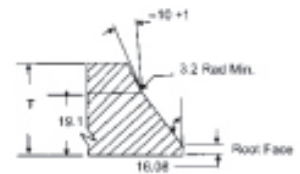
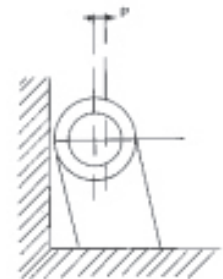
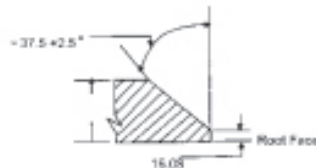
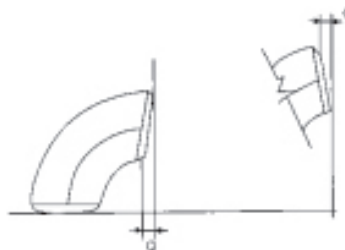
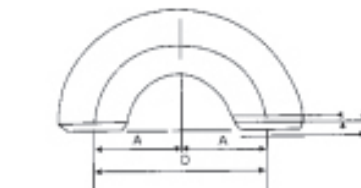
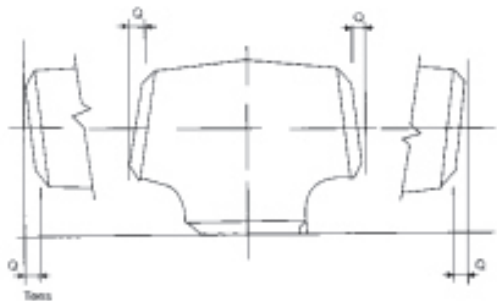
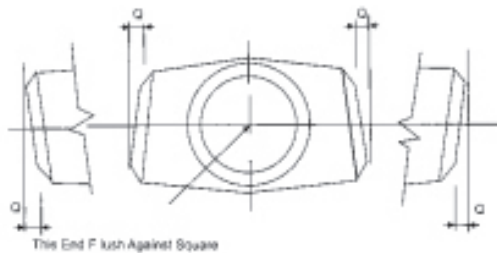
Nominal Pipe Size		Outside Diameter		Center to End		Length
Inch	MM	D	P	C	M	H
1/2 x 3/8	15x10	21.3	17.1	25	25	-
1/2x1/4	15x8	21.3	13.7	25	25	-
3/4x1/2	20x15	26.7	21.3	29	29	38
3/4 x 3/8	20x10	26.7	17.1	29	29	38
1 x3/4	25x20	33.4	26.7	38	38	51
1x1/2	25x15	33.4	21.3	38	38	51
1 1/4x1	32x25	42.2	33.4	48	48	51
1 1/4x3/4	32x20	42.2	26.7	48	48	51
1 1/4x1/2	32x15	42.2	21.3	48	48	51
1 1/2x1 1/4	40x32	48.3	42.2	57	57	64
1 1/2x1	40x25	48.3	33.4	57	57	64
1 1/2x3/4	40x20	48.3	26.7	57	57	64
1 1/2x1/2	40x15	48.3	21.3	57	57	64
2x1 1/2	50x40	60.3	48.3	64	60	76
2x1 1/4	50x32	60.3	42.2	64	57	76
2x1	50x25	60.3	33.4	64	51	76
2x3/4	50x20	60.3	26.7	64	44	76
2 1/2x2	65x50	73.0	60.3	76	70	89
2 1/2x1 1/2	65x40	73.0	48.3	76	67	89
2 1/2x1 1/4	65x32	73.0	42.2	76	64	89
2 1/2x1	65x25	73.0	33.4	76	57	89
3x2 1/2	80x65	88.9	73.0	86	83	89
3x2	80x50	88.9	60.3	86	76	89
3x1 1/2	80x40	88.9	48.3	86	73	89
3x1 1/4	80x32	88.9	42.2	86	70	89
4x3 1/2	100x90	114.3	101.6	105	102	102
4x3	100x80	114.3	88.9	105	98	102
4x2 1/2	100x65	114.3	73.0	105	95	102
4x2	100x50	114.3	60.3	105	89	102
4x1 1/2	100x40	114.3	48.3	105	86	102
5x4	125x100	141.3	114.3	124	117	127
5x3 1/2	125x90	141.3	101.6	124	114	127
5x3	125x80	141.3	88.9	124	111	127
5x2 1/2	125x65	141.3	73.0	124	108	127
5x2	125x50	141.3	60.3	124	105	127
6x5	150x125	168.3	141.3	143	137	140
6x4	150x100	168.3	114.3	143	130	140
6x3 1/2	150x90	168.3	101.6	143	127	140
6x3	150x80	168.3	88.9	143	124	140
6x2 1/2	150x65	168.3	73.0	143	121	140

Nominal Pipe Size		Outside Diameter		Center to End		Length
Inch	MM	D	P	C	M	H
8x6	200x150	219.1	168.3	178	168	152
8x5	200x125	219.1	141.3	178	162	152
8x4	200x100	219.1	114.3	178	156	152
8x3 1/2	200x90	219.1	101.6	178	152	152
10x8	250x200	273.1	219.1	216	203	178
10x6	250x150	273.1	168.1	216	194	178
10x5	250x125	273.1	141.3	216	191	178
10x4	250x100	273.1	114.3	216	184	178
12x10	300x250	323.9	273.1	254	241	203
12x8	300x200	323.9	219.1	254	229	203
12x6	300x150	323.9	168.3	254	219	203
12x5	300x125	323.9	141.3	254	216	203
14x12	350x300	355.6	323.9	279	270	330
14x10	350x250	355.6	273.1	279	257	330
14x8	350x200	355.6	219.1	279	248	330
14x6	350x150	355.6	168.3	279	238	330
16x14	400x350	406.4	355.6	305	305	356
16x12	400x300	406.4	323.9	305	295	356
16x10	400x250	406.4	273.1	305	283	356
16x8	400x200	406.4	219.1	305	273	356
16x6	400x150	406.4	168.3	305	264	356
18x16	450x400	457.0	406.4	343	330	381
18x14	450x350	457.0	355.6	343	330	381
18x12	450x300	457.0	323.9	343	321	381
18x10	450x250	457.0	273.1	343	308	381
18x8	450x200	457.0	219.1	343	298	381
20x18	500x450	508.0	457.0	381	368	508
20x16	500x400	508.0	406.4	381	356	508
20x14	500x350	508.0	355.6	381	356	508
20x12	500x300	508.0	323.9	381	346	508
20x10	500x250	508.0	273.1	381	333	508
20x8	500x200	508.0	219.1	381	324	508
24x22	600x550	610.0	559.0	432	432	508
24x20	600x500	610.0	508.0	432	432	508
24x18	600x450	610.0	457.0	432	419	508
24x16	600x400	610.0	406.4	432	406	508
24x14	600x350	610.0	355.6	432	406	508
24x12	600x300	610.0	323.9	432	397	508
24x10	600x250	610.0	273.1	432	384	508

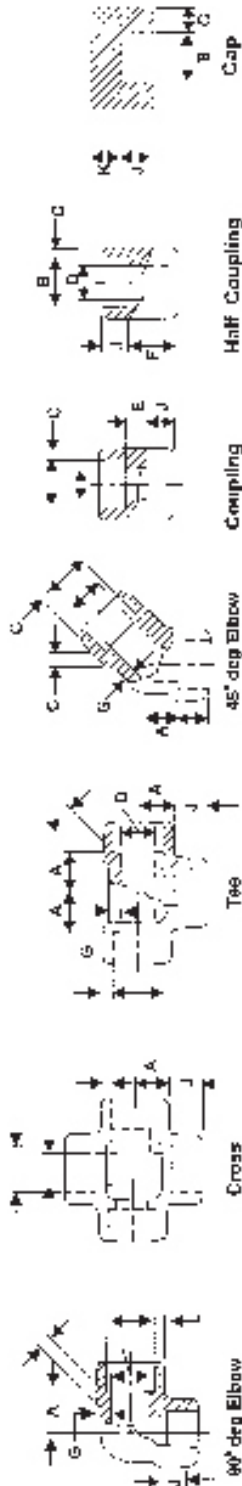
All Dimensions in Millimeters

DIMENSIONAL TOLERANCE ANSI B16.9 / B16.28 / MMS SP-43

ALL FITTINGS					90°/60°/45° 30° ELBOWS & TEES		REDUC- ERS		180° RETURNS					CAPS		ANGULARITY TOLERANC												
Nominal Pipe size INCH/MM	Outside Diameter at Bevel		Inside Dia Meter	Wall Thickness at End		Center to End		Overall Length Dimension		Center to End		Back to Face Dimension		Alignment of End Dimension		Overall Length		Nominal Pipe Size		Off Angel Inch/mm		Off Plane						
	D			T		A,B,C,M		H		O		K		U		E			Q		P							
	(1) B16.9	MSS Sp43	(2) B16.9	B16.9	MSS SP43	B16.9	MSS SP43	B16.9	MSS SP43	B16.9	MSS SP43	B16.9	MSS SP43	B16.9	MSS SP43	B16.9	MSS SP43		B16.9	MSS SP75	B16.9							
½" - 2½" 15-65	±1.6 -0.8	±0.80	±0.8	Not Less than 87.5% Normal Thk	Not Less than 87.5% Normal Thk	FROM ½" TO 18 15 TO 600	FROM ¾"	FROM ½" - 24" 15-600	FROM ½" - 8" 15-200	±6	±6.35	±6.0	±6.4	±1	±0.8	±3	±3.17	½"-4" 15-100	±1	16"-24" 400- 600 1.6	±2							
3" - 3½" 80-90	±1.6																											±4
4" 100			±1.6			±2	±1.60	±2	±1.60																			±5
5"-6" 125-150	+2.4 -1.6	+1.60 -0.80																										±7
8" 200																												
10"-18" 250 - 450	+4 -3.2	+2.38 -0.80	±3.2			±2.40		10-24" +2.38 250- 600		±10	±10			±2.0"	±1.60			26"-30" 650-750	±5	26"-36" 650- 900 2.4	±10							
20" - 24" 500 - 600	+6.4 -4.8	3.17 0.79																32"-42" 800-1050	±5		±13							
26" - 30" 650 - 750	+6.4 -4.8	±4.8	±4.8			±3		FROM 26"-48" 650NB -701200 NB ±5								±10		44"-48" 1100-1200	±5	32"-48" 950- 1200 3.2	±20							
32" - 48" 800 - 1200	+6.4 -4.8					±5												42"-48" 1050-1200	±5		±20							



DIMENSIONS OF SOCKET-WELDING FITTINGS ANSI B 16.11



Nominal Pipe Size		Socket Bore Diameter B	Bore Diameter of Fitting D [Note(1)]		Socket Wall Thickness, C [Note (2)]						Body wall G		Min. Depth of Socket J	Center to Bottom of Socket, A				Laying Lengths		Tolerances			End Wall Thickness K Min. Class Designation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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					3000	6000	9000	Avg.	Min.	Avg.	Min.	3000	6000	9000	Min.	Min.	Min.	3000	6000	9000	3000	6000	9000	45 Elbows	Class Designation	Couplings E	Half Couplings F	A	E	F	3000	6000	9000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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(1) All Dimensions Are In Millimeters

(2) Upper and lower values for each size are the respective maximum and minimum dimensions.

(3) Average of socket wall thickness around periphery shall be no less than listed values. The minimum values are permitted in localized areas.

ASTM A193/A 193M ALLOY STEEL, CARBON STEEL & STAINLESS STEEL, BOLTING FOR HIGH TEMPERATURE SERVICE

ASTM GRADE	C	Mn	Si	S	P	Cr	Ni	Mo	Other	Hardness	Tensile Psi (MPa)	Yield Psi(MPa)	Elongation in Area%	Redu
A193 B8-B8A Al SI Type 304	0.08 Max	2.00 Max	1.00 Max	0.030 Max	0.045 Max	18.00 20.00	8.00 10.50	- -	- -	223HB	75000(515)	30000(205)	30	50
A193B8-B8MA AISIType316	0.08 Max	2.00 Max	1.00 Max	0.030 Max	0.045 Max	16.00 18.00	10.00 14.00	2.00 3.00		223HB 223HB	75000(515)	30000(205)	30	50
A193B8T-B8TA AISI Type 321	0.08 Max	2.00 Max	1.00 Max	0.030 Max	0.045 Max	17.00 19.00	9.00 12.00	-	Ti>5xC <0.70	223HB	75000(515)	30000(205)	30	50
A193 B8C-B8CA AISI Type 347	0.08 Max	2.00 Max	1.00 Max	0.030 Max	0.045 Max	17.00 19.00	9.00 13.00		Cb+7a>10 XC51.10	192HB	75000(515)	30000(205)	30	50
A193B6-B6X AISI Type 410	0.15 Max	1.00 Max	1.00 Max	0.03 Max	0.040 Max	11.50 13.50	-				110000(760)	85000(585)	15	50
A193 B7-B7M Alloy Steel (Cr. Mo)	0.37 0.49	0.65 1.10	0.15 0.35	0.040 Max	0.035 Max	0.75 1.20	- -	0.15 0.25	- -	- -	125000(860)	105000(720)	16	50
A193B5 A S -5% Cr-AISI501	0.10 min	1.00 Max	1.00 Max	0.030 Max	0.040 Max	4.00 6.00	-	0.40	-	-	100000(690)	80000(550)	16	50

ASTM A 194/194 M CARBON STEEL, ALLOY STEEL & STAINLESS STEEL NUTS, BOLTS FOR HIGH PRESSURE & HIGH TEMPERATURE SERVICE

A194/8A AISI Type 304	0.08 Max	2.00 Max	1.00 Max	0.03 Max	0.045 Max	18.00 20.00	8.00 10.50	-	-	-	126-300 Grade 8 126-182 Grade8A
A194 8M/MA AISI Type 316	0.08 Max	2.00 Max	1.00 Max	0.03 Max	0.045 Max	16.00 18.00	10.00 14.00	2.00 3.00	-	-	126-300 Grade 8m 126-192 Grade 8 MA
A194/ 8T/8TA AISI Type 321	0.08 max	2.00 12.00	1.00 max	0.03 0.78 Min	0.045	17.00 19.00	9.00 12.00	-	Ti >5 x C <0.70	-	126-300 Grade 8T 126-192 Grade 8 TA
A194/8C/8CA AISI Type 347	0.08 Max	2.00 Max	1.00 Max	0.03 Max	0.045 Max	17.00 19.00	9.00 13.00	-	-	Cb+7ax10 xC<1.10	126 - 300 G rade 8CA 126-192 Grade 8 CA
A194-6 AISI Type 410	0.15 Max	1.00 Max	1.00 Max	0.03 Max	0.040 Max	11.50 13.50	-	-	-	-	228 271HRC-20-28
A19422HM&2H Carbon Steel	0.4 min	1 Max	0.4 Max	1.050. Max	0.040 Max	-	-	-	-	-	159-352GR.2 248-352GR.2H 159-237GR.2HM
A194-77M Alloy Steel A194-30.10A.S.-5%Cr AISI501	0.37 0.49 0.10 Max	0.65 1.1 1.00 Max	0.15 0.35 1.00 Max	0.04 Max 0.030 Max	0.4 Max 0.040 Max	0.75 1.2 4.00 6.00	- - - -	0.15 0.25 0.4 0.65	-	-	248-352GR.7 159-237GR.7M 248-352 (HRC-24-38)



SUMMARY OF THE MAIN ASTM STANDARDS GENERALLY USED FOR SHEETS / PLATES

ASTM	Grade	Chemical requirements percent (%)										Mechanical requirements				
		C max	Mn max	P max	S max	Si max	Ni	Cr	Mo	Cu	Others	Tensile Strength mini-MPa	Yield Strength mini-MPa	Elong mini %	Hardness Brinell	Hardness Rockwell
A240	304	0.08	2.00	0.045	0.030	0.75	8.00-10.5	18.00-20.0				515	205	40	201	92
	304L	0.03	2.00	0.045	0.030	0.75	8.00-12.0	18.00-20.0				485	170	40	201	92
	310	0.08	2.00	0.045	0.030	1.50	19.0-22.0	24.0-26.0				515	205	40	217	95
	316	0.08	2.00	0.045	0.030	0.75	10.0-14.0	16.0-18.0	2.00-3.00			515	205	40	217	95
	316L	0.03	2.00	0.045	0.030	0.75	10.0-14.0	16.0-18.0	2.00-3.00			485	170	40	217	95
	317L	0.03	2.00	0.045	0.030	0.75	11.0-15.0	18.0-20.0	3.00-4.00		Ti>50C<0.70 Cb+Ta<1.10	515	205	40	217	95
A 387 Class 1 Class 2	347	0.08	2.00	0.045	0.030	0.75	9.00-12.0	17.0-19.0				515	205	40	217	95
	2	0.05-0.21	0.55-0.80	0.035	0.040	0.15-0.40	9.00-13.0	17.0-19.0				Class 1 380	Class 2 486	205	201	92
	5	0.15	0.30-0.60	0.04	0.030	0.050		0.50-0.80	0.45-0.60			380	230	310	22	max201HB max92HRB
	7	0.15	0.30-0.60	0.030	0.030	1.00		4.00-6.00	0.45-0.65			415	205	310	18	max202HB max92HRB
	9	0.15	0.30-0.60	0.030	0.030	1.00		6.00-8.00	0.45-0.65			415	205	310	18	max217HB
	11	0.04-0.17	0.40-0.65	0.035	0.04	0.50-0.80		8.00-10.0	0.90-1.10			415	205	310	18	max217HB max95HRB
	12	0.04-0.17	0.40-0.65	0.035	0.04	0.15-0.40		1.00-1.50	0.45-0.65			415	240	310	22	max217HB max95HRB
	21	0.04-0.17	0.30-0.60	0.035	0.035	0.50		0.80-1.15	0.45-0.60			380	230	275	22	max217HB max95HRB
	22	0.05-0.17	0.30-0.60	0.035	0.035	0.50		2.75-3.25	0.90-1.10			415	205	310	18	max201HB max92HRB
	55	0.22	0.90	0.035	0.04	0.15-0.40		2.00-2.50	0.90-1.10			415	205	310	18	max201HB max92HRB
A 515	60	0.27	0.90	0.035	0.04	0.15-0.40						415-550	220	25		
	65	0.31	0.90	0.035	0.04	0.15-0.40						450-585	240	23		
	70	0.33	1.20	0.035	0.04	0.15-0.40						485-620	260	21		
	55	0.20	0.60-1.20	0.035	0.04	0.15-0.40						380-515	205	27		
	60	0.23	0.85-1.20	0.035	0.04	0.15-0.40						415-550	202	25		
A 516	65	0.26	0.85-1.20	0.035	0.04	0.15-0.40						450-585	240	23		
	70	0.28	0.85-1.20	0.035	0.04	0.15-0.40						485-620	260	21		
	Class 1	0.24	0.70-1.35	0.035	0.040	0.15-0.40	0.25 max	0.80 max	0.35 max			485-620	345	22		
A 537	Class 2	0.24	0.70-1.35	0.035	0.040	0.15-0.40	0.25 max	0.80 max	0.35 max			550-690	415	22		

IS-2002-62 STEEL PLATES FOR BOILERS

Grade	Designation	Chemical Composition				Tensile Test			Elongation	
		C max	Si max	P max	S max	Tensile strength MPa	Yield strength MPa	Test Piece	%min	
A	IS 2002-1	0.18	0.10-0.35	0.040	0.040	362-442	540	5.65√Sc 4√Sc	26	
	IS 2002-2A	0.20	0.10-0.35	0.050	00.50	412-491	491	5.60√Sc 4√Sc	25	
B	IS 2002-2B	0.22	0.10-0.35	0.050	0.050	510-608	491	5.65√Sc 4√Sc	20	
	IS 2002-2B	0.22	0.10-0.35	0.050	0.050	510-608	491	5.65√Sc 4√Sc	24	

IS-2002-92 STEEL FOR GENERAL STRUCTURAL PURPOSES

Grade	Designation	% Chemical Composition				Tensile strength (Min) Kg/mm2	Yield Strength (Min) Mpa		%El in gauge length 5.65√Sc	Bend Test	Std test Piece Charpy V Notch Impact Energy Joule min
		C max	Mn max	S max	P max		<20 min	>20-40 min			
A	FE410WA	0.23	1.5	0.050	0.050	0.42	41.8	250	230	3t	-
	FE410WB	0.22	1.5	0.045	0.045	0.40	41.8	250	230	t<25mm	2t for 27 3t for t>25mm
B	FE410WC	0.20	1.5	0.040	0.040	0.40	41.8	250	230	2t	27
	FE410WC	0.20	1.5	0.040	0.040	0.40	41.8	250	230	2t	27

Formula - Weight of Stainless Steel Sheets/Plates = Length (mm) x Width (mm) x Thickness (mm) x 7.86 = Kg./Sheet.

STAINLESS STEEL BRIGHT BARS (PEELED/TURNED)

We, within a short span has become a major source for Stainless Steel Rolled / Forged / Peeled Rounds, Res, Blooms & Billets. We have huge stocks for our quality products which are supplied on time at lowest possible rates meeting most of our customer's requirement.

Product Range

Condition	Peeled, Centreless & Polished	Peeled & Polished	Peeled (Rough Turned)	Forged, Rough Turned
Grades	301,303,304,304L, 310,316,316L, 321,410, 416,416,420,, 430,431,430F & others		304,304L, 316L, 410,416 420,430	303,304,304L, 316,316L, 410,416,420,431
Diameter (Size)	20mm to 85mm (3/4" to 3-1/4")	85mm to 140mm (3-1/4" to 5 - Vi")	25mm to 140mm (1" to 5-1/2")	150mm to 400mm (6" to 16")
Diameter /+3mmTolerance	h9 (Din 671) (ASTM A484)	h 11	K12/K13 (Din 1013)	-0mm to (-07+0.12")
Length	3/4/5,6/6 meter (12/14ft/20 feet)	3/4/5,6/6 meter (12/14ft/20 feet)	3/4/5,6/6 meter 10 feet, 16 feet	3 meter - 5 meter
Length Tolerance	-0/+200mm of + 100mm to + 50mm (-0"/1 feet or +4" or 2")	-0/+ 200mm or +100mm or +50mm (-07+1 feet or +4" or 2")	-0/+ 100mm or 500mm (-07+3 feet or+2 feet)	-0/+2 meter -(-0/+6 feet)

ASTM A182 Alloy Steel Round Bar Chemical & Physical Properties

ASTM Grade	C	Mn	Si	S	P	Cr	Ni	Mo	Other	Tensiile Psi (MPa)	Yield Psi(Mpa)	Elongation Strip/Round	Hardn.	Redu. in Area. (%)
182 F11 Class 2	0.10 0.20	0.30 0.80	0.50 1.0	0.04 max	0.04 max	1.0 1.50	- -	0.04 0.65	-	70000 (485)	40000 (275)	20	143-207	30
A 182 F22 Class	0.05 0.15	0.30 0.60	0.50 max	0.04 max	0.04 max	2.0 2.50		0.87 1.13	-	75000 (515)	45000 (310)	20	156-207	30
A 182 F5	0.15 max	0.30 0.06	0.50 max	0.03 max	0.03 max	4.0 6.0	0.5 max	0.44 0.65	-	70000 (485)	40000 (275)	20	143-217	35
A 182 F9	0.15 max	0.30 0.60	0.50 1.00	0.03 max	0.03 max	8.0 10.0	-	0.90 1.10	-	85 (585)	55 (380)	20	179-217 (BHN)	40

Stainless Steel Bright Bars (Cold Drawn)

Condition	Cold Drawn and Polished	Cold Drawn, Center less Ground & Polished	Cold Drawn, Center less Ground and Polished (Strain Hardened)
Grades	201,202,303,304,304L, 310,316, 316L, 321,410,420,416,430,431,430F, & others		304,304L, 316,316L
Diameter (Size)	2mm to 5mm (1/8" to 3/16)	6mm to 22mm (1/4" to 7/8")	10mm to 40mm (3/8"to 1-1/2")
Diameter Tolerance	h9 (Din 671), h11 ASTM A 484	h9 (Din 671) ASTM A 484	h9 (Din 671), h11 ASTM A 484
Length	3/4/5,6/6 meter (12/14ft/20 feet)	3/4/5,6/6 meter (12/14ft/20 feet)	3/4/5,6/6 meter (12/14/20 feet)
Length Tolerance	-0/+ 200mm of +100mm or+50mm (-07+1 feet or+ 4" or 2")	-0/+200mm or +100mm or +50mm (-07+1 feet or+4" or2")	-0/+200mm (-07+1 feet)

Stainless Steel Hexagon & Square Bars

Type	Cold Drawn and Polished(Squares)	Cold Drawn and Polished (Hexagons)
Grades	304,304L, 316,316L	304,304L,316,316L
Diameter	5mm to 40mm (1/4" to 1-1/2")	10mm to 40mm (3/8" to 1-1/2")
Diameter	h 11	h 11
Tolerance	(ASTM A 484)	(ASTM A 484)
Length	3/4/6 meter (12/14ft/20feet)	3/4/6 meter (12/14ft/20 feet)
Length Tolerance	-0/+500mm (-07+2 feet)	-0/+500mm or+ 100mm or +50mm (-0"/+2feet)

Stainless Steel Cold Heading Wires

Condition	Cold drawn. Annealed and Picketed
Diameter	1.6 mm to 17 mm (1/16" to 11 /16")
Tensile Strength	65kg / mm2 max
Packing	HDPE wrapped coils of 300 kg to 500 kg
Grades	202,304,304L, 316,316L, 304HC, 302HQ

FORMULA OF CALCULATING WEIGHT

WEIGHT OF STAINLESS STEEL I CARBON STEEL PIPES & TUBES OD (mm) -
 $W.T. (mm) \times W.T. (mm) \times 0.02466 = KG/MTR$

WEIGHT OF STAINLESS STEEL SHEETS
 $Length (mtr) \times Width (mtr) \times Thk. (mm) \times 8 = KG/SHEET$

WEIGHT OF CARBON STEEL SHEETS
 $Length (mtr) \times Width (mtr) \times Thk. (mm) \times 7.85 = KG/SHEET$

WEIGHT OF STAINLESS STEEL CIRCLE & BLANKS
 $O.D. (mm) \times O.D. (mm) \times Thk (mm) / 160/1000 = KG/PCS.$

WEIGHT OF STAINLESS STEEL ROUNDS
 $Dia. (mm) \times Dia. (mm) \times 0.00623 = KG/MTR$

WEIGHT OF STAINLESS STEEL HEXAGONAL RODS
 $Dia. (mm) \times Dia. (mm) \times 0.00679 = KG/MTR$

WEIGHT OF STAINLESS STEEL SQUARE RODS
 $Dia. (mm) \times Dia. (mm) \times 0.00787 = KG/MTR$

WEIGHT OF COPPER PIPES
 $O.D. (mm) - W.T. (mm) \times W.T. (mm) \times 0.0285 = KG/MTR$

WEIGHT OF ALLUMINIUM PIPES
 $O.D. (mm) - W.T. (mm) \times W.T. (mm) \times 0.0082 = KG/MTR$

WEIGHT OF ALLUMINIUM SHEETS
 $Length (mtr) \times Width (mtr) \times Thk. (mm) \times 2.66 = KG/SHEET$

WEIGHT OF LEAD PIPES
 $O.D. (mm) - W.T. (mm) \times W.T. (mm) \times 0.0345 = KG/MTR$

WEIGHT OF LEAD SHEETS
 $Length (mtr.) \times Width (mtr.) \times Thk (mm) \times 11.2 = KG/SHEET$

SHEET WIDTH REQD FOR ROLLED & WELDED PIPES
 $O.D. (mm) - Thk. (mm) \times 3.14 = SHEET WIDTH (mm)$

WEIGHT FOR SQUARE I RECTANGLE PIPES
 $Length From 4 Angle (OD)/3.14-Thk. (mm) \times Thk. (mm) \times 0.00756 = KG I PER FEET$

