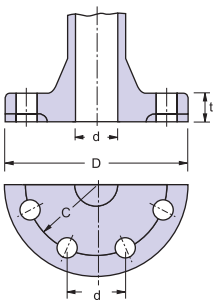
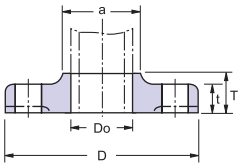
ANNEX. A TOLERANCE

ANSI B16.5 FORGED FLANGES

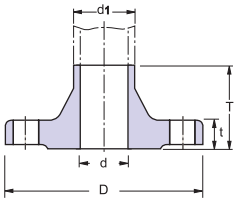
SOLID FLANGE



SLIP-ON FLANGE

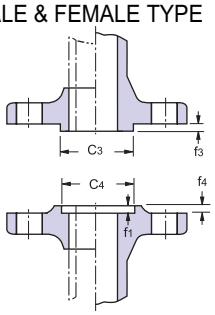


WELDING NECK FLANGE

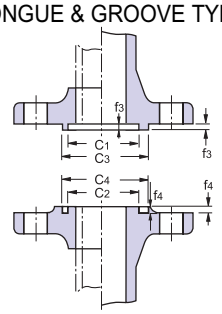


TYPE OF GASKET SURFACE

MALE & FEMALE TYPE



TONGUE & GROOVE TYPE



THREAD, SOCKET-WELDING, SLIP-ON, LAP JOINT AND BLIND

Outside Diameter	When O.D. is 24″ or less	±1/16″(1.6mm) *
	When O.D. is over 24″	±1/8″(3.2mm) *
Inside Diameter	Threaded	Within limits on boring gauge
	Socket-Welding, Slip-on and Lap joint	10″ & Smaller +1/32″(0.8mm), -o″ 12″ & Larger +1/16″(1.6mm). -0″
Outside Diameter of Hub	5″ and Smaller	+3/32″ (2.4mm) * -1/32″ (0.8mm)
	6″ and Larger	+5/32″ (4.0mm) -1/32″ (0.8mm)
Diameter of Contact Face	1/16″ Raised Face	±1/32″ (0.8mm)
	1/4″ Raised Face Tongue & Groove Male, Female	±1/64″ (0.4mm)
Diameter of Counterbore	Same as for Inside Diameter	
Drilling	Bolt Circle	±1/16″ (1.6mm)
	Bolt Hole Spacing	±1/32″ (0.8mm)
	Eccentricity of Bolt Circle with Respect to Facing	2 1/2″ Smaller 1/32″ (0.8mm) Max. 3″ & Larger 1/16″ (1.6mm) Max.
	Eccentricity of Bolt Circle with Respect to Bore	1/32″ (0.8mm) Max. *
	Eccentricity of Facing with Respect to Bore	1/32″ (0.8mm) Max. *
Thickness	18″ and Smaller	+ 1/8″ (3.2mm).-0″
	20″ and Larger	+ 3/16″ (4.8mm).-0″
Length Thru Hub	10″ and Smaller	±1/16″ (1.6mm)
	12″ and Larger	±1/8″ (3.2mm)

WELDING NECK

Outside Diameter	When O.D. is 24″ or less	±1/16″(1.6mm) *
	When O.D. is Over 24″	±1/8″(3.2mm) *
Inside Diameter	10″ and Smaller	±1/32″(0.8mm)
	12″ thru 18″	±1/16″(1.6mm)
	20″ and Larger	+ 1/8″(3.2mm) - 1/16″(1.6mm)
Diameter of Contact Face	1/16″ Raised Face	±1/32″(0.8mm)
	1/4″ Raised Face Tongue & Groove Male, Female	±1/64″(0.4mm)
Diameter of Hub at Base	When Hub Base is 24″ or Smaller	±1/16″(1.6mm) *
	When Hub Base is Over 24″	±1/8″(3.2mm) *
Diameter of Hub at Point of Welding	5″ and Smaller	+ 3/32″(2.4mm) - 1/32″(0.8mm)
	6″ and Larger	+ 5/32″(4.0mm) - 1/32″(0.8mm)
Drilling	Bolt Circle	±1/16″ (1.6mm)
	Bolt Hole Spacing	±1/32″ (0.8mm)
	Eccentricity of Bolt Circle with Respect to Facing	2 1/2″ Smaller 1/32″ (0.8mm) Max. 3″ & Larger 1/16″ (1.6mm) Max.
	Eccentricity of Bolt Circle with Respect to Bore	1/32″ (0.8mm) Max. *
	Eccentricity of Facing with Respect to Bore	1/32″ (0.8mm) Max. *
Thickness	18″ and Smaller	±1/8″ (3.2mm).-0″
	20″ and Larger	±3/16″ (4.8mm).-0″
Length Thru Hub	10″ and Smaller	±1/16″ (1.6mm)
	12″ and Larger	±1/8″ (3.2mm)

Notes : * This tolerance is not covered in ANSI B16.5, but maker's option.

RING JOINT FLANGES

Ring Type Joint	Depth-E	+0.016″ −0.0	(+0.4mm) (−0.0)
	Width-F	±0.008″	(±0.20mm)
	Pitch Diameter-P	±0.005″	(±0.13mm)
	Radius at Bottom-R	max	max
	23° Angle	±½°	±½°

ASNS B16.47 LAGE DIAMETER FLANGES

WELDING NECK & BLIND

* Outside Diameter	All Sizes	±0.12″	(±3.0mm)
Inside Diameter	Normal Inside Diameter Welding End	+0.12″ −0.06″	(+3.0mm) (−1.5mm)
	Inside Counter Type	+0.00″ −0.06″	(+0.0mm) (−1.5mm)
	Backing Ring Contact Surface	+0.10″ −0	(+0.25mm −0)
Diameter of Contact Face	0.06″ Raised Face	±0.08″	(±2.0mm)
	0.25″ Raised Face	±0.04″	(±1.0mm)
* Diameter of Hub at Base	Hub Diameter	±0.12″	(±3.0mm)
Diameter of Hub at Point of Welding	Outside Diameter of Welding End	+0.21″ −0.06″	(+5.3mm) (−1.5mm)
Drilling	Bolt Circle	±0.06″	(±1.5mm)
	Bolt Hole spacing	±0.03″	(±0.8mm)
	Eccentricity of Bolt Circle with Respect to Facing	0.06″max	(1.5mm max)
*	Eccentricity of Bolt Circle with Respect to bore	0.03″max	(0.8mm max)
*	Eccentricity of Facing with Respect to bore	0.03″max	(0.8mm max)
Thickness	Upto 1.0″(25.4mm)	+0.12″ −0	(+3.2mm −0)
	1.0″ to 2.0″ (25.4mm to 50.8mm)	+0.19″ −0	(+5.0mm −0)
	>2.0″ to 3.0″(>50.8mm to 76.2mm)	+0.31″ −0	(+7.9mm −0)
	Over 3.0″(76.2mm)	+0.38″ −0	(+9.7mm −0)
Length thru Hub	All sizes	±0.19″	(±5.0mm)

Notes : * This tolerance is not covered in ASTM/ANSI B16.47, but maker's option.

ANNEX. B WALL THICKNESS OF STAINLESS &

ANSI B36.10 & ANSI B36.19

Nominal Pipe Size		Outside Diam.		Nominal Wall Thickness							
MM	INCH	KS/JIS	ANSI	SPP/SGP	Sch 5s	Sch 10s	Sch 10	Sch 20s	Sch 20	Sch 30	Sch 40s
6	1/8	10.50	10.30	-	-	1.24	-	1.50	-	-	1.73
8	1/4	13.80	13.70	-	-	1.65	-	2.00	-	-	2.24
10	3/8	17.30	17.10	-	-	1.65	-	2.00	-	-	2.31
15	1/2	21.70	21.30	2.80	1.65	2.11	-	2.50	-	-	2.77
20	3/4	27.20	26.70	2.80	1.65	2.11	-	2.50	-	-	2.87
25	1	34.00	33.40	3.20	1.65	2.77	-	3.00	-	-	3.38
32	1 1/4	42.70	42.20	3.50	1.65	2.77	-	3.00	-	-	3.56
40	1 1/2	48.60	48.30	3.50	1.65	2.77	-	3.00	-	-	3.68
50	2	60.50	60.30	3.80	1.65	2.77	-	3.50	-	-	3.91
65	2 1/2	76.30	73.00	4.20	2.11	3.05	-	3.50	-	-	5.16
80	3	89.10	88.90	4.20	2.11	3.05	-	4.00	-	-	5.49
90	3 1/2	101.60	101.60	4.20	2.11	3.05	-	4.00	-	-	5.74
100	4	114.30	114.30	4.50	2.11	3.05	-	4.00	-	-	6.02
125	5	139.80	141.30	4.50	2.77	3.40	-	5.00	5.10	-	6.55
150	6	165.20	168.30	5.00	2.77	3.40	-	5.00	5.50	-	7.11
200	8	216.30	219.10	5.80	2.77	3.76	-	6.50	6.35	7.04	8.18
250	10	267.40	273.00	6.60	3.40	4.19	-	6.50	6.35	7.80	9.27
300	12	318.50	323.80	6.90	3.96	4.57	-	6.50	6.35	8.38	9.52
350	14	355.60	355.60	7.90	3.96	4.78	6.35	-	7.92	9.53	-
400	16	406.40	406.40	7.90	4.19	4.78	6.35	-	7.92	9.53	-
450	18	457.20	457.00	7.90	4.19	4.78	6.35	-	7.92	11.13	-
500	20	508.00	508.00	7.90	4.78	5.54	6.35	-	9.53	12.70	-
550	22	558.80	559.00	-	4.78	5.54	6.35	-	9.53	12.70	-
600	24	609.60	610.00	-	5.54	6.35	6.35	-	9.53	14.27	-
650	26	660.40	660.00	-	-	-	7.92	-	12.70	-	-
700	28	711.20	711.00	-	-	-	7.92	-	12.70	15.88	-
750	30	762.00	762.00	-	6.35	-	7.92	-	12.70	15.88	-
800	32	812.80	813.00	-	-	-	7.92	-	12.70	15.88	-
850	34	863.60	864.00	-	-	-	7.92	-	12.70	15.88	-
900	36	914.40	914.00	-	-	-	7.92	-	12.70	15.88	-
950	38	965.20	965.00	-	-	-	-	-	-	-	-
1000	40	1016.00	1016.00	-	-	-	-	-	-	-	-
1050	42	1066.80	1067.00	-	-	-	-	-	-	-	-
1100	44	1117.60	1118.00	-	-	-	-	-	-	-	-
1150	46	1168.40	1168.00	-	-	-	-	-	-	-	-
1200	48	1219.20	1219.00	-	-	-	-	-	-	-	-

CARBON STEEL PIPE

ANSI B36.10 & ANSI B36.19

Nominal Wall Thickness											INCH
STD	Sch 40	Sch 60	Sch 80s	X.S	Sch 80	Sch 100	Sch 120	Sch 140	Sch 160	XXS	
1.73	1.73	–	2.41	2.41	2.41	–	–	–	3.15	4.83	⅛
2.24	2.24	–	3.02	3.02	3.02	–	–	–	3.68	6.05	¼
2.31	2.31	–	3.20	3.20	3.20	–	–	–	4.01	6.40	⅜
2.77	2.77	–	3.73	3.73	3.73	–	–	–	4.78	7.47	½
2.87	2.87	–	3.91	3.91	3.91	–	–	–	5.56	7.82	¾
3.38	3.38	–	4.55	4.55	4.55	–	–	–	6.35	9.09	1
3.56	3.56	–	4.85	4.85	4.85	–	–	–	6.35	9.70	1¼
3.68	3.68	–	5.08	5.08	5.08	–	–	–	7.14	10.15	1½
3.91	3.91	–	5.54	5.54	5.54	–	–	–	8.74	11.07	2
5.16	5.16	–	7.01	7.01	7.01	–	–	–	9.53	14.02	2½
5.49	5.49	–	7.62	7.62	7.62	–	–	–	11.13	15.24	3
5.74	5.74	–	8.08	8.08	8.08	–	–	–	–	–	3½
6.02	6.02	–	8.56	8.56	8.56	–	11.13	–	13.49	17.12	4
6.55	6.55	–	9.53	9.53	9.53	–	12.70	–	15.88	19.05	5
7.11	7.11	–	10.97	10.97	10.97	–	14.27	–	18.26	21.95	6
8.18	8.18	10.31	12.70	12.70	12.70	15.09	18.26	20.62	23.01	22.23	8
9.27	9.27	12.70	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40	10
9.53	10.31	14.27	12.70	12.70	17.48	21.44	25.40	28.58	33.32	25.40	12
9.53	11.13	15.09	–	12.70	19.05	23.83	27.79	31.75	35.71	–	14
9.53	12.70	16.66	–	12.70	21.44	26.19	30.96	36.63	40.49	–	16
9.53	14.27	19.05	–	12.70	23.83	29.36	34.93	39.67	45.24	–	18
9.53	15.09	20.62	–	12.70	26.19	32.54	38.10	44.45	50.01	–	20
9.53	–	22.23	–	12.70	28.58	34.93	41.28	47.63	53.98	–	22
9.53	17.48	24.61	–	12.70	30.96	38.89	46.02	52.37	59.54	–	24
9.53	–	–	–	12.70	–	–	–	–	–	–	26
9.53	–	–	–	12.70	–	–	–	–	–	–	28
9.53	–	–	–	12.70	–	–	–	–	–	–	30
9.53	17.48	–	–	12.70	–	–	–	–	–	–	32
9.53	17.48	–	–	12.70	–	–	–	–	–	–	34
9.53	19.05	–	–	12.70	–	–	–	–	–	–	36
9.53	–	–	–	12.70	–	--	–	–	–	–	38
9.53	–	–	–	12.70	–	–	–	–	–	–	40
9.53	–	–	–	12.70	–	–	–	–	–	–	42
9.53	–	–	–	12.70	–	–	–	–	–	–	44
9.53	–	–	–	12.70	–	–	–	–	–	–	46
9.53	–	–	–	12.70	–	–	–	–	–	–	48

ANNEX. C MATERIAL SPECIFICATION

ANSI B16.5 (ASTM STANDARD)

ASTM	Grade	CHEMICAL COMPOSITION,%										MECHANICAL PROPERTIES				
		C %	Mn %	P Max. %	S Max. %	Si %	Ni %	Cr %	Mo %	Col %	Ti %	T.S. Min. Ksi[Mpa]	Y.S. Min Ksi[Mpa]	EL. Min. %	Red. Min. %	HB
Carbon Steel																
A105		Max 0.350	0.60~ 1.05	0.035	0.040	0.10~ 0.35	0.40	0.30	0.12			70 [485]	36 [250]	22.0	30.0	Max.187
A181	Class 60	Max 0.350	1.10	0.050	0.050	0.10~ 0.35						60 [415]	30 [205]	22.0	35.0	
	Class 70	Max 0.360	1.10	0.050	0.050	0.10~ 0.35						70 [485]	36 [250]	18.0	24.0	
Carbon and Alloy Steel																
A350	LF1	Max 0.350	0.60~ 1.35	0.035	0.040	0.15~ 0.30	0.40	0.30	0.12			60~85 [415~585]	30 [205]	25.0	38.0	
	LF2	Max 0.350	0.60~ 1.35	0.035	0.040	0.15~ 0.30	0.40	0.30	0.12			70~95 [485~655]	36 [250]	22.0	30.0	
	LF3	Max 0.200	Max 0.09	0.035	0.040	0.20~ 0.35	3.30~ 3.70	0.30	0.12			70~95 [485~655]	37.5 [260]	22.0	35.0	
Low Alloy Steel																
A-182	F1	0.28	0.60~ 0.90	0.045	0.045	0.15~ 0.35			0.44~ 0.65			70 [485]	40 [275]	20.0	30.0	143~ 192
	F2 (2)	0.05~ 0.21	0.30~ 0.80	0.040	0.040	0.10~ 0.60		0.50~ 0.81	0.44~ 0.65			70 [485]	40 [275]	20.0	30.0	143~ 192
	F5 (3)	0.15	0.30~ 0.60	0.030	0.030	0.50	0.50	4.0~ 6.0	0.44~ 0.65			70 [485]	40 [275]	20.0	35.0	143~ 217
	F5a (3)	0.25	0.60	0.040	0.030	0.50	0.50	4.0~ 6.0	0.44~ 0.65			90 [620]	65 [450]	22.0	50.0	187~ 248
	F9	0.15	0.30~ 0.60	0.030	0.030	0.5~ 1.00		8.0~ 10.0	0.90~ 1.10			85 [585]	55 [380]	20.0	40.0	179~ 217
	F91	0.08~ 0.12	0.30~ 0.60	0.020	0.010	0.20~ 0.50	0.40	8.0~ 9.5	0.85~ 1.05	0.06~ 0.10		85 [585]	60 [415]	20.0	40.0	248 Max.
	F92	0.07~ 0.13	0.30~ 0.60	0.020	0.010	0.50	0.40	8.50~ 9.50	0.30~ 0.60	0.04~ 0.09		90 [620]	64 [440]	20.0	45.0	269 Max.
	F911	0.09~ 0.13	0.30~ 0.60	0.020	0.010	0.10~ 0.50	0.40	8.50~ 10.50	0.90~ 1.10	0.06~ 0.10		90 [620]	64 [440]	18.0	40.0	187~ 248
	F11 Class 1	0.05~ 0.15	0.30~ 0.60	0.030	0.030	0.50~ 1.00		1.00~ 1.50	0.44~ 0.65			60 [415]	30 [205]	20.0	45.0	121~ 174
	F11 Class 2	0.10~ 0.20	0.30~ 0.80	0.040	0.040	0.50~ 1.00		1.00~ 1.50	0.44~ 0.65			70 [485]	40 [275]	20.0	30.0	143~ 207
	F11 Class 3	0.10~ 0.20	0.30~ 0.80	0.040	0.040	0.50~ 1.00		1.00~ 1.50	0.44~ 0.65			75 [515]	45 [310]	20.0	30.0	156~ 207
	F12 Class 1	0.05~ 0.15	0.30~ 0.60	0.045	0.045	0.50MAX.		0.80~ 1.25	0.44~ 0.65			60 [415]	32 [220]	20.0	45.0	121~ 174
	F12 Class 2	0.10~ 0.20	0.30~ 0.80	0.040	0.040	0.10~ 0.60		0.80~ 1.25	0.44~ 0.65			70 [485]	40 [275]	20.0	30.0	143~ 207
	F22 Class 1	0.05~ 0.15	0.30~ 0.60	0.040	0.040	0.50		2.00~ 2.50	0.87~ 1.13			60 [415]	30 [205]	20.0	35.0	170 Max.
	F22 Class 3	0.05~ 0.15	0.30~ 0.60	0.040	0.040	0.50		2.00~ 2.50	0.87~ 1.13			75 [515]	45 [310]	20.0	30.0	156~ 207
	F22V (4)	0.11~ 0.15	0.30~ 0.60	0.015	0.010	0.10	0.25	2.00~ 2.50	0.90~ 1.10	0.07	0.03	85~110 [585~780]	60 [415]	18.0	45.0	174~ 237
Austenitic Stainless Steel																
A-182	F304 (5)	0.08	2.00	0.045	0.030	1.00	8.0~ 11.0	18.0~ 20.0				75(13) [515]	30 [205]	30.0	50.0	
	F304H	0.04~ 0.10	2.00	0.045	0.030	1.00	8.0~ 11.0	18.0~ 20.0				75(13) [515]	30 [205]	30.0	50.0	
	F304L (5)	0.03	2.00	0.045	0.030	1.00	8.0~ 13.0	18.0~ 20.0				70(14) [485]	25 [170]	30.0	50.0	

Notes :
(1) All values are maximum unless otherwise stated.
(2) Grade F2 was formerly assigned to the 1% chromium. 0.5% molybdenum grade which is now Grade F12.
(3) The present grade F 5a (0.25 Max. carbon) previous 1955 was assigned the identification symbol F5.
Identification symbol F5 in 1955 was assigned to the 0.15 max carbon grade to be consisitent with ASTM specification for other products such as pipe, tubing, bolting, welding fitting, etc.
(4) For Grade F22V, rate earth metals (REM) may be added in place of calcium subject to agreement between the producer and purchaser. In that case, the total amount of REM shall be determined and reported.
(5) Grade F304, F304L, F316 and F316L shall have a nitrogen content of 0.10%.
(6) Grade F304N, F316N, F304LN and F316LN shall have a nitrigen content of 0.10 to 10.16%.
(7) Grade F321 shall have a titanium content of not less than five times the carbon content and not more than 0.70%.
(8) Grade F321H shall have a titanium content of not less than 4 times the carbon content and not more than 0.70%.

ASTM	Grade	CHEMICAL COMPOSITION,%										MECHANICAL PROPERTIES				
		C %	Mn %	P Max. %	S Max. %	Si %	Ni %	Cr %	Mo %	Col %	Ti %	T.S. Min. Ksi[Mpa]	Y.S. Min Ksi[Mpa]	EL Min. %	Red. Min. %	HB
Austenitic Stainless Steel																
A-182	F304N (6)	0.08	2.00	0.045	0.030	1.00	8.0~ 10.5	18.0~ 20.0				80 [550]	35 [240]	30.0 (15)	50.0 (16)	
	F304LN (6)	0.03	2.00	0.045	0.030	1.00	8.0~ 10.5	18.0~ 20.0				75 (2) [515]	30 [205]	30.0	50.0	
	F309H	0.04~ 0.10	2.00	0.045	0.030	1.00	12.0~ 15.0	22.0~ 24.0				75 (2) [515]	30 [205]	30.0	50.0	
	F310	0.25	2.00	0.045	0.030	1.00	19.0~ 22.0	24.0~ 26.0				75 (2) [515]	30 [205]	30.0	50.0	
	F310H	0.04~ 0.10	2.00	0.045	0.030	1.00	19.0~ 22.0	24.0~ 26.0				75 (2) [515]	30 [205]	30.0	50.0	
	F316 (5)	0.08	2.00	0.045	0.030	1.00	10.0~ 14.0	16.0~ 18.0	2.00~ 3.00			75 (13) [515]	30 [205]	30.0	50.0	
	F316H	0.04~ 0.10	2.00	0.045	0.030	1.00	10.0~ 14.0	16.0~ 18.0	2.00~ 3.00			75 (13) [515]	30 [205]	30.0	50.0	
	F316L (5)	0.03	2.00	0.045	0.030	1.00	10.0~ 15.0	16.0~ 18.0	2.00~ 3.00			70 (14) [485]	25 [170]	30.0	50.0	
	F316N (6)	0.08	2.00	0.045	0.030	1.00	11.00~ 14.0	16.0~ 18.0	2.00~ 3.00			80 [550]	35 [240]	30.0 (15)	50.0 (16)	
	F317	0.08	2.00	0.045	0.030	1.00	11.00~ 15.0	18.0~ 20.0	3.00~ 4.00			75 (13) [515]	30 [205]	30.0	50.0	
	F317L	0.03	2.00	0.045	0.030	1.00	11.0~ 15.0	18.0~ 20.0	3.00~ 4.00			70 (14) [485]	25 [170]	30.0	50.0	
	F321	0.08	2.00	0.045	0.030	1.00	9.0~ 12.0	17.0~ 19.0				75 (13) [515]	30 [205]	30.0	50.0	
	F321H	0.04~ 0.10	2.00	0.045	0.030	1.00	9.0~ 12.0	17.0~ 19.0				75 (13) [515]	30 [205]	30.0	50.0	
	F347	0.08	2.00	0.045	0.030	1.00	9.0~ 13.0	17.0~ 20.0				75 (13) [515]	30 [205]	30.0	50.0	
	F347H	0.04~ 0.10	2.00	0.045	0.030	1.00	9.0~ 13.0	17.0~ 20.0				75 (13) [515]	30 [205]	30.0	50.0	
	F348	0.08	2.00	0.045	0.030	1.00	9.0~ 13.0	17.0~ 20.0				75 (13) [515]	30 [205]	30.0	50.0	
	F348H	0.04~ 0.10	2.00	0.045	0.030	1.00	9.0~ 13.0	17.0~ 20.0				75 (13) [515]	30 [205]	30.0	50.0	
Ferritic Austenitic Stainless Steel																
A-182	F50	0.03	2.00	0.045	0.030	1.00	5.5~ 6.5	24.0~ 26.0	1.20~ 2.00			100-130 [690-900]	65 [450]	25.0	50.0	
	F51	0.03	2.00	0.030	0.020	1.00	4.5~ 6.5	21.0~ 23.0	2.50~ 3.50			90 [620]	65 [450]	25.0	45.0	
	F52	0.03	2.00	0.035	0.010	0.60	3.5~ 5.2	26.0~ 29.0	1.00~ 2.50			100 [690]	70 [485]	15.0	-	
	F53	0.03	1.20	0.035	0.020	0.80	6.0~ 8.0	24.0~ 26.0	3.00~ 5.00			116 (17) [800]	80 (17) [550]	15.0	-	310 Max.
	F54	0.03	1.00	0.030	0.030	0.80	6.0~ 8.0	24.0~ 26.0	2.50~ 3.50			116 [800]	80 [550]	15.0	30.0	310 Max.
	F55	0.03	1.00	0.030	0.010	1.00	6.0~ 8.0	24.0~ 26.0	3.00~ 4.00			109-130 [750-895]	80 [550]	25.0	45.0	
	F57	0.025	0.80	0.025	0.002	0.80	6.5~ 8.0	24.0~ 26.0	3.00~ 4.00			118 [820]	85 [585]	25.0	50.0	
	F59	0.03	1.50	0.035	0.002	0.80	5.5~ 8.0	24.0~ 26.0	3.00~ 5.00			112 [770]	80 [550]	25.0	40.0	
	F60	0.03	2.00	0.030	0.020	1.00	4.5~ 6.5	22.0~ 23.0	3.00~ 3.50			95 [655]	70 [485]	25.0	45.0	
	F61	0.04	1.50	0.040	0.030	1.00	4.5~ 6.5	24.0~ 27.0	2.90~ 3.90			109 [750]	80 [550]	25.0	50.0	

Notes :

(9) Grade F347 and F348 shall have a columbium content of not less than ten times the carbon content and not more than 1.10%.
(10) Grade F347H and 348H shall have a columbium content of not less than 8 times the carbon content and not more than 1.10%
(11) % Cr + 3.3*% Mo + 16*N = 40 Min.
(12) Determined by the 0.2% offset method. For ferritic steels only, the 0.5% extension-under load method may also be used.
(13) For section over 5 in. [130mm] in thickness, the minimum tensile strength shall be 70 Ksi [485 Mpa]
(14) For section over 5 in. [130mm] in thickness. the minimum tensile strength shall be 65 Ksi [450 Mpa]
(15) Longitudinal. The tranverse elongation shall be 25% Min. in 2 inch or 50mm Min.
(16) Longitudinal. The tranverse elongation shall be 45% Min.
(17) For sections over 2 in. [50mm] in thickness, the minimum tensile strength shall be 106 Ksi [730 Mpa];the Minimum Yield Strength shall be 75 Ksi [515 Mpa]

ANNEX. D COMPARISON TABLE OF ASTM SPEC

Steel Composition	ASTM Specification and Grade				JIS Specification and Grade	
	Marking Symbol	Pipe	Plate	Forging	Pipe	Plate
Carbon Steel	-	A120	A283-A	-	SGP (STPY400)	SS400
Carbon Steel	-	A53-B	A284	-	STPG 370	SM418
Carbon Steel	-	A53-B	A284	-	STPG 410	SM 3418
-	-	-	-	-	STPT 370	SB42
Carbon Steel	WPB	A106-B	A515-65 or 70	A181-2 and A105	STPT 410	SB42
Carbon Steel	WPC	A106-C	-	-	STPT 480	SB49
Carbon and Low-Alloy Steel	WPL6	A333 and A334-6	A516-60	A350-LF2	STPL 380	-
3 1/2% Ni Steel	WPL3	A333 and A334-3	A203-D	A350-LF3	STPL450	-
Carbon Mo Steel	WP1	A335-P1	A204-B	A1820F1	STPA 12	-
1% Cr-1/2% Mo Steel	WP12	A335-P12	A387-12	A182-F12	STPA 22	-
1 1/4% Cr-1/2% Mo Steel	WP11	A335-P11	A387-11	A182-F11	STPA 23	-
2 1/4% Cr-1/2% Mo Steel	WP22	A335-P22	A387-22	A182-F22	STPA 24	SCMV4
5% Cr-1/2% Mo Steel	WP5	A335-P5	A387-5	A182-F5	STPA 25	-
7% Cr-1/2% Mo Steel	WP7	A335-P7	-	A182-F7	-	-
9% Cr-1% Mo Steel	WP9	A335-P9	-	A182-F9	STPA 26	-
18% Cr-8% Ni Steel	WP304	A312-TP304	A240-Type 304	A182-F304	SUS304 TP	SUS304
18% Cr-8% Ni-(0.04-0.10)% C Steel	WP304H	A312-TP304H	A240-Type F304H	A182-F304H	SUS304 HTP	-
18% Cr-8% Ni-0.035% C Steel	WP304L	A312-TP304L	A240-Type F304L	A182-F304L	SUS304 LTP	SUS304L
22% Cr-12% Ni Steel	WP309	A312-TP309	A240-Type 3095	-	SUS309 STP	SUS309S
25% Cr-20% Ni Steel	WP310	A312-TP310	A240-Type 3105	A182-F310	SUS310 STP	SUS310S
18% Cr-8% Ni-(cb+Ta) Steel	WP347	A312-TP347	A240-Type 347	A182-F347	SUS347 TP	SUS347
18% Cr-8% Ni-Mo Steel	WP316	A312-TP316	A240-Type 316	A182-F316	SUS316 TP	SUS316
18% Cr-8% Ni-Mo-(0.04-0.01)% C Steel	WP316H	A312-TP316H	A240-Type 316	A182-F316H	SUS316 HTP	-
18% Cr-8% Ni-Mo-0.035% Steel	WP316L	A312-TP316L	A240-Type 316L	A182-F316L	SUS316 LTP	SUS316L
18% Cr-8% Ni-Ti Steel	WP321	A312-TP321	A240-Type 321	A182-F321	SUS321 TP	SUS321
18% Cr-8% Ni-Ti(0.04-0.01)% C Steel	WP321H	A312-TP321H	A240-Type 321	A182-F321H	SUS321 HTP	-
18% Cr-8% Ni-(Cb+Ta)-(0.04-0.01)% C Steel	WP347H	A312-TP347H	A240-Type 347	A182-F347H	SUS347 HTP	-

AND SIMILAR STANDARDS

KS Specification		B.S. Specification and Grade	DIN Specification and Grade	Steel Composition
Pipe	Plate	Pipe	Plate	
SPP	SB41	1387-M	2440-ST33-1	Carbon Steel
SPPS 38	SWS 41B	3602-ERW 23	1626-ST37	Carbon Steel
SPPS 42	SWS 41B	3602-ERW 27	-	Carbon Steel
SPHT 38	SBB 42	3602-Steel 23	17175-ST35.8	Carbon Steel
SPHT 42	SBB 42	3602-Steel 27	17175-ST45.8	Carbon Steel
SPHT 49	SBB 49	3602-Steel 35	-	Carbon Steel
STPL 39	SLAL 39	3603-Steel 27 LT 30	-	Carbon and Low-Alloy Steel
-	-	3603-Steel 503 LT 100	-	3 1/2% Ni Steel
SPA 12	SBB 46M	-	17175-15Mo3	Carbon Mo Steel
SPA 22	SCMV 2	3604-HF 620	17175-13 Cr Mo44	1% Cr-1/2% Mo Steel
SPA 23	SCMV 3	3604-HF 621	-	1 1/4% Cr-1/2% Mo Steel
SPA 24	SCMV 4	3604-HF 622,27	17175-10 Cr Mo910	2 1/4% Cr-1% Mo Steel
SPA 25	SCMV 6	3604-HF 625	-	5% Cr-1/2% Mo Steel
-	-	-	-	7% Cr-1/2% Mo Steel
-	-	-	-	9% Cr-1% Mo Steel
STS304 TP	STS304	3605-801	17440-X5 Cr Ni189	18% Cr-8% Ni Steel
-	-	3605-811	-	18% Cr-8% Ni-(0.04-0.10)% C Steel
STS304 LTP	STS304 L	3605-811L	17440x2 Cr Ni189	18% Cr-8% Ni-0.035% C Steel
STS309 STP	STS309 S	-	-	22% Cr-12% Ni Steel
STS310 STP	STS310 S	3605-8055	-	25% Cr-20% Ni Steel
STS347 TP	STS347	3605-822Nb	17440-X1 Cr Ni Nb 189	18% Cr-8% Ni-(cb-Ta) Steel
STS316 TP	STS316	3605-845	17440-X5 Cr Ni Mo 1810	18% Cr-8% Ni-Mo Steel
STS316 HTP	-	3605-855	-	18% Cr-8% Ni-Mo-(0.04-0.10)% C Steel
STS316 LTP	STS316 L	3605-845L	17440-X2 Cr Ni Mo 1810	18% Cr-8% Ni-Mo-0.035% C Steel
ST321 TP	STS321	3605-822Ti	17440-X10 Cr Ni Ti 189	18% Cr-8% Ni-Ti Steel
-	-	3605-832Ti	-	18% Cr-8% Ni-Ti-(0.04-0.10)% C Steel
STS347 HTP	-	3605-832Nb	-	18% Cr-8% Ni-(Cb+Ta)-(0.04-0.10)% C Steel