MATERIAL SPECIFICATIONS (ASTM-2009)

ASTM	GRADE	CHEMISTRY															
		C %	Mn %	P %	S %	SI %	NI %	Cr %	Mo %	Cu %	V %	Nb %	T.S. Min psi (MPA)	Y.S. Min psi (MPA)	EL Min %	RED Min %	HB MAX
A-105		MAX 0.35	0.60~1.05	MAX 0.035	MAX 0.040	MAX 0.10~0.35	MAX 0.40	MAX 0.30	MAX 0.12	MAX 0.40	MAX 0.08	MAX 0.02	70,000 (485)	36,000 (250)	22	30	187
A-181	I	〃 0.35	〃 1.10	〃 0.050	〃 0.050	〃 0.10~0.35							60,000 (415)	30,000 (205)	22	35	
A-181	II	〃 0.35	〃 1.10	〃 0.050	〃 0.050	〃 0.10~0.35							70,000 (485)	36,000 (250)	18	24	
A-182	F1	〃 0.28	0.60~0.90	〃 0.045	〃 0.045	0.15~0.35			0.44~0.65				70,000 (485)	40,000 (275)	20	30	192
A-182	F5	〃 0.15	0.30~0.60	〃 0.030	〃 0.030	MAX 0.50	MAX 0.50	4.0~6.0	0.44~0.65				70,000 (485)	40,000 (275)	20	35	217
A-182	F5a	〃 0.25	MAX 0.6	MAX 0.040	MAX 0.030	MAX 0.50	MAX 0.50	4.0~6.0	0.44~0.65				90,000 (620)	65,000 (450)	22	50	248
A-182	F6a-2	〃 0.15	MAX 1.00	MAX 0.040	〃 0.030	MAX 1.00	MAX 0.50	11.5~13.5					85,000 (585)	55,000 (380)	18	35	229
A-182	F11-1	0.05~0.15	0.30~0.60	〃 0.030	〃 0.030	0.5~1.00		1.00~1.50	0.44~0.65				60,000 (415)	30,000 (205)	20	45	174
A-182	F11-2	0.10~0.20	0.30~0.80	〃 0.040	〃 0.040	0.5~1.00		1.00~1.50	0.44~0.65				70,000 (485)	40,000 (275)	20	30	207
A-182	F11-3	0.10~0.20	0.30~0.80	MAX 0.040	MAX 0.040	0.5~1.00		1.00~1.50	0.44~0.65				75,000 (515)	45,000 (310)	20	30	207
A-182	F22-3	0.05~0.15	0.30~0.60	MAX 0.040	MAX 0.040	MAX 0.50		2.00~2.50	0.87~1.13				75,000 (515)	45,000 (310)	20	30	207
A-182	F304	〃 0.08	MAX 2.00	〃 0.045	〃 0.030	〃 1.00	8.00~11.00	18.00~20.00					75,000 (515)	30,000 (205)	30	50	
A-182	F304L	〃 0.030	〃 2.00	〃 0.045	〃 0.030	〃 1.00	8.00~13.00	18.00~20.00					70,000 (485)	25,000 (170)	30	50	
A-182	F316	〃 0.08	〃 2.00	〃 0.045	〃 0.030	〃 1.00	10.00~14.00	16.00~18.00	2.00~3.00				75,000 (515)	30,000 (205)	30	50	
A-182	F321	〃 0.08	〃 2.00	〃 0.045	〃 0.030	MAX 1.0	9.00~12.00	17.00~19.00					75,000 (515)	30,000 (205)	30	50	
A-182	F316L	〃 0.030	〃 2.00	〃 0.045	〃 0.030	〃 1.00	10.00~15.00	16.00~18.00	2.00~3.00				70,000 (485)	25,000 (170)	30	50	
A-350	LF1	〃 0.30	0.6 1.35	〃 0.035	〃 0.040	0.15~0.30	〃 0.40	〃 0.30	〃 0.12	〃 0.40	〃 0.03	〃 0.02	60,000 (415)	30,000 (205)	25	38	197
A-350	LF2	〃 0.30	0.6 1.35	〃 0.035	〃 0.040	0.15~0.30	〃 0.40	〃 0.30	〃 0.12	〃 0.40	〃 0.03	〃 0.02	70,000 (485)	36,000 (250)	22	30	197
A-350	LF3	〃 0.20	MAX 0.90	〃 0.035	〃 0.040	0.20~0.35	3.3~3.7	〃 0.30	〃 0.12	〃 0.40	〃 0.03	〃 0.02	70,000 (485)	37,500 (260)	22	35	197

Charpy V-Notch Energy Requirements for Standard Size [10 by 10 mm] Specimens

Grade	Minimum Impact Energy Required for Average of Each Set of Three Specimens. ft.lbf[j]	Minimum Impact Energy Permitted for One Specimen only of a Set, ft.lbf[j]
LF1	13[18]	10[14]
LF2, LF3	15[20]	12[16]

Standard Impact Test Temperature for Standard Size [10 by 10mm] Specimens

Grade	Test Temperature, °F[℃]
LF1	-20[-28.9]
LF2	-50[-45.6]
LF3	-150[-101.1]