

Body & Bonnet Materials

Chemical Composiotion	Carben steel	Cryogenic			Alloy steel			ASTM-A182 Austenite stainless steel ASTM-A182						Duplex Stainless Steels
	A105	LF2	LF3	F5	F91	F11 Class2	F22 Class3	F304	F304H	F304L	F316	F316L	F347H	F51
C	0.35	0.35	0.20	0.15	0.08-0.12	0.10-0.20	0.05-0.15	0.08	0.04-0.10	0.035	0.08	0.035	0.04-0.1	0.030
Mn	0.60-1.05	0.60-1.05	0.90	0.30-0.60	0.30-0.60	0.30-0.80	0.30-0.60	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P	0.035	0.035	0.035	0.030	0.020	0.040	0.040	0.045	0.045	0.045	0.045	0.045	0.045	0.030
S	0.040	0.040	0.040	0.030	0.010	0.040	0.040	0.030	0.030	0.030	0.030	0.030	0.030	0.20
Si	0.10-0.35	0.10-0.35	0.20-0.35	0.50	0.20-0.50	0.50-1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ni	0.40	0.40	3.3-3.7	0.50	0.40	-	-	8.0-11.0	8.0-11.0	8.0-13.0	10.0-14.0	10.0-15.0	9.0-13.0	4.5-6.5
Cr	0.30	0.30	0.30	4.0-6.0	8-9.5	1.00-1.50	2.00-2.50	18.0-20.0	18.0-20.0	18.0-20.0	16.0-18.0	16.0-18.0	17.0-20.0	21-23
Mo	0.12	0.12	0.12	0.44-0.65	0.85-1.05	0.44-0.65	0.87-1.13	-	-	-	2.00-3.00	2.00-3.00	-	2.5-3.5
Mechanical Property	ASTM A105	LF2	LF3	F5	F91	F11Class2	F22Class3	F304	F304H	F304L	F316	F316L	F347H	F51
Tensile strength	70	70-95	70-95	70	85	70	75	75	75	70	75	70	75	90
Yield strength	36	36	37.5	40	60	40	45	30	30	25	30	25	30	65
Elongation at Rupture	22	22	22	20	20	20	20	30	30	30	30	30	30	25
Shrinkage of R.A	30	30	35	35	40	30	30	50	50	50	50	50	50	45
Brinell hardness	187(2)	197	197	143-217	≤248	143-207	156-207	-	-	-	-	-	-	-

Trim & bolt materials

Chemical compo- sition	Trim materials					Bolt materials				
	AISI 410	AISI 416	AISI 420	ASTM B164 Monel	Stellite Gr.6	ASTM A193		ASTM 430	ASTM A194	
						B7	B8		2H	G8
C	0.15max.	0.15max.	0.15max.	0.3max	1.00	0.37-0.49	0.08max.	0.12max.	0.40max.	0.08max.
Mn	1.00max.	1.25max.	1.00max.	2.0max	1.00max.	0.65-1.10	2.0max.	1.00max.	1.00max.	2.00max.
P	0.040	0.060max.	0.040	-	-	0.035	0.045	0.040	0.040max.	0.045
S	0.030	0.15max.	0.030	0.025	-	0.04	0.030	0.030	0.050max.	0.030
Si	1.00max.	1.00max.	1.00max.	0.5max.	1.00	0.15-0.35	1.00max.	1.00max.	0.40max.	1.00max.
Cr	11.5-13.5	12.0-14.0	12.0-14.0	-	28.00	0.75-1.20	18.0-20.0	14.0-18.0	-	18.0-20.0
Ni	-	-	-	63.0max.	3.0max.	-	8.00-11.0	-	-	8.00-11.0
Mo	-	0.600max.	-	-	-	0.15-0.25	-	-	-	-
Cu	-	-	-	28.0-37.0	-	-	-	-	-	-
Other element	-	-	-	Fe:2.5max.	Fe:3.0max. W:4.0 Co:balance	-	-	-	-	-
Mechanical property	410	416	420	ASTM A164	Gr.6	B7	B8	430	2H	G8
Tensile strength	99/85	85/170	149/298	70(2)	-	125	75	75.4	-	-
	70/130	85/170	105/210	49.2	-	87.8	52.7	53	-	-
Yield strength	59/170	59/128	119/199	25(2)	-	105	30	40	-	-
	42/120	42/90	84/140	17.6	-	73.8	21	28	-	-
Elongation at Rupture	(15)(1)	(10)(1)	(8)(1)	(35)(2)	-	16	30	28	-	-
Shrinkage of R.A	50/75	8/60	5/40	-	-	50	50	65	-	-
Brinell hardness	180/375	180/375	300-600	-	HRC min.37	-	-	160	248-352	126-300

ASTM Code	CHEMICAL COMPOSITION												MECHANICAL PROPERTIES				HARDNESS	SHOCKVALUE
	C ≤	Mn ≤	P ≤	S ≤	Si ≤	Cr ≤	Mo ≤	Ni ≤	Cu ≤	V ≤	Nb ≤	Tensile Mpa,≥	Yield Mpa,≥	Elongation %,≥	Reduce %,≥	Brinell HB,≥	J,≥	
A105	0.35	0.60~ 1.05	0.035	0.040	0.10~ 0.35	0.30	0.12	0.4	0.40	0.08	0.02	485	250	30	30	187		
A182F11	0.05~ 0.15	0.30~ 0.60	0.030	0.030	0.50~ 1.00	1.00~ 1.50	0.44~ 0.65					415	205	20	45	121~ 174		
A182F22	0.05~ 0.15	0.30~ 0.60	0.040	0.040	0.50	2.00~ 2.50	0.87~ 1.13					415	205	20	35	170		
A182F304	0.08	2.00	0.045	0.030	1.00	18.0~ 20.0		8.0~ 11.0				515	205	30	50			
A182F304L	0.030	2.00	0.045	0.030	1.00	18.0~ 20.0		8.0~ 13.0				485	170	30	50			
A182F316	0.08	2.00	0.045	0.030	1.00	16.0~ 18.0	2.00~ 3.00	10.0~ 14.0				515	205	30	50			
A182F316L	0.030	2.00	0.045	0.030	1.00	16.0~ 18.0	2.00~ 3.00	10.0~ 15.0				485	170	30	50			
A182F51	0.030	2.00	0.030	0.020	1.00	21.0~ 23.0	2.5~ 3.5	4.5~ 6.5				620	450	25	45			
A182F6a	0.15	1.00	0.040	0.030	1.00	11.5~ 13.5		0.50				585	380	18	35	167~ 229		
A193B7	0.37~ 0.49	0.65~ 1.10	0.035	0.040	0.15~ 0.35	0.75~ 1.20	0.15~ 0.25					860	720	16	50	321		
A193B7M	0.37~ 0.49	0.65~ 1.10	0.035	0.040	0.15~ 0.35	0.75~ 1.20	0.15~ 0.25	8.0~ 11.0				690	550	18	50	235		
A193B8	0.08	2.00	0.045	0.030	1.00	18.0~ 20.0		10.0~ 14.0		0.25~ 0.35		515	205	30	50	223		
A193B8M	0.08	2.00	0.045	0.030	1.00	16.0~ 18.0	2.00~ 3.00					515	205	30	50	223		
A193B16	0.36~ 0.47	0.45~ 0.70	0.035	0.040	0.15~ 0.35	0.80~ 1.15	0.50~ 0.65					860	720	18	50	321		
A1942H	≥0.40	1.00	0.040	0.050	0.04											248~ 352		
A1942HM	≥0.40	1.00	0.040	0.050	0.04			8.0~ 11.0								159~ 237		
A1948	0.08	2.00	0.045	0.030	1.00	18.0~ 20.0		10.0~ 14.0								126~ 300		
A1948M	0.08	2.00	0.045	0.030	1.00	16.0~ 18.0	2.00~ 3.00									126~ 300		
A216WCB	0.30	1.00	0.04	0.045	0.60	0.50	0.20	0.50	0.30	0.03		485~ 655	250	22	35			
A216WCC	0.25	1.20	0.04	0.045	0.60	0.50	0.2	0.50	0.30	0.03		485~ 655	275	22	35			
A217C5	0.20	0.40~ 0.70	0.04	0.045	0.75	4.00~ 6.50	0.45~ 0.65	0.50	0.50			620~ 795	415	18	35			
A217CA15	0.15	1.00	0.040	0.040	1.50	11.5~ 14.0	0.50	1.00				620~ 795	450	18	30			
A217WC6	0.05~ 0.20	0.50~ 0.80	0.04	0.045	0.60	1.00~ 1.50	0.45~ 0.65	0.50	0.50			485~ 655	275	20	35			
A217WC9	0.05~ 0.18	0.40~ 0.70	0.04	0.045	0.60	2.00~ 2.75	0.90~ 1.20	0.50				485~ 655	275	20	35			
A276410	0.05~ 0.15	1.00	0.040	0.030	1.00	11.5~ 13.5						480	275	20	45			
A276420	≥0.15	1.00	0.040	0.030	1.00	12.0~ 14.0												
A320L7	0.38~ 0.48	0.75~ 1.00	0.035	0.040	0.15~ 0.35	0.80~ 1.10	0.15~ 0.25					860	725	16	50	241	Avg:27; min:20	
A320L7M	0.38~ 0.48	0.75~ 1.00	0.035	0.040	0.15~ 0.35	0.80~ 1.10	0.15~ 0.25					690	550	18	50	235	Avg:27; min:20	
A336F22	0.05~ 0.15	0.30~ 0.60	0.025	0.025	0.50	2.00~ 2.50	0.90~ 1.10					515~ 690	310	19	40			
A350LF1	0.30	0.60~ 1.35	0.035	0.040	0.15~ 0.30	0.30	0.12	0.40	0.40	0.08	0.02	415~ 585	205	28	38		Avg:18; min:14	
A350LF2	0.30	0.60~ 1.35	0.035	0.040	0.15~ 0.30	0.30	0.12	0.40	0.40	0.08		485~ 655	250	30	30		Avg:20; min:16	
A351CF3	0.03	1.50	0.040	0.040	2.00	17.0~ 21.0	0.50	8.0~ 12.0			0.02	485	205	35.0				
A51CF3M	0.03	1.50	0.040	0.040	1.50	17.0~ 21.0	2.0~ 3.00	9.0~ 13.0				485	205	30.0				
A351CF8	0.08	1.50	0.040	0.040	2.00	18.0~ 21.0	0.50	8.0~ 11.0				485	205	35.0				
A351CF8M	0.08	1.50	0.040	0.040	1.50	18.0~ 21.0	2.0~ 3.00	9.0~ 12.0				485	205	30.0				
A351CF8C	0.08	1.50	0.040	0.040	2.00	18.0~ 21.0	0.50	9.0~ 12.0	3.0~ 4.0			485	205	30.0				
A351CN7M	0.07	1.50	0.040	0.040	1.50	19.0~ 22.0	2.0~ 3.00	27.5~ 30.5				425	170	35				
A352LC1	0.25	0.50~ 0.80	0.04	0.045	0.60		0.45~ 0.65					450~ 620	240	24	35			
A352LC2	0.25	0.50~ 0.80	0.04	0.045	0.60			2.00~ 3.00				485~ 655	275	24	35		Avg:18; min:14	
A352LC3	0.15	0.50~ 0.80	0.04	0.045	0.60			3.00~ 4.00				485~ 655	275	24	35		Avg:20; min:16	
A352LCB	0.30	1.00	0.04	0.045	0.60	0.05	0.20	0.50	0.30	0.03		450~ 620	240	24	35		Avg:20; min:16	
A352LCC	0.25	1.20	0.04	0.045	0.60	0.05	0.20	0.50		0.03		485~ 655	275	22	35	139~ 202	Avg:18; min:14	
A439D2	3.00	0.70~ 1.25	0.08	0.045	1.50~ 3.00	1.75~ 2.75		18.00~ 22.00				400	207	8.0			Avg:20; min:16	