

ASTM Material Specifications

The following is a chart from ANSI B16.34 - 1996 Version; Table 1- Material Specification

Group 1 Materials

Material		Product Form									
Group No.	Nominal Designation	Forgings		Castings		Plates		Bars		Tubular	
		Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade
1.1	C C-Si C-Mn-Si	A105 A350	LF2	A216	WCB	A515 A516 A537	70 70 Cl. 1	A675 A105 A350 A696	70 LF2 C	A672 A672	B70 C70
1.2	C-Si 21/2Ni 31/2Ni C-Mn-Si	A 350	LF3	A352 A352 A216 A352	LC2 LC3 WCC LCC	A203 A203	B E	A350	LF3	A106	C
1.3	C C-Si 21/2Ni 31/2Ni C-Mn-Si			A352	LCB	A515 A203 A203 A516	65 A D 65	A675	65	A672 A672	B 65 C 65
1.4	C C-Si C-Mn-Si	A350	LF1			A515 A516	60 60	A675 A350 A696	60 LF1 B	A106 A672 A672	B B 60 C 60
1.5	C-1/2Mo	A182	F1	A217 A352	WC1 LC1	A204 A204	A B	A182	F1	A691	CM-70
1.6	C-1/2Mo 1/2Cr-1/2Mo 1Cr-1/2Mo					A387 A387 A387	2 Cl.1 2 Cl. 2 12 Cl. 1			A335 A369 A691	P1 FP1 1/2Cr
1.7	C-1/2Mo 1/2Cr-1/2Mo Ni-1/2Cr-1/2Mo 3/4Ni-Mo-3/4Cr	A182	F2	A217 A217	WC4 WC5	A204	C	A182	F2	A691	CM-75
1.8	1Cr-1/2Mo					A387	12 Cl.2			A691 A335	1CR P12

	1-1/4Cr-1/2Mo-Si 2-1/4Cr-1Mo					A387 A387	11 Cl.1 22 Cl.1			A369 A691 A335 A369 A691 A335 A335	FP12 1-1/4CR P11 FP11 2-1/4CR P22 FP22
1.9	1Cr-1/2Mo 1-1/4Cr-1/2Mo-Si 1-1/4Cr-1/2Mo	A182 A182	F12 Cl.2 F11 Cl.2	A217	WC6	A387	11 Cl.2	A182 A182 A739	F12 Cl.2 F11 Cl.2 B11		
1.10	2-1/4Cr-1Mo 3Cr-1Mo	A182 A182	F22 Cl.3 F21	A217	WC9	A387 A387	22 Cl.2 21 Cl.2	A182 A739 A182	F22 Cl.3 B2210.2 F21		
1.11	Mn-1/2Mo Mn-s1/2Mo-1/2Ni Mn-1/2Mo-3/4Ni C-Mn-Si					A302 A302 A302 A537	A & B C D CL2				
1.12	5Cr-1/2Mo 5Cr-1/2Mo-Si					A387 A387	5 Cl.1 5 Cl. 2			A691 A335 A369 A335	5CR P5 FP5 P5b
1.13	5Cr-1/2Mo	A182 A182	F5a F5	A217	C5			A182	F5a		
1.14	9Cr-1Mo	A182	F9	A217	C12			A192	F9		

ASTM Material Specifications (2)

The following is a chart from ANSI B16.34 - 1996 Version; Table 1- Material Specification

Group 2 Materials

Material		Product Form									
Group No.	Nominal Designation	Forgings		Castings		Plates		Bars		Tubular	
		Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade
2.1	18Cr-8Ni	A182 A182	F304 F304H	A351 A351	CF3 CF8	A240 A240	304 304H	A182 A182 A479 A479	F304 F304H 304 304H	A312 A312 A358 A376 A376 A430	TP304 TP304H 304 TP304 TP304H FP304

										A430	FP304H
2.2	16Cr-2Ni-2Mo					A240	316			A312	TP316
						A240	316H			A312	TP316H
	18Cr-8Ni	A182 A182	F316 F316H		A351 CF3A A351 CF8A			A182 F316 A182 F316H A479 316 A479 316H	A358 316 A376 TP316 A376 TP316H A430 FP316 A430 FP316H		
	18Cr-13Ni-3Mo 16Cr-12Ni-2Mo 19Cr-10Ni-3Mo			A351 CF3M A351 CF8M A351 CG8M	A240	317			A312	TP317	
2.3	18Cr-8Ni	A182	F304L			A240	304L	A182 A479	F304L 304L	A312	TP304L
	16Cr-12Ni-2Mo	A182	F316L			A240	316L	A182 A479	F316L 316L	A312	TP316L
2.4	18Cr-10Ni-Ti	A182 A182	F321 F321H			A240 A240	321 321H	A182 A479 A182 A479	F321 321 F321H 321H	A312	TP321
										A312	TP321H
2.5	18Cr-10Ni-Cb	A182 A182 A182 A182	F347 F347H F348 F348H	A351	CF8C	A240 A240 A240 A240	347 347H 348 348H	A182 A182 A182 A479 A479 A479	F347 F347H F348 F348H 347 347H 348 348H	A312	TP347
										A312	TP347H
2.6	25Cr-12Ni			A351	CH8						
	23Cr-12Ni			A351	CH20	A240 A240	309S 309H			A312 A358	TP309H 309H
2.7	25Cr-20Ni	A182	F310H	A351	CK20	A240 A240	310S 310H	A182 A479	F310H 310H	A312	TP310H

								A479	310S	A358	310H
2.8	20Cr-18Ni-6Mo	A182	F44			A240	S31254			A312	S31254
	22Cr-5Ni-3Mo-N	A182	F51	A351	CK3MCuN	A240	S31803	A479	S31254	A358	S31254
	25Cr-7Ni-4Mo-N	A182	F53			A240	S32750	A479	S31803	A789	S31803
										A790	S31803
										A789	S32750
										A790	S32750

ASTM Material Specifications (3)

The following is a chart from ANSI B16.34 - 1996 Version; Table 1- Material Specification

Group 3 Materials

Material		Product Form									
Group No.	Nominal Designation	Forgings		Castings		Plates		Bars		Tubular	
		Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade	Spec. No.	Grade
3.1	35Ni-35Fe-20Cr-Cb	B462	N08020			B463	N08020			B464	N08020
	28Ni-19Cr-Cu-Mo					A351	CN7M	B473	N08020	B468	N08020
3.2	99Ni	B160	N02200			B162	N02200	B160	N02200	B161	N02200
										B163	N02200
3.3	99Ni-Low C			B160	N02201			B162	N02201	B160	N02200
3.4	67Ni-30Cu	B564	N04400					B164	N04400	B165	N04400
	67Ni-30Cu-S			B564	N04405	B127	N04400	B164	N04405	B163	N04400
3.5	72Ni-15Cr-8Fe	B564	N06600			B168	N06600	B166	N06600	B167	N06600
										B163	N06600
3.6	33Ni-42Fe-21Cr	B564	N08800			B409	N08800	B408	N08800	N163	N08800
3.7	65Ni-28Mo-2Fe	B335	N10665			B333	N10665	B335	N10665	B622	N10665
3.8	54Ni-16Mo-15Cr	B574	N10276			B575	N10276	B574	N10276	B622	N10276
	60Ni-22Cr-9Mo-3.5Cb	B564	N06625			B443	N06625	B446	N06625		
	62Ni-28Mo-5Fe	B335	N10001			B333	N10001	B335	N10001	B622	N10001
	70Ni-16Mo-7Cr-5Fe	B573	N10003			B434	N10003	B573	N10003		
	61Ni-16Mo-16Cr	B574	N06455			B575	N06455	B574	N06455	B622	N06455
	42Ni-21.5Cr-3Mo-2.3Cu	B425	N08825			B424	N08825	B425	N08825	B423	N08825
3.9	47Ni-22Cr-9Mo-18Fe	B572	N06002			B435	N06002	B572	N06002	B622	N06002
3.10	25Ni-47Fe-21Cr-5Mo	B672	N08700			B599	N08700	B672	N08700		

3.11	44Fe-25Ni-21Cr-Mo	B649	N08904			B625	N08904	B649	N08904	B677	N08904
3.12	26Ni-43Fe-22Cr-5Mo	B621	N08320			B620	N08320	B621	N08320	B622	N08320
	47Ni-22Cr-20Fe-7Mo	B581	N06985			B582	N06985	B581	N06985	B622	N06985
3.13	49Ni-25Cr-18Fe-6Mo	B581	N06975			B582	N06975	B581	N06975	B622	N06975
	Ni-Fe-Cr-Mo-Cu-Low C	B564	N08031			B625	N08031	B649	N08031	B622	N08031
3.14	47Ni-22Cr-19Fe-6Mo	B581	N06007			B582	N06007	B581	N06007	B622	N06007
3.15	33Ni-2Fe-21Cr	B564	N08810	A494	N-12MV	B409	N08810	B408	N08810	B407	N08810
	Ni-Mo			A494	CW-12MW						
	Ni-Mo-Cr										
3.16	35Ni-19Cr-11/4Si	B511	N08330			B536	N08330	B511	N08330	B535	N08330

ASTM Material Specifications (4)

The following is a chart from ANSI B16.34 - 1996 Version; Table 1- Material Specification

Group 4 Materials

Bolting Material Specifications [Note (1)]					
Specification No.	Grade	Notes	Specification No.	Grade	Notes
A193	-	(2)(3)	A449	-	(7)(8)
A307 B	-	(4)(5)	A453	-	(9)(10)
A320	-	2)(3)(6)	A540	-	-
A354	-	-	A564	630	(7)
B164	-	(11)(12)(13)	B408	-	(11)(12)(13)
B165	-	(11)(12)	B473	-	(11)
B335	N10665	(11)	B574	N10276	(11)
			B574	N06022	(11)
			B637	N07718	(11)

GENERAL NOTES:

- The user is responsible for assuring that bolting material is not used beyond the limits specified in the governing code or regulations.
- ASME Boiler and Pressure Vessel Code Section II material that also meet the requirements of the listed ASTM specification may also be used.
- Material limitations, restrictions, and special requirements are shown on pressure-temperature tables.

NOTES

1. Repair welding of bolting material is not permitted.
2. Where austenitic bolting materials have been carbide solution treated but not strain hardened, they are designated Class 1 or Class 1A in ASTM A193. ASTM A194 nuts of corresponding material are recommended.
3. Where austenitic bolting materials have been carbide solution treated and strain hardened, they are designated Class 2 in ASTM A193. ASTM A194 nuts of corresponding material are recommended.
4. For limitations of usage and strength levels, see ASME B16.34 para. 5.1.1.
5. Bolts with drilled or undersize heads shall not be used.
6. For ferritic bolting materials intended for service at low temperatures, ASTM A194 Gr. 4 or Gr. 7 nuts are recommended.
7. Acceptable nuts for use with these quenched and tempered steel bolts are ASTM A194 Grade 2 and 2H.
8. Mechanical property requirements for studs shall be the same as those for bolts.
9. These are bolting materials suitable for high temperature service with austenitic stainless steel valve materials.
10. Only Grades 651 and 660 shall be used.
11. Nuts may be of the same material or may be of compatible grade of ASTM A194.
12. Forging quality not permitted unless the producer last heating or working these parts tests them as required for other permitted conditions in the same specification and certifies their final tensile, yield, and elongation properties to equal or exceed the requirements for one of the other permitted conditions.
13. Maximum operating temperature is arbitrarily set at 500°F (260°C) unless material has been annealed, solution annealed, or hot finished, because hard temper adversely affects design stress in the creep-rupture temperature range.