ASTM Material Specifications

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

Group 1 Materials

Material		Product Form									
		Forgings		Castings		Plates		Bars		Tubular	
Group No.	Nominal Designation	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**									
		Forgings		**Castings**		**Plates**		**Bars**		**Tubular**	
Group No.	**Nominal Designation**	**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 18Cr-8Ni 18Cr-13Ni-3Mo 16Cr-12Ni-2Mo 19Cr-10Ni-3Mo	A182 A182	F316 F316H	A351 A351 A351 A351 A351	CF3A CF8A CF3M CF8M CG8M	A240 A240 A240	316 316H 317	A182 A182 A479 A479	F316 F316H 316 316H	A312 A312 A358 A376 A376 A430 A430 A312	TP316 TP316H 316 TP316 TP316H FP316 FP316H TP317
2.3	18Cr-8Ni 16Cr-12Ni-2Mo	A182 A182	F304L F316L			A240 A240	304L 316L	A182 A479 A182 A479	F304L 304L F316L 316L	A312 A312	TP304L TP316L
2.4	18Cr-10Ni-Ti	A182 A182	F321 F321H			A240 A240	321 321H	A182 A479 A182 A479	F321 321 F321H 321H	A312 A312 A358 A376 A376 A430 A430	TP321 TP321H 321 TP321 TP321H FP321 FP321H
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 A182 A479 A479 A479 A479	F347 F347H F348 F348H 347 347H 348 348H	A312 A312 A358 A376 A376 A376 A430 A430 A312 A312	TP347 TP347H TP347 TP347 TP347H TP348 FP347 FP347H TP348 TP348H
2.6	25Cr-12Ni 23Cr-12Ni			A351 A351	CH8 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 22Cr-5Ni-3Mo-N 25Cr-7Ni-4Mo-N	A182 A182 A182	F44 F51 F53	A351	CK3MCuN	A240 A240 A240	S31254 S31803 S32750	A479 A479 A479	S31254 S31803 S32750	A312 A358 A789 A790 A789 A790	S31254 S31254 S31803 S31803 S32750 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**									
		Forgings		**Castings**		**Plates**		**Bars**		**Tubular**	
Group No.	**Nominal Designation**	**Spec. No.**	**Grade**	**Spec. No.**	**Grade**	**Spec. No.**	**Grade**	**Spec. No.**	**Grade**	**Spec. No.**	**Grade**
3.1	35Ni-35Fe-20Cr-Cb 28Ni-19Cr-Cu-Mo	B462	N08020			B463 A351	N08020 CN7M	B473	N08020	B464 B468	N08020 N08020
3.2	99Ni	B160	N02200			B162	N02200	B160	N02200	B161 B163	N02200 N02200
3.3	99Ni-Low C			B160	N02201			B162	N02201	B160	N02200
3.4	67Ni-30Cu 67Ni-30Cu-S	B564	N04400	B564	N04405	B127	N04400	B164 B164	N04400 N04405	B165 B163	N04400 N04400
3.5	72Ni-15Cr-8Fe	B564	N06600			B168	N06600	B166	N06600	B167 B163	N06600 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 60Ni-22Cr-9Mo-3.5Cb 62Ni-28Mo-5Fe 70Ni-16Mo-7Cr-5Fe 61Ni-16Mo-16Cr 42Ni-21.5Cr-3Mo-2.3Cu	B574 B564 B335 B573 B574 B425	N10276 N06625 N10001 N10003 N06455 N08825			B575 B443 B333 B434 B575 B424	N10276 N06625 N10001 N10003 N06455 N08825	B574 B446 B335 B573 B574 B425	N10276 N06625 N10001 N10003 N06455 N08825	B622 B622 B622 B423	N10276 N10001 N06455 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 47Ni-22Cr-20Fe-7Mo	B621 B581	N08320 N06985			B620 B582	N08320 N06985	B621 B581	N08320 N06985	B622 B622	N08320 N06985
3.13	49Ni-25Cr-18Fe-6Mo Ni-Fe-Cr-Mo-Cu-Low C	B581 B564	N06975 N08031			B582 B625	N06975 N08031	B581 B649	N06975 N08031	B622 B622	N06975 N08031
3.14	47Ni-22Cr-19Fe-6Mo	B581	N06007			B582	N06007	B581	N06007	B622	N06007
3.15	33Ni-2Fe-21Cr Ni-Mo Ni-Mo-Cr	B564	N08810	A494 A494	N-12MV CW-12MW	B409	N08810	B408	N08810	B407	N08810
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)
			B408	-	(11)(12)(13)
B164	-	(11)(12)(13)	B473	-	(11)
B165	-	(11)(12)	B574	N10276	(11)
B335	N10665	(11)	B574	N06022	(11)
			B637	N07718	(11)

GENERAL NOTES:

a. The user is responsible for assuring that bolting material is not used beyond the limits specified in the governing code or regulations.

b. ASME Boiler and Pressure Vessel Code Section II material that also meet the requirements of the listed ASTM specification may also be used.

c. 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 tampered 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^{o}F (260^{o}C) unless material has been annealed, solution annealed, or hot finished, because hard temper adversely affects design stress in the creep-rupture temperature range.