AUSTRALIAN PIPELINE VALVE®

VALVE BODY & BOLTING TEMPERATURE RATINGS

VALVE BODY MATERIAL TEMPERATURE RANGE ASME B16.34

Material	Lower Temp	Upper Temp
Cast Iron	-18ºC	210ºC
Ductile Iron	-20ºC	343ºC
Carbon Steel - Grade A216 - WCB	-29ºC	425ºC
Carbon Steel - Grade A352 - LCB	-46ºC	345ºC
Carbon Moly - Grade A217 - WC1 (1)	-29ºC	538ºC
1¼ Cr - ½ Mo - Grade A217 - WC6 (2)	-29ºC	595ºC
2¼ Cr - 1 Mo - Grade A217 - WC9 (2)	-29ºC	595ºC
5 Cr - ½ Mo - Grade A217 - C5 (2)	-29ºC	650ºC
9 Cr - 1 Mo - Grade A217 - C12 (2)	-29ºC	650ºC
Type 304 SS - Grade A351 - CF8 (2/3)	-254ºC	816ºC
Type 347 SS - Grade A351 - CF8C (2/4)	-254ºC	816ºC
Type 316 SS - Grade A351 - CF8M (2/3)	-254ºC	816ºC
3½ Ni - Grade A352 - LC3	-101ºC	345ºC
Aluminium	-198ºC	204ºC
Bronze	-198ºC	288ºC
Inconel	-198ºC	649ºC
Monel	-198ºC	450ºC
Hastelloy B	-198ºC	371ºC
Hastelloy C	-198ºC	538ºC
Titanium		316ºC
Nickel	-198ºC	260ºC
Alloy 20 - Grade A351 - CN7M	-46ºC	150ºC
Alloy 20 - Grade A990 - CN3MCu	-29ºC	320ºC

Notes per ASME B16.34-2009:-
(1) Not suitable for prolonged exposure above 470ºC.
(2) Flanged ends in 150 class ratings terminate at 538ºC.
(3) At temperatures above 538ºC carbon content must be > 0.04%.
(4) At temperatures above 538ºC consult ANSI B16.34 for heat treatment requirements.

VALVE TRIM MATERIAL TEMPERATURE RANGE

Material	Lower Temp	Upper Temp
Type 304 SS	-232ºC	600ºC
Type 316 SS	-232ºC	600ºC
Hastelloy B	-195ºC	371ºC
Hastelloy C	-195ºC	538ºC
Alloy 20	-46ºC	316ºC
Type 416, F6A, 410 SS*	-29ºC*	427ºC
TFE	-200ºC	220ºC
Buna-N / NBR	-46ºC	150ºC

Note:- Cold working pressure rating (CWP) decreases as temperature increases. Refer to ASTM P/T charts.
*Minimum Temperature will vary from -100ºC to 0ºC according to grade of CR13 and treatment. Must be charpies impact tested if lower than -29ºC. Many of the above valve body and trim material temperatures are indicative and can vary widely depending on manufacturers:- grade, form, class of valve, end connections, duration, carbon content, annealing process, impact testing, fluid type, application etc.

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VALVE MATERIALS & CORRESPONDING BOLTING COMBINED TEMPERATURE RANGE

Valve Body Material	Corresponding Bolting	Material Nuts	Lower Temp	Upper Temp
Grade WCB (Carbon Steel)	ASTM A193 Gr B7*	ASTM A194 Gr 2H	-29ºC	427ºC
Grade LCB (Carbon Steel)	ASTM A320 Gr L7†	ASTM A194 Gr 4	-46ºC	343ºC
Grade WC1 (Carbon Moly)	ASTM A193 Gr B7*	ASTM A194 Gr 2H	-29ºC	400ºC
	ASTM A193 Gr B16	ASTM A194 Gr 4	-29ºC	454ºC
Grade WC6 (1 ¼ Cr-½ Mo)	ASTM A193 Gr B7*	ASTM A194 Gr 2H	-29ºC	400ºC
	ASTM A193 Gr B16	ASTM A194 Gr 4	-29ºC	593ºC
Grade WC9 (2 ¼ Cr-1 Mo)	ASTM A193 Gr B7	ASTM A194 Gr 2H	-29ºC	400ºC
	ASTM A193 Gr B16	ASTM A194 Gr 4	-29ºC	593ºC
Grade C5 (5Cr-½ Mo)	ASTM A193 Gr B7*	ASTM A194 Gr 2H	-29ºC	400ºC
	ASTM A193 Gr B16	ASTM A194 Gr 4	-29ºC	593ºC
Grade C12 (9Cr-1 Mo)	ASTM A193 Gr B7	ASTM A194 Gr 2H	-29ºC	400ºC
	ASTM A193 Gr B16	ASTM A194 Gr 4	-29ºC	593ºC
Grade CF8 (Type 304)	ASTM A320 Gr B8***	ASTM A194 Gr 8	-254ºC	575ºC
	ASTM A193 Gr B8**	ASTM A194 Gr 8	-150ºC	650ºC
Grade CF8M (Type 316)	ASTM A320 Gr B8M***	ASTM A194 Gr 8M	-250ºC	575ºC
	ASTM A193 Gr B8M**	ASTM A194 Gr 8M	-150ºC	750ºC
Grade LC3 (3½ Ni)	ASTM A320 Gr L7†	ASTM A194 Gr 4	-101ºC	343ºC

*Alloy steel bolting, A193 Gr B7 bolts and A194 Gr 2H nuts can only be used at moderate temperatures depending on the permissable differential expansion of valve design which may vary between manufacturers.

**ASTM A193 Gr B8/B8M bolting can rate from -198ºC to 800ºC, however many manufacturers of bolts and/or valves specify the narrower rating range shown.

***For temperatures lower than -200ºC (-325ºF) ASTM A320 Gr B8/B8M bolting must be impact tested.

†All L7 bolts and Grade 4 nuts must be charpies impact tested for service temperature lower than -29ºC.

The above chart shows the combined temperature range, taking into account the valve and bolting material ratings. Refer to ASTM pressure/temperature charts. For limitations of usage and strength levels refer ANSI B16.34.

Where austenitic bolting materials have be carbide solution treated but not strain hardened, they are designated Class 1 or Class 1A. Where austenitic bolting materials have been carbide solution treated and strain hardened, they are designated Class 2. In B8 and B8M, ‘Class 2’ is recommended for higher classes 900lb and above in larger sizes depending on temperature due to it’s higher tensile strength (carbide solution treated, strain hardened).

A193 Gr B7 and Gr L7 are acceptable for NACE (as class III NACE Bolting) service as bolting is “Non wetted parts”, however if bolts themselves must conform to NACE then B7M, L7M bolts are required. B8M bolting (same service as 316) conforms to NACE.

Temperature range of studs can vary widely depending on size, stud, manufacturer, bonnet enclosure and valve manufacturers calculation. Also refer to ASTM standard for ‘design temperature rating’ of bolting.

For technical references and ASTM/ASME cross reference information on stainless, duplex, chrome-moly and alloy steel used in valves & piping systems in the petrochemical and refining.
Go to our website:- http://www.australianpipelinevalve.com.au

We can manufacture exotic grades like Nickel, Super Duplex F55 and Monel (ASTM A494-M35-1), Cd4M-Cu, Hastelloy C (ASTM A-494 CW12MW) and 317 (C8GM) in short lead-time.

ASTM MATERIALS SPECIFICATIONS AND PRESSURE TEMPERATURE CATEGORIES B16.34 - 2009

Material Group	Nominal Designation	Pressure - Temp Ratings	Applicable ASTM Specifications		
			Forgings	Castings	Plate
1.1	C - Si	2 - 1.1	A 105	A 216 Gr. WCB	A 515 Gr. 70
	C - Mn - Si		A 350 Gr. LF2		A 516 Gr. 70
	3½ Ni		A 350 Gr. LF3		A 537 Cl. 1
	C - Mn - Si -V		A 350 Gr. LF6 Cl. 1		
1.2	C - Mn - Si	2 - 1.2		A 216 Gr. WCC	
				A 352 Gr. LCC	
	C - Mn - Si - V		A 350 Gr. LF6 Cl. 2		
	2½ Ni			A 352 Gr. LC2	A 203 Gr. B
	3½ Ni			A 352 Gr. LC3	A 203 Gr. E
1.3	C - Si	2 - 1.3		A 352 Gr. LCB	A 515 Gr. 65
	C - Mn - Si				A 515 Gr. 65
	C - ½Mo			A 217 Gr. WC1/A352 LC1	
1.4	C - Si	2 - 1.4			A 515 Gr. 60
	C - Mn - Si		A 350 Gr. LF1		A 516 Gr. 60
1.5	C - ½Mo	2 - 1.5	A 182 Gr. F1		A 204 Gr. A
					A 204 Gr. B
1.7	C - ½Mo	2 - 1.7			
	½Cr - ½Mo		A 182 Gr. F2		
	Ni - ½Cr - ½Mo			A 217 Gr. WC4	
	¾Ni - ¾Cr - Mo			A 217 Gr. WC5	
1.9	1¼Cr - ½Mo			A 217 Gr. WC6	
	1¼Cr - ½Mo - Si		A 182 Gr. F11 Cl. 2		A 387 Gr. 11 Cl. 2
1.10	2¼Cr - 1Mo	2 - 1.10	A 182 Gr. F22 Cl. 3	A 217 Gr. WC9	A 387 Gr. 22 Cl. 2
1.11	3Cr - 1Mo	2 - 1.11	A 182 Gr. F21		A 204 Gr. C
1.13	5Cr - ½Mo	2 - 1.13	A 182 Gr. F5A	A 217 Gr. C5	
1.14	9Cr - 1Mo	2 - 1.14	A 182 Gr. F9	A 217 Gr. C12	
1.15	9Cr - 1Mo -V	2 - 1.15	A 182 Gr. F91	A 217 Gr. C12A	A 387 Gr. 91 Cl. 2
1.17	1Cr - ½Mo	2 - 1.17	A 182 Gr. F12 Cl. 2		
	5Cr - ½Mo		A 182 Gr. F5		
2.1	18Cr - 8Ni	2 - 2.1	A 182 Gr. F304	A 351 Gr. CF8	A 240 Gr. 304
			A 182 Gr. F304H	A 351 Gr. CF10	A 240 Gr. 304H
2.2	16Cr - 12Ni - 2Mo	2 - 2.2	A 182 Gr. F316	A 351 Gr. CF8M	A 240 Gr. 316
			A 182 Gr. F316H	A 351 Gr. CF10M	A 240 Gr. 316H
	18Cr - 8Ni			A 351 Gr. CF3A	
	18Cr - 13Ni - 3Mo		A 182 Gr. F317		A 240 Gr. 317
	18Cr - 13Ni - 3Mo		A 182 Gr. 317H	A 351 Gr. CF8A	A 240 Gr. 317H
	19Cr - 10Ni - 3Mo			A 351 Gr. CG8M	
	19Cr - 10Ni - 3Mo			A 351 Gr. CG3M	
2.3	18Cr - 8Ni	2 - 2.3	A 182 Gr. F304L	A 351 Gr. CF3	A 240 Gr. 304L
	18Cr - 13Ni - 3Mo		A 182 Gr. F317L		
	16Cr - 12Ni - 2Mo		A 182 Gr. F316L	A 351 Gr. CF3M	A 240 Gr. 316L
2.4	18Cr - 10Ni - Ti	2 - 2.4	A 182 Gr. F321		A 240 Gr. 321
			A 182 Gr. F321H		A 240 Gr. 321H
2.5	18Cr - 10Ni - Cb	2 - 2.5	A 182 Gr. F347	A 351 Gr. CF8C	A 240 Gr. 347
			A 182 Gr. F347H		A 240 Gr. 347H
			A 182 Gr. F348		A 240 Gr. 348
			A 182 Gr. F348H		A 240 Gr. 348H
2.7	25Cr - 20Ni	2 - 2.7	A 182 Gr. F310H		
					A 240 Gr. 310H
2.8	20Cr - 18Ni - 6Mo	2 - 2.8	A 182 Gr. F44	A 351 Gr. CK3MCuN	A 240 Gr. S31254
	22Cr - 5Ni - 3Mo - N		A 182 Gr. F51	A 351 Gr. CD3MN	A 240 Gr. S31803
	25Cr - 7Ni - 4Mo - N		A 182 Gr. F53		A 240 Gr. S32750
	24Cr - 10Ni - 4Mo - V			A 351 Gr. CE8MN/CD4MCuN	
	25Cr - 5Ni - 2Mo - 3Cu			A 995 Gr. 1B	
	25Cr - 7Ni - 3.5Mo - W - Cb			A 995 Gr. CD3MWCuN/6A	
	25Cr - 7.5Ni - 3.5Mo - N - Cu - W		A 182 Gr. F55		A 240 Gr. S32760

ASTM MATERIALS SPECIFICATIONS AND PRESSURE TEMPERATURE CATEGORIES B16.34 (Cont'd)

Material Group	Nominal Designation	Pressure - Temp Ratings	Applicable ASTM Specifications		
			Forgings	Castings	Plate
3.1	35Ni - 35Fe - 20Cr -Cb	2 - 3.1	B 462 Gr. N08020		B 463 Gr. N08020
3.2	99.0Ni	2 - 3.2	B 564 Gr. N02200		B 162 Gr. N02200
3.3	99.0Ni - Low C	2 - 3.3			B 162 Gr. N02201
3.4	67Ni - 30Cu	2 - 3.4	B 564 Gr. N04400	A 494 Gr M-35-1	B 127 Gr. N04400
	67Ni - 30Cu - S			A 494 Gr M-35-1	
3.5	72Ni - 15Cr - 8Fe	2 - 3.5	B 564 Gr. N06600		B 168 Gr. N06600
3.6	33Ni - 42Fe - 21Cr	2 - 3.6	B 564 Gr. N08800		B 409 Gr. N08800
3.7	64Ni - 29.5Mo - 2Cr - 2Fe-Mn-W	2 - 3.7	B 462 Gr. N10675		B 333 Gr. N10675
	65Ni - 28Mo - 2Fe		B 564/B462 Gr. N10665		B 333 Gr. N10665
3.8	42Ni - 21.5Cr - 3Mo - 2.3Cu	2 - 3.8	B 564 Gr. N08825		B 424 Gr. N08825
	54Ni - 16Mo - 15Cr		B 564/B462 Gr. N10276		B 575 Gr. N10276
	55Ni - 21Cr - 13.5Mo		B 462 Gr. N06022		B 575 Gr. N06022
	55Ni - 23Cr - 16Mo - 1.6Cu		B 462 Gr. N06200		B 575 Gr. N06200
	60Ni - 22Cr - 9Mo - 3.5Cb		B 564 Gr. N06625		B 443 Gr. N06625
3.10	25Ni - 46Fe - 21Cr - 5Mo	2 - 3.10			B 599 Gr. N08700
3.11	44Fe - 25Ni - 21Cr - Mo	2 - 3.11			B 625 Gr. N08904
3.13	Ni - Fe - Cr - Mo - Cu - Low C	2 - 3.13	B 564 Gr. N08031		B 625 Gr. N08031
3.14	40Ni - 29Cr - 15Fe - 5Mo	2 - 3.14	B 462 Gr. N06030		B 582 Gr. N06030
3.15	42Ni - 2Fe - 21Cr	2 - 3.15	B 564 Gr. N08810		B 409 Gr. N08810
	Ni - Mo			A 494 Gr N-12MV	
	Ni - Mo - Cr			A 494 Gr CW-12MW	
3.17	29Ni - 20½Cr - 3½Cu - 2½Mo	2 - 3.17		A 351 Gr CN7M	
3.19	57Ni - 22Cr - 14W - 2Mo - La	2 - 3.19	B 564 Gr. N06230		