

## VALVE BODY MATERIALS

Australian Pipeline Valves are manufactured in a wide range of materials as follows:

Material Group	Common Name	Material Type	Forging Spec	UNS	Casting Spec. Equivalent	DIN	DIN W. No	Application	
Carbon Steel	CS	C-Mn-Fe	A105N	K03504	A216-WCB	C22.8 DIN 17243	1.0460	General non-corrosive service from -20°F (-29°C) to 800°F (427°C)	
Low Temperature Carbon Steel	LTCS	C-Mn-Fe	A350-LF2	K03011	A352-LC1 A352-LCB A352-LCC	TSTE 355 DIN 18103	1.0566	General non-corrosive service from -50°F (-46°C) to 650°F (340°C), LF2 to 800°F (427°C)	
Low Temperature Alloy Steel	Nickel Steel	3.1/2Ni	A350-LF3	K32025	A352-LC3	10Ni14	1.5637	-150°F (-101°C) to 650°F (340°C)	
Low Alloy Steel	Moly Steel	C-1/2Mo	A182-F1	K12822	A217-WC1	15Mo3	1.5415	Up to 875°F (468°C)	
	Alloy Steel Chrome Moly	1.1/4Cr-1/2Mo	A182-F11 cl2	K11572	A217-WC6	13CrMo44	1.7335	Up to 1100°F (593°C)	
		2.1/4Cr-1Mo	A182-F22 cl3	K21590	A217-WC9	10CrMo910	1.7380	Up to 1100°F (593°C), HP steam	
		5Cr-1/2Mo	A182-F5a	K41545	A217-C5	12CrMo195	1.7362	High temp. refinery service	
		9Cr-1Mo	A182-F9	K90941	A217-C12	X 12 CrMo 9 1	1.7386	High temp. erosive refinery service	
9Cr-1Mo-V	A182-F91		A217-C12A	X 10 CrMoVNb 9 1	1.4903	High pressure steam			
Stainless Steel	Austenitic	Austenitic S.Steel 300 series S.Steel	304 : 18Cr-8Ni	A182-F304	S30400	A351-CF8	DIN X5CrNi 18 9	1.4301	0.04% min. carbon for temp. >1000°F (538°C)
			304L : 18Cr-8Ni	A182-F304L	S30403	A351-CF3	X 2 CrNi 19 11	1.4306	Up to 800°F (427°C)
			304H :	A182-F304H	S30409	A351-CF10	n/a	n/a	
			316 : 16Cr-12Ni-2Mo	A182-F316	S31600	A351-CF8M	DIN X5CrNiMo 18 10	1.4401	0.04% min. carbon for temp. >1000°F (538°C)
			316L : 16Cr-12Ni-2Mo	A182-F316L	S31603	A351-CF3M	X 5 CrNiMo 17 12 2	1.4404	Up to 800°F (427°C)
			316H :	A182-F316H	S31609	A351-CF10M	n/a	n/a	
			316Ti :	A182-F316 Ti	S31635		X 6 CrNiMoTi 17 12 2	1.4571	Special grade
			321 : 18Cr-10Ni-Ti	A182-F321	S32100		X 6 CrNiTi 18 10	1.4541	0.04%min. carbon (grade F321H) and heat treat at 2000°F (1100°C) for service temps. >1000°F (538°C)
			321H	A182-F321H	S32109		n/a	n/a	
			347 : 18Cr-10Ni-Cb(Nb)	A182-F347	S34700	A351-CF8C	DIN 8556	1.4550	0.04%min. carbon (grade F347H) and heat treat at 2000°F (1100°C) for service temps. >1000°F (538°C)
	347H	A182-F347H	S34709		n/a	n/a			
	317L	A182-F317L	S31703	A351-CG3M*	X2CrNiMo18-16-4	1.4438			
	Alloy	Alloy 20	28Ni-19Cr-Cu-Mo	A182-F20*	N08020	A351-CN7M†	DIN 1.4500	2.4660	Service to 600°F (316°C)*
	Duplex	Duplex 2205	22Cr-5Ni-3Mo-N	A182-F51	S31803	A351-CD3MN (A995-4A)*	X2CrNiMoN22-5-3	1.4462	Service to 600°F (316°C) - The original S31803 UNS designation has been supplemented by S32205 which has higher minimum N,CR, and Mo
					S32205	J92205 (A995-4A)*	DIN 10088-1 (95)		
Super Austenitic	Super Austenitic/ 6Mo	20Cr-18Ni-6Mo	A182-F44	S31254	A351-CK3MCuN	X1CrNiMoCuN20-18-7	DIN 10088-1 (95)	1.4547	Service to 600°F (316°C)
Super Duplex	Super Duplex 2507	25Cr-7Ni-4Mo-N	A182-F53	S32750	A351-CD4MCu*	X2CrNiMoN27-7-4	DIN 10088-1 (95)	1.4501	Service to 600°F (316°C)
	Super Duplex F55	25Cr-7Ni-3.5Mo-N-Cu-W	A182-F55	S32760	A995-CD3MWCuN (A995-6A)				
Nickel-Iron Alloy	Incoloy 800	33Ni-42Fe-21Cr	B564-N08800	N08800		X10NiCrAlTi32-20	1.4876	Service to 1000°F (538°C)	
	Incoloy 825	42Ni-21.5Cr-3Mo-2.3Cu	B564-N08825*	N08825	A494-CU5MCuC*	DIN 17744	2.4858	Service to 600°F (316°C) for N02200, 1200°F (648°C) for N02201	
Nickel	Nickel	99/95Ni	B160-N02200 (bar)	N02200	A494-CZ-100*	NW2200	1.7740		
Nickel-Copper	Monel 400	67Ni-30Cu	B564-N04400	N04400	A494-M35-1	DIN 17730	2.4360		
	Monel 500		B564-N05500*	N05500			2.4375		
Nickel-Alloy	904L		904L*	N08904	n/a	Z2 NCDU 25-20	1.4539		
Nickel Superalloys	Inconel 600	72Ni-15Cr-8Fe	B564-N06600	N06600	A494-CY40*	DIN 17742	2.4816		
	Inconel 625	60Ni-22Cr-9Mo-3.5Cb	B564-N06625	N06625	A494-CW-6MC*		2.4856		
	Hastelloy C-276	54Ni-15Cr-16Mo	B564-N10276	N10276	A494-CW-2M*	NiMo 16 Cr 15 W	2.4819		
Titanium	Titanium	98Ti	B381-Gr2	R50400	B367-C2*	Ti 2	3.7035	Special grade	

† Cast CN7M only rated to 150°C, however 'New Alloy 20' grade CN3MCu is available which is to be rated to at least 316°C.

\* No longer referenced in ANSI B16.34 - 2009, A995 supersedes A990 (meets & surpasses).

Disclaimer: These charts are for reference only, Australian Pipeline Valve cannot be held liable for any damages incurred due to the use of these tables. Temperatures shown must be analysed in conjunction with ASTM P/T charts and manufacturers recommendations for each valve type.

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>.

## MAJOR VALVE MATERIAL GROUPS

FORGED	CAST
<b>CARBON STEEL</b>	
ASTM A105	ASTM A216 WCB/WCC
ASTM A350 LF2	ASTM A352 LCB/LCC
<b>ALLOY STEEL</b>	
ASM A350 LF3	ASTM A352 LC3
ASTM A182 F5a	ASTM A217 C5
ASTM A182 F9	ASTM A217 C12
ASTM A182 F11	ASTM A217 WC6
ASTM A182 F22	ASTM A217 WC9
ASTM A182 F91	ASTM A217 C12A
<b>AUSTENITIC STAINLESS STEEL</b>	
ASTM A182 F304/F304L	ASTM A351 CF8/CF3
ASTM A182 F316/F316L	ASTM A351 CF8M/CF3M
ASTM A182 F321	
ASTM A182 F347	ASTM A351 CF8C
ASTM A182 F44 (6MO)	ASTM CK3MCuN
ASTM A182 F20* (ALLOY 20)	A351 CN7M
<b>FERRITIC-AUSTENITIC STAINLESS STEEL</b>	
ASTM A182 F51 - UNS S31803† (DUPLEX S.S.)	A995* GR.4A/A351 CD3MN
ASTM A182 F53 - UNS S32750 (SUPER DUPLEX S.S.)	A995* GR.5A/A351 CE3MN
ASTM A182 F55 - UNS S32760 (SUPER DUPLEX S.S.)	A995* CD3MWCuN/A995 GR.6A
<b>NICKEL ALLOY</b>	
INCONEL 825 - UNS N08825 ASTM B564 - N08825	A484 CU5MCu*
INCONEL 600 - UNS N06600 ASTM B564 - N06600	A494 CY40*
INCONEL 625 - UNS N06625 ASTM B564 - N06625	A494 CW6MC*
MONEL 400 - UNS N04400 ASTM B564 - N04400	A494 M35-1
<b>TITANIUM</b>	
ASTM B381 GR.F2	ASTM B367 GR.C2
ASTM B381 GR.F3	ASTM B367 GR.C3

† S31803 has been supplemented by S32205 (F60) which dual conforms to S31803 but has a higher minimum N, Mo, Ni and Cr which guarantees a better corrosion resistance.

\* No longer referenced in ANSI B16.34 - 2009, A995 supersedes A890.

APV can manufacture exotic grades such as Nickel, Super-Duplex F55 and Monel (ASTM A494-M35-1), Cd4M-Cu, Hastelloy C (ASTM A-494 CW12MW), 317 (C8G8M) in short lead-time.

For other ANSI, ASME, ISO, API, BS, API valve related technical cross reference charts and tables relating to standards, codes, pressure, temperature, application, suitability, equivalents, body & trim materials, valve manufacturing & test standards, etc., go to the technical section of our website: <http://www.australianpipelinevalve.com.au>

We manufacture valves in API600, API602, API6D, API603, BS1868, API6A and numerous other standards including Butterfly, Ball, Check, Globe, Gate, Plug and Needle valves.

# VALVE TRIM MATERIALS

The following tables detail standard trim material available at Australian Pipeline Valve (APV). Special trims are available upon request.

## APV TRIM CONFIGURATIONS

API Trim No	Nonimal Trim	Trim code	Stem	Disc/Wedge	Seat	Min. Hardness (Brinell)
1	F6	F6	410 (13Cr)	F6 (13Cr)	410 (13Cr)	250
2	304	304	304 (18Cr-8Ni)	304 (18Cr-8Ni)	304 (18Cr-8Ni)	not specified
3	310	310	(25Cr-20Ni)	310 (25Cr-20Ni)	310 (25Cr-20Ni)	not specified
4	Hard 410	F6-H	410 (13Cr)	F6 (13Cr)	F6 (13Cr)	275
5	410 Full Hard faced	F6-HF	410 (13Cr)	F6+St Gr6 (CoCr Alloy)	410+St Gr6 (CoCr Alloy)	350
5A	410 Full Hard faced	F6-HF	410 (13Cr)	F6+Hardf. NiCr Alloy	410+Hardf. NiCr Alloy	350
6	410 and Ni-Cu	F6-HFS	410 (13Cr)	F6 (13Cr)	Monel 400 ® (NiCu Alloy)	250/175
7	410 and Full Hard	410	410 (13Cr)	F6 (13Cr)	F6 (13Cr) (750 HB)	250/750
8	410 and Hard faced	F6-HFS	410 (13Cr)	F6 (13Cr)	410+St Gr6 (CoCr Alloy)	250/350
8A	410 and Hard faced	F6-HFS	410 (13Cr)	F6 (13Cr)	410+Hardf. NiCr Alloy	250/350
9	Monel	Monel	Monel® (NiCu Alloy)	Monel® (NiCu Alloy)	Monel 400 ® (NiCu Alloy)	not specified
10	316	316	316 (18Cr-Ni-Mo)	316 (18Cr-8Ni-Mo)	316 (18Cr-8Ni-Mo)	not specified
11	Monel and Hard faced	Monel-HFS	Monel® (NiCu Alloy)	Monel® (NiCu Alloy)	Monel 400 ® St Gr6	350
11A	Monel and Hard faced	Monel-HFS	Monel® (NiCu Alloy)	Monel® (NiCu Alloy)	Monel 400 ® Hardf. NiCrA	350
12	316 and Hard faced	316-HFS	316 (18Cr-Ni-Mo)	316 (18Cr-8Ni-Mo)	316+St Gr6	350
12A	316 and Hard faced	316-HFS	316 (18Cr-Ni-Mo)	316 (18Cr-8Ni-Mo)	316 Hardf. NiCr Alloy	350
13	Alloy 20	Alloy 20	Alloy 20 (19Cr-29Ni)	Alloy 20 (19Cr-29Ni)	Alloy 20 (19Cr-29Ni)	not specified
14	Alloy 20 & Hard faced	Alloy 20-HFS	Alloy 20 (19Cr-29Ni)	Alloy 20 (19Cr-29Ni)	Alloy 20 St Gr6	350
14A	Alloy 20 & Hard faced	Alloy 20-HFS	Alloy 20 (19Cr-29Ni)	Alloy 20 (19Cr-29Ni)	Alloy 20 hardf. NiCr Alloy	350
15	304 Full Hard faced	304-HF	304 (18Cr-8Ni-Mo)	304+St Gr6	304+St Gr6	350
16	316 Full Hard faced	316-HF	316 HF (18Cr-8Ni-Mo)	316+St Gr6	316+St Gr6	350
17	347 Full Hard faced	347-HF	347 HF (18Cr-10Ni-Cb)	347+St Gr6	347+St Gr6	350
18	Alloy 20 Full Hard faced	Alloy-HF	Alloy 20 (19Cr-29Ni)	Alloy 20+St Gr6	Alloy 20+St Gr6	350
n/a	Alloy 625	Alloy 625	Alloy 625	Alloy 625	Alloy 625	

## TRIM MATERIAL EQUIVALENT GRADES

TRIM	UNS	TYPE	Grade (forged)	ASTM wrought	DIN	DIN W NO.
F6	UNS S41000	13Cr	ASTM A182 F6a	A276-410	DIN X12Cr13	1.4006
304	UNS S30400	18-8 Cr-Ni	ASTM A182 F304	A276-304	DIN X5CrNi 18 10	1.4301
316	UNS S31600	18-8 Cr-Ni (18-10-2)	ASTM A182 F316	A276-316	DIN X5CrNiMo 18 10	1.4401
321	UNS S32100	18 Cr-10 Ni-Ti	ASTM A182 F321	A276-321	DIN X6CrNiTi 18 10	1.4541
347	UNS S34700	18 Cr-10 Ni-Cb	ASTM A182 F347	A276-347	DIN X6CrNiNb18 10	1.4550
MONEL®	UNS N04400	67Ni-30Cu	ASTM B564-N04400	B164-N04400	BDIN 17743	2.4360
ALLOY 20	UNS N08020	28Ni-19Cr-Cu-Mo	ASTM A182-F20*	ASTM B473	DIN 14500	2.4660
ALLOY 625	UNS N06625	60Ni-22Cr-9Mo-3.5Cb	ASTM B564-N06625	ASTM B564-N06625	DIN 17361	2.4865
C276	UNS N10276	54Ni-15Cr-16Mo	ASTM B564-N10276	ASTM B574-N10276	DIN NiMo 16 Cr 15 W	2.4819
17/4PH	UNS S17400	0Cr17Ni4Cu4Nb	ASTM A705 UNS S17400	ASTM A564 UNS S17400	X5CrNiCuNb17-4-4	1.4548
St. Gr6†	UNS R30006	Co Cr-A	AMS 5894		Stellite(R) Gr6	

† Hard facing weld overlay

\* No longer referenced in ANSI B16.34 - 2009.

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Valve Material Types Equivalent R8 - AS