Summary of Alloys for OCTG & Equipment

Corrosion Resistant Alloys, L.P.
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Material Category ISO 13680	Common Name	Various Trade Name	UNS Number	Strength-ening method	Magnetic behavior	ISO 13680 Group and Category	Common Strength Levels	Maximum Hardness		NACEMR0175/ISO15156	NACEMR0175/ISO15156	NACEMR0175/ISO15156	Chemical Composition %																	Physical Properties				Coefficient of thermal expansion		Mechanical Properties				Mechanical Properties Compression		Typical CVN minimum
								HRC	PSL 2 HRC	Reference Paragraph in Part 3	Environmental Limits Table Part 3	H2S Limit	Ni Min	Ni Max	Cr Min	Cr Max	Mo Min	Mo Max	Fe Min	Fe Max	C Min	C Max	N Min	N Max	Cu Min	Cu Max	W Min	W Max	Other major elements	Min PREN	Density lb/in³	Young's Modulus 10x6 psi	Poisson's Ratio	Thermal conductivity Btu.lb/ft2.in-°F	RT to 100°C	RT to 200°C	UTS ksi min.	0.2% YS min ksi	0.2% YS max ksi	min. % Elongation	UTS	0.2% YS	Longitudinal @ -10°C
Low Alloy Steel																																								
	C-90	C-90		Q&T	Mag	NA		25.4	NA	Part 2	Part 2 Table A.3	none		0.99		1.5	0.25	0.85		Bal		0.35						Mn 1.2 max		0.284	29.7	0.29	296	6.8	7.6	100	90	105				
	T-95	T-95		Q&T	Mag	NA		25.4	NA	Part 2	Part 2 Table A.3	none		0.99	0.4	1.5	0.25	0.85		Bal		0.35						Mn 1.2 max		0.284	29.7	0.29	296	6.8	7.6	105	95	110				
	C-110	C-110		Q&T	Mag	NA		30	NA	P,part 2	Part 2 Table A.3	none - 150 F min		0.99	0.4	1.5	0.25	1.0		Bal		0.35						Mn 1.2 max		0.284	29.7	0.29	296	6.8	7.6	120	110	120				
Martensitic Stainless																																								
	13 Chrome	13 Chrome		Q&T	Mag	NA	80	23	NA	A.6	A.19	1 1/2 psi		0.5	12	14	NA		Bal		0.15	0.22	NA			0.25	NA		NA		0.28	29	0.3	173	5.67		95	80	95				40
							85	24	NA	A.6	Not approved	Not approved																									100	85	100				40
							95	27	NA	A.6	Not approved	Not approved																									105	95	110				40
	13Cr HP1/13Cr Mod	Hyper 13 Cr Mod		Q&T	Mag	NA	80	27	NA	Not approved	Not approved	Not approved	3.5 4.0	4.5 5.5	12.0 11.0	14.0 14.0	0.8 0.2	1.5 1.2	Bal			0.04 max 0.03 max	NA		NA		NA		NA								105	95	110				40
							95	28	NA	Not approved	Not approved	Not approved																															
							110	32	NA	Not approved	Not approved	Not approved																									120	110	130				40
	13Cr HP2/Super 13 Cr	Hyper 2 Super 13Cr		Q&T	Mag	Group 1 13-5-2	80	27	27	Not approved	Not approved	Not approved	4.5 4.5	5.5 6.5	12.0 11.5	14.0 13.5	1.8 1.5	2.5 3.0	Bal			0.04 max 0.03 max	NA		NA		NA		NA Ti		0.276	29	0.27	114	6	6.1	105	95	110	formula			40
							95	28	27	Not approved	Not approved	Not approved																															
							110	32	NA	Not approved	Not approved	Not approved																									120	110	130				40
	15Cr/UHP	UHP		Q&T	Mag		125	37	NA	Not approved	Not approved	Not approved	6.0	7.0	14.0	16.0	1.8	2.5	Bal			0.04 max	NA			1.5	NA		NA								135	125	150				40
Duplex Stainless																																								
	22 Chrome	2205	S31803	SA	Mag	Group 2 22-5-3	65	26	26	A.7	A.25	0.3 psi	4.5	6.5	21.0	23.0	2.5	3.5	Bal			0.030 max	0.08	0.20	NA		NA		NA	35	0.282	29	0.333	118	7.2	7.5	90	65	90	25			40
				CW			110	36	36	A.7	A.25	0.3 psi																									125	110	140	11			40
				CW			125	37	36	A.7	A.25	0.3 psi																									130	125	150	10			40
				CW			140	38	NA	A.7	A.25	0.3 psi																									145	140	160	9			40
	25 Chrome	2507	S31260	SA	Mag	Group 2 22-7-3	75	26	26	A.7	A.25	0.3 psi	5.5	7.5	24.0	26.0	2.5	3.5	Bal			0.030 max	0.10	0.30	0.2	0.8	0.1	0.5	NA	38	0.282	29.0	0.3	118	7.5	7.8	90	75	100	25			40
				CW			110	36	36	A.7	A.25	0.3 psi																									125	110	140	11			40
				CW			125	37	36	A.7	A.25	0.3 psi																									130	125	150	10			40
				CW			140	38	NA	A.7	A.25	0.3 psi																									145	140	160	9			40
	Super 25 Cr (PREN>40)	25.7N 25CRS 25CRW	S32760	SA	Mag	Group 2 22-7-4	80	28	28	A.7	A.25	3 psi	6.0	8.0	24.0	26.0	3.0	4.0	Bal			0.030 max	0.20	0.30	0.50	1.0	0.50	1.0	NA	41.5	0.282	29.0	0.3	98	6.2		110	80	105	20			40
				CW			110	36	36	A.7	A.25	3 psi																									125	110	140	12			40
				CW			125	37	36	A.7	A.25	3 psi																									130	125	150	10			40
				CW			140	38	NA	A.7	A.25	3 psi																									145	140	160	9			40
Austenitic Fe Based Stainless																																								
	2535	2535	N08535	CW	non-mag	Group3 25-32-3	110	35	33	A.4	A.12,A.14 - type 4c	200 psi @ 350 F	29.0	36.5	24.0	27.0	2.5	4.0	Bal			0.030 max	NA	NA		1.5	NA				0.29	28.2	0.3	85	8.7	9	115	110	140	11			40
				CW			125	37	35	A.4	A.12,A.14 - type 4c	200 psi @ 350 F																									130	125	150	10			40
				CW			140	38	NA	A.4	A.12,A.14 - type 4c	200 psi @ 350 F																									145	140	160	9			40
	28 Cr	928 SAN28 2832 2535	N08028	CW	non-mag	Group 3 27-31-4	110	35	33	A.4	A.12,A.14 - type 4c	200 psi @ 350 F	30.0	34.0	26.0	28.0	3.0	4.0	Bal			0.025 max	0.08	0.10	0.60	1.40	NA				0.290	28.3	0.3	83	8.7	9.0	115	110	140	11			40
				CW			125	37	35	A.4	A.12,A.14 - type 4c	200 psi @ 350 F																									130	125	150	10			40
				CW			140	38	NA	A.4	A.12,A.14 - type 4c	200 psi @ 350 F																									145	140	160	9			40
										A.4	A.12,A.14 - type 4c	200 psi @ 350 F																																	
Austenitic Ni Base																																								
(cold-worked & solid solution	825	825	N08825	CW	non-mag	Group 4 21-42-3	80			A.4	A.12,A.14 - type 4c	200 psi @ 350 F	38.0	46.0	19.5	23.5	2.5	3.5	22.0 min			0.05 max	NA	1.5	3.0		NA		Nb, Al, Ti		0.294	28.3	0.29	77	7.8	8.1	90	80	110	18			40
alloys for downhole tubulars)				CW			110	35	35	A.4	A.12,A.14 - type 4c	200 psi @ 350 F																									115	110	140	11			40
				CW			125	37	35	A.4	A.12,A.14 - type 4c	200 psi @ 350 F																									130	125	150	10			40
	2550	2550/G2	N06975	CW	non-mag	Group 4 25-50-6	110	35	35	A.4	A.12,A.14 - type 4b	300 psi @ 425 F	47	52.0	23.0	26.0	5.0	7.0	Bal			0.030 max	NA	0.70	1.20		NA		Ti		0.296	29.7	0.31	77	7.5	7.8	115	110	140	11			40
				CW			125	37	35	A.4	A.12,A.14 - type 4b	300 psi @ 425 F																									130	125	150	10			40
				CW			140	38	NA	A.4	A.12,A.14 - type 4b	300 psi @ 425 F																									145	140	160	9			40
	G-3	G-3	N06985	CW	non-mag	Group 4 22-50-7	110	35	35	A.4	A.12,A.14 - type 4b	300 psi @ 425 F		Bal	21.0	23.5	6.0	8.0	18	21.0		0.015 max	NA	1.5	2.5			1.5 max	Co, Nb		0.294	28.9	0.31	69	8.1	8.1	115	110	140	11			40
				CW			125	37	37	A.4	A.12,A.14 - type 4b	300 psi @ 425 F																									130	125	150	10			40
				CW			140	38	NA	A.4	A.12,A.14 - type 4b	300 psi @ 425 F																									145	140	160	9			40
	50	050/G50	N06950	CW	non-mag	Group 4 20-54-9	110	35	35	A.4	A.12,A.14 - type 4b	300 psi @ 425 F	50.0		19.0	21.0	8.0	10.0	15	20.0		0.015 max	NA	1.50	2.50			1.0 max	Nb, Al, Ti, Co		0.301	27.9	0.33	78	7.2	7.5	115	110	140	11			40
				CW			125	37	37	A.4	A.12,A.14 - type 4b	300 psi @ 425 F																									130	125	150	10			40
				CW			140	38	NA	A.4	A.12,A.14 - type 4b	300 psi @ 425 F																									145	140	160	9			40
	625	625	N06625	CW	non-mag	Group 4 20-54-9	110	35	35	A.4	A.12,A.14 - type 4d	300 psi @ 425 F	58.0		20.0	23.0	8.0	10.0		5.0 max		0.10 max	NA		NA		NA		Nb, Al, Ti, Co		0.305	30.1	0.28	68	7.4	7.5	115	110	140	11			40
	C-276	C-276	N10276	CW	non-mag	Group 4 15-60-16	110	35	35	A.4	A.12,A.14 - type 4e	1,000 psi @ 450 F		57 nom	14.5	16.5	15.0	17.0	4.0	7.0		0.01 max	NA		NA		3.0	4.5	Co		0.321	29.8	0.31	68	7.2	7.2	115	110	140	11			40
				CW			125	37	35	A.4	A.12,A.14 - type 4e	1,000 psi @ 450 F																									130	125	150	10			40
				CW			140	38	35	A.4	A.12,A.14 - type 4e	1,000 psi @ 450 F																									145	140	160	9			40
Titanium Alloy																																								
	Ti 6-2-4-6	6-2-4-6	R56260	Aging	non-mag		145	45		A.11	A.41	no limits					5.5	6.5		0.15 max		0.04 max			0.04 max				Ti,Al,Sn,Zr		0.168	16.7	0.33	53	5	5.5	160	145		8			
Austenitic Ni Base																																								
(precipitation-hardened Ni -base	718	718	N07718	Aging	non-mag		120	40	NA	A.9	A.32	400 psi @ 300 F	50.0	55.0	17.0	21.0	2.80	3.30	Bal			0.08 max	NA		0.3 max		NA		Nb, Ti, Al, Co		0.296	29	0.29	79		7.3	150	120	140	20			40
alloys for thick-walled tubulars	925	925	N09925	Aging	non-mag		110	38	NA	A.9	A.32	400 psi @ 300 F	42.0	46.0	19.5	22.5	2.5	3.5	22.0 min			0.03 max	NA	1.5	3.0		NA		Nb, Al, Ti		0.292	28.9	0.29	83	7.8	8.1	140	110 min		18			35
& equipment, SCSSV & hangers)	945	945	N09945	Aging	non-mag		125	42	NA	A.9	A.32 - ballot		45.0	55.0	19.5	23.0	3.0	4.0	Bal		0.005	0.04	NA	1.5	3.0		NA		Nb, Al, Ti		0.281	29.1	0.31	75.9	7.9	8	150	125		18			40
	945	945	N09945	Aging	non-mag		130	42	NA	A.9	A.32 - ballot		45.0	55.0	19.5	23.0	3.0	4.0	Bal		0.005	0.04	NA	1.5	3.0		NA		Nb, Al, Ti		0.281	29.1	0.31	75.9	7.9	8	150	130		18			40
	945	945	N09945	Aging	non-mag		135	42	NA	A.9	A.32 - ballot		45.0	55.0	19.5	23.0	3.0	4.0	Bal		0.005	0.04	NA	1.5	3.0		NA		Nb, Al, Ti		0.281	29.1	0.31	75.9	7.9	8	150	135		18			40
	945X	945X	N09945	Aging	non-mag		140	42	NA	A.9			45.0	55.0	19.5	23.0	3.0	4.0	Bal		0.005	0.04	NA	1.5	3.0		NA		Nb, Al, Ti		0.281	29.1	0.31	75.9	7.9	8	150	140		18			
	945X	945X	N09945	Aging	non-mag		145	42	NA	A.9			45.0	55.0	19.5	23.0	3.0	4.0	Bal		0.005	0.04	NA	1.5	3.0		NA		Nb, Al, Ti		0.281	29.1	0.31	75.9	7.9	8	150	145		18			
	945X	945X	N09945	Aging	non-mag		150	42	NA	A.9			45.0	55.0	19.5	23.0	3.0	4.0	Bal		0.005	0.04	NA	1.5	3.0		NA		Nb, Al, Ti		0.281	29.1	0.31	75.9	7.9	8	150	150		18			
	725	725	N07725	Aging	non-mag		125	44	NA	A.9	A.33	600 psi @400 F	55.0	59.0	19.0	22.5	7.0	9.5	9 nom			0.03 max	NA		NA		NA		Nb, Ti, Al		0.3	29.6	0.31	74	7.2	7.2	170	125 min		20			40
	625 plus	625 plus	N07716	Aging	non-mag		125	43	NA	A.9	A.33	600 psi @400 F	57	63	19	22	7	9.5	Bal			0.03 max	NA		NA		NA		Cb, Ti, Al														40