

HAYNES® 188 alloy

HAYNES® 188 alloy (UNS R30188) is a cobalt-nickel-chromium-tungsten alloy that combines excellent high-temperature strength with very good resistance to oxidizing environments up to 2000°F (1095°C) for prolonged exposures, and excellent resistance to sulfate deposit hot corrosion. It is readily fabricated and formed by conventional techniques, and has been used for cast components. Other attractive features include excellent resistance to molten chloride salts, and good resistance to gaseous sulfidation. In many new applications, it has been replaced by HAYNES® 230® alloy or HAYNES® 233® alloy.

Nominal Composition (wt%):

Co	Ni	C	W	Fe	Mn	Si	C	La	B
39 ^a	22	22	14	3*	1.25*	0.35	0.1	0.03	0.015*

^aAs Balance

*Maximum

Hot Corrosion Resistance at 1650°F (900°C):

HAYNES® 188 alloy exhibits excellent resistance to sulfate deposit hot corrosion. Tests were conducted in a low velocity burner rig burning No. 2 Fuel oil with 0.4 percent sulfur. The air:fuel ratio was 30:1. Artificial sea water was injected at a rate equivalent to 5 ppm salt. Tests were run for 1000 hours, with samples cycled out of the gas stream once an hour and cooled to near ambient temperature. Gas velocity was 13 ft./ sec. (4 m/s).

Alloy	Metal Loss		Average Metal Affected	
	mils	µm	mils	µm
—				
188	0.8	20	2.7	69
230®	1.2	30	5.1	130
625	1.8	46	5.2	132
X	1.6	41	5.5	140

Heat Treatment:

2125-2175°F (1163-1191°C), rapid cool or water quench.

Dynamic Modulus of Elasticity:

Temperature, °F	10 ⁶ psi	Temperature, °C	GPa	Temperature, °F	10 ⁶ psi	Temperature, °C	GPa
Room	33.7	Room	232	1200	27.1	600	189
400	31.8	200	220	1400	25.6	700	180
600	30.8	300	213	1600	24.0	800	171
800	29.5	400	206	1800	22.2	900	160
1000	28.6	500	198	2000	20.2	1000	150

Tensile Properties, Sheet:

Test Temperature		0.2% Yield Strength		Ultimate Tensile Strength		Elongation
°F	°C	ksi	MPa	ksi	MPa	%
RT	RT	70.1	483	142.4	982	50.9
1000	538	44.8	309	117.4	809	58.8
1200	649	44.8	309	119.1	821	58.6
1400	760	43.8	302	81.6	563	81.8
1600	871	37.8	261	47.0	324	103.9
1800	982	18.2	125	25.4	175	81.0
2000	1093	8.5	59	12.4	85	49.7

Creep-Rupture Properties, Sheet:

Temperature		Creep	Approximate Initial Stress to Produce Specified Creep in					
			10 h		100 h		1,000 h	
°F	°C	%	ksi	MPa	ksi	MPa	ksi	MPa
1400	760	1	25.5	176	18.5	128	13.3	92
		R	43.0*	296*	32.0	221	23.0	159
1600	871	1	12.2	84	8.4	58	5.7	39
		R	21.0	145	14.4	99	9.4	65
1800	982	1	5.6	39	3.6	25	2.1	14
		R	9.1	63	5.4	37	3.0	21
1900	1038	1	3.6	25	2.2	15	1.4	9.7
		R	5.5	38	3.2	22	2.0	14
2000	1093	1	2.3*	16*	1.4	9.7	0.9	6.2
		R	3.3*	23*	2.0	14	1.2	8.3

*Significant extrapolation

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