HIGH-TEMPERATURE
ALLOY AT A GLANCE

HAYNES International

HAYNES® Waspaloy alloy

CHEMISTRY: Weight %

Ni	Co	Fe	Cr	Mo	Al	Ti	C	Mn	Si	B	Cu	Zr
58[a]	13.5	2*	19	4.3	1.5	3	0.08	0.1*	0.15*	0.006	0.1*	0.05

[a]As Balance *Maximum

ALLOY DESCRIPTION:

HAYNES Waspaloy alloy is an age-hardenable, nickel-based superalloy with very good strength at temperatures up to about 1800°F (980°C). It is widely used as a wrought material for forged and fabricated gas turbine and aerospace components. Its strength is generally comparable to HAYNES® R-41 alloy, and is superior to that of alloy 718 at temperatures above 1200-1300°F (650-705°C). Waspaloy alloy can be cold-formed in the annealed condition, and may also be hot-formed at temperatures of 1900°F (1040°C) or above. Weldability is somewhat limited by susceptibility to strain age cracking under conditions of heavy restraint. The alloy exhibits good resistance to gas turbine combustion environments at temperatures up to about 1600°F (870°C).

PHYSICAL PROPERTIES:

	Temp., °F	British Units	Temp., °C	Metric Units
Density	Room	0.296 lb/in³	Room	8.20 g/cm³
Melting Range	2425-2475		1330-1360	
Thermal Conductivity	400	88 BTU-in/ft²-hr-°F	200	12.6 W/m-K
	800	112 BTU-in/ft²-hr-°F	400	15.7 W/m-K
	1000	125 BTU-in/ft²-hr-°F	600	19.1 W/m-K
	1200	139 BTU-in/ft²-hr-°F	700	20.9 W/m-K
	1400	152 BTU-in/ft²-hr-°F	800	22.7 W/m-K
	1600	167 BTU-in/ft²-hr-°F	900	24.5 W/m-K
Mean Coefficient of Thermal Expansion	70-800	7.6 µin/in-°F	20-500	13.9 µm/m-°C
	70-1000	7.8 µin/in-°F	20-600	14.3 µm/m-°C
	70-1200	8.1 µin/in-°F	20-700	14.8 µm/m-°C
	70-1400	8.4 µin/in-°F	20-800	15.4 µm/m-°C
	70-1600	8.9 µin/in-°F	20-900	16.4 µm/m-°C
	70-1800	9.7 µin/in-°F	20-1000	17.8 µm/m-°C

HEAT TREATMENT, SHEET, STRIP, AND PLATE (AMS 5544):

1975°F(1080°C)/30 min.*/WQ + 1825°F(995°)/2 Hr./AC + 1550°F(845°C)/4 Hr./AC + 1400°F(760°C)/16 Hr./AC *Maximum

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DYNAMIC MODULUS OF ELASTICITY:

Temp.,°F	10^6 psi	Temp.,°C	GPa
70	30.9	20	213
400	29.5	200	204
800	27.7	400	192
1000	26.7	600	180
1200	25.6	700	172
1400	24.3	800	164
1600	22.9	900	155
1800	21.1	1000	146

TYPICAL TENSILE PROPERTIES, SHEET (AMS 5544):

Test Temperature		Ultimate Tensile Strength		0.2% Yield Strength		Elongation in 2 in (51mm)
°F	°C	Ksi	MPa	Ksi	MPa	%
ROOM	ROOM	193.5	1335	131.8	910	26.6
1200	650	173.4	1195	112.0	770	20.8
1400	760	140.4	970	111.8	770	12.0
1600	870	79.3	545	60.0	415	12.0
1800	980	31.6	220	19.6	135	19.4
2000	1095	12.0	83	5.9	41	36.8

TYPICAL STRESS-RUPTURE STRENGTH, SHEET (AMS 5544):

Test Temperature		Approximate Initial Stress, Ksi (MPa) to Produce Rupture in:					
°F	°C	10 Hours		100 Hours		1000 Hours	
1100	600	-	-	-	-	96	(660)
1200	650	-	-	92	(635)	80	(550)
1300	705	89	(615)	75	(515)	57	(395)
1400	760	72	(495)	53	(365)	35	(240)
1500	815	50	(345)	32	(220)	19	(130)
1600	870	31	(215)	18	(125)	9.9	(68)
1700	925	17.5	(120)	9.6	(66)	-	-

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