

## Haynes Hastelloy® S alloy, flat products, solution heat-treated at 760°C (1400°F), aged 1000 hours

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

### Material Notes:

Nickel-based, high temperature alloy. Excellent thermal stability, low thermal expansion, excellent oxidation resistance to 1093°C, good high temperature and thermal fatigue strength. Applications include seal rings in gas turbine engines, and severe cyclical heating conditions where it retains strength, ductility, and integrity. Data provided by the manufacturer, Haynes International, Inc.

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[http://www.lookpolymers.com/polymer\\_Haynes-Hastelloy-S-alloy-flat-products-solution-heat-treated-at-760C-1400F-aged-1000-hours.php](http://www.lookpolymers.com/polymer_Haynes-Hastelloy-S-alloy-flat-products-solution-heat-treated-at-760C-1400F-aged-1000-hours.php)

Physical Properties	Metric	English	Comments
Density	8.75 g/cc	0.316 lb/in <sup>3</sup>	

Mechanical Properties	Metric	English	Comments
Hardness, Rockwell A	54	54	
	@Thickness 1.45 mm	@Thickness 0.0571 in	
	57	57	
	@Thickness 12.7 mm	@Thickness 0.500 in	
Tensile Strength, Ultimate	919 MPa	133000 psi	
	@Thickness 1.45 mm	@Thickness 0.0571 in	
Tensile Strength, Yield	370 MPa	53700 psi	
	@Strain 0.200 %, Thickness 12.7 mm	@Strain 0.200 %, Thickness 0.500 in	
	459 MPa	66600 psi	
	@Strain 0.200 %, Thickness 1.45 mm	@Strain 0.200 %, Thickness 0.0571 in	
Elongation at Break	54 %	54 %	in 50.8 mm
	@Thickness 1.45 mm	@Thickness 0.0571 in	
	55 %	55 %	in 50.8 mm
	@Thickness 12.7 mm	@Thickness 0.500 in	
Modulus of Elasticity	132 GPa	19100 ksi	Heat treated at 1066°C, air cooled
	@Temperature 1093 °C	@Temperature 1999 °F	
	151 GPa	21900 ksi	Heat treated at 1066°C, air cooled
	@Temperature 927 °C	@Temperature 1700 °F	

Mechanical Properties	Metric	English	Comments
	@Temperature 813 °C	@Temperature 1500 °F	Heat treated at 1066 °C, air cooled
	166 GPa	24100 ksi	Heat treated at 1066°C, air cooled
	@Temperature 760 °C	@Temperature 1400 °F	
	174 GPa	25200 ksi	Heat treated at 1066°C, air cooled
	@Temperature 649 °C	@Temperature 1200 °F	
	182 GPa	26400 ksi	Heat treated at 1066°C, air cooled
	@Temperature 538 °C	@Temperature 1000 °F	
	194 GPa	28100 ksi	Heat treated at 1066°C, air cooled
	@Temperature 357 °C	@Temperature 675 °F	
	212 GPa	30700 ksi	
	@Temperature 24.0 °C	@Temperature 75.2 °F	
Charpy Impact	190 J	140 ft-lb	V Notch; plate

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 µm/m-°C	6.39 µin/in-°F	
	@Temperature 20.0 - 93.0 °C	@Temperature 68.0 - 199 °F	
	12.2 µm/m-°C	6.78 µin/in-°F	
	@Temperature 20.0 - 204 °C	@Temperature 68.0 - 399 °F	
	12.8 µm/m-°C	7.11 µin/in-°F	
	@Temperature 20.0 - 316 °C	@Temperature 68.0 - 601 °F	
	13.1 µm/m-°C	7.28 µin/in-°F	
	@Temperature 20.0 - 427 °C	@Temperature 68.0 - 801 °F	
	13.3 µm/m-°C	7.39 µin/in-°F	
	@Temperature 20.0 - 538 °C	@Temperature 68.0 - 1000 °F	
	14.4 µm/m-°C	8.00 µin/in-°F	
	@Temperature 20.0 - 760 °C	@Temperature 68.0 - 1400 °F	
	14.9 µm/m-°C	8.28 µin/in-°F	

Thermal Properties	@Temperature 20.0 - Metric 377 °C	@Temperature 68.0 - English 190 °F	Comments
	15.5 µm/m-°C	8.61 µin/in-°F	
	@Temperature 20.0 - 982 °C	@Temperature 68.0 - 1800 °F	
	16.0 µm/m-°C	8.89 µin/in-°F	
	@Temperature 20.0 - 1093 °C	@Temperature 68.0 - 1999 °F	
Specific Heat Capacity	0.398 J/g-°C	0.0951 BTU/lb-°F	
	@Temperature 0.000 °C	@Temperature 32.0 °F	
	0.414 J/g-°C	0.0989 BTU/lb-°F	
	@Temperature 50.0 °C	@Temperature 122 °F	
	0.440 J/g-°C	0.105 BTU/lb-°F	
	@Temperature 150 °C	@Temperature 302 °F	
	0.456 J/g-°C	0.109 BTU/lb-°F	
	@Temperature 250 °C	@Temperature 482 °F	
	0.473 J/g-°C	0.113 BTU/lb-°F	
	@Temperature 350 °C	@Temperature 662 °F	
	0.481 J/g-°C	0.115 BTU/lb-°F	
	@Temperature 450 °C	@Temperature 842 °F	
	0.494 J/g-°C	0.118 BTU/lb-°F	
	@Temperature 550 °C	@Temperature 1020 °F	
	0.502 J/g-°C	0.120 BTU/lb-°F	
	@Temperature 650 °C	@Temperature 1200 °F	
	0.590 J/g-°C	0.141 BTU/lb-°F	
	@Temperature 800 °C	@Temperature 1470 °F	
	0.594 J/g-°C	0.142 BTU/lb-°F	
	@Temperature 850 °C	@Temperature 1560 °F	
	0.594 J/g-°C	0.142 BTU/lb-°F	
	@Temperature 900 °C	@Temperature 1650 °F	
	0.594 J/g-°C	0.142 BTU/lb-°F	
	@Temperature 700 °C	@Temperature 1290 °F	
	0.594 J/g-°C	0.142 BTU/lb-°F	

Thermal Properties	Metric @ Temperature 750 °C	English @ Temperature 1380 °F	Comments
	0.598 J/g-°C @Temperature 950 °C	0.143 BTU/lb-°F @Temperature 1740 °F	
	0.598 J/g-°C @Temperature 1000 °C	0.143 BTU/lb-°F @Temperature 1830 °F	
	0.598 J/g-°C @Temperature 1050 °C	0.143 BTU/lb-°F @Temperature 1920 °F	
	0.603 J/g-°C @Temperature 1100 °C	0.144 BTU/lb-°F @Temperature 2010 °F	
Thermal Conductivity	14.0 W/m-K @Temperature 200 °C	97.2 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 392 °F	
	16.1 W/m-K @Temperature 300 °C	112 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 572 °F	
	17.9 W/m-K @Temperature 400 °C	124 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 752 °F	
	19.5 W/m-K @Temperature 500 °C	135 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 932 °F	
	21.0 W/m-K @Temperature 600 °C	146 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 1110 °F	
	26.1 W/m-K @Temperature 700 °C	181 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 1290 °F	
	26.1 W/m-K @Temperature 800 °C	181 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 1470 °F	
	26.1 W/m-K @Temperature 900 °C	181 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 1650 °F	
	27.1 W/m-K @Temperature 950 °C	188 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 1740 °F	
	28.0 W/m-K @Temperature 1000 °C	194 BTU-in/hr-ft <sup>2</sup> -°F @Temperature 1830 °F	
Melting Point	1335 - 1380 °C	2435 - 2520 °F	

<b>Solidus Thermal Properties</b>	<b>1335 °C Metric</b>	<b>2435 °F English</b>	<b>Comments</b>
Liquidus	1380 °C	2520 °F	
Maximum Service Temperature, Air	1093 °C	1999 °F	

<b>Component Elements Properties</b>	<b>Metric</b>	<b>English</b>	<b>Comments</b>
Aluminum, Al	0.10 - 0.50 %	0.10 - 0.50 %	
Boron, B	<= 0.015 %	<= 0.015 %	
Carbon, C	<= 0.020 %	<= 0.020 %	
Chromium, Cr	14.5 - 17 %	14.5 - 17 %	
Cobalt, Co	<= 2.0 %	<= 2.0 %	
Copper, Cu	<= 0.35 %	<= 0.35 %	
Iron, Fe	<= 3.0 %	<= 3.0 %	
Lanthanum, La	0.010 - 0.10 %	0.010 - 0.10 %	
Manganese, Mn	0.30 - 1.0 %	0.30 - 1.0 %	
Molybdenum, Mo	14 - 16.5 %	14 - 16.5 %	
Nickel, Ni	67 %	67 %	
Phosphorous, P	<= 0.020 %	<= 0.020 %	
Silicon, Si	0.20 - 0.75 %	0.20 - 0.75 %	
Sulfur, S	<= 0.015 %	<= 0.015 %	

<b>Electrical Properties</b>	<b>Metric</b>	<b>English</b>	<b>Comments</b>
Electrical Resistivity	0.000128 ohm-cm @Temperature 25.0 °C	0.000128 ohm-cm @Temperature 77.0 °F	specimen aged 16000 hours at 650°C (1200°F)

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