

Haynes Hastelloy® S alloy, gas tungsten arc welded, aged at 538Â°C (1000Â°F) for 4000 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 1093Â°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-gas-tungsten-arc-welded-aged-at-538C-1000F-for-4000-hours.php

Physical Properties	Metric	English	Comments
Density	8.75 g/cc	0.316 lb/inÂ³	

Mechanical Properties	Metric	English	Comments
Hardness, Rockwell A	66	66	
Tensile Strength, Ultimate	1004 MPa	145600 psi	
Tensile Strength, Yield	742 MPa @Strain 0.200 %	108000 psi @Strain 0.200 %	
Elongation at Break	19 %	19 %	in 50.8 mm
Reduction of Area	26 %	26 %	
Modulus of Elasticity	132 GPa @Temperature 1093 Â°C	19100 ksi @Temperature 1999 Â°F	Heat treated at 1066Â°C, air cooled
	151 GPa @Temperature 927 Â°C	21900 ksi @Temperature 1700 Â°F	Heat treated at 1066Â°C, air cooled
	161 GPa @Temperature 813 Â°C	23400 ksi @Temperature 1500 Â°F	Heat treated at 1066Â°C, air cooled
	166 GPa @Temperature 760 Â°C	24100 ksi @Temperature 1400 Â°F	Heat treated at 1066Â°C, air cooled
	174 GPa @Temperature 649 Â°C	25200 ksi @Temperature 1200 Â°F	Heat treated at 1066Â°C, air cooled

Mechanical Properties	182 GPa Metric	26400 ksi English	Comments Heat treated at 1066Â°C, air cooled
	@Temperature 538 Â°C	@Temperature 1000 Â°F	
	194 GPa	28100 ksi	Heat treated at 1066Â°C, air cooled
	@Temperature 357 Â°C	@Temperature 675 Â°F	
	212 GPa	30700 ksi	
	@Temperature 24.0 Â°C	@Temperature 75.2 Â°F	

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 Âµm/m-Â°C	6.39 Âµin/in-Â°F	
	@Temperature 20.0 - 93.0 Â°C	@Temperature 68.0 - 199 Â°F	
	12.2 Âµm/m-Â°C	6.78 Âµin/in-Â°F	
	@Temperature 20.0 - 204 Â°C	@Temperature 68.0 - 399 Â°F	
	12.8 Âµm/m-Â°C	7.11 Âµin/in-Â°F	
	@Temperature 20.0 - 316 Â°C	@Temperature 68.0 - 601 Â°F	
	13.1 Âµm/m-Â°C	7.28 Âµin/in-Â°F	
	@Temperature 20.0 - 427 Â°C	@Temperature 68.0 - 801 Â°F	
	13.3 Âµm/m-Â°C	7.39 Âµin/in-Â°F	
	@Temperature 20.0 - 538 Â°C	@Temperature 68.0 - 1000 Â°F	
	14.4 Âµm/m-Â°C	8.00 Âµin/in-Â°F	
	@Temperature 20.0 - 760 Â°C	@Temperature 68.0 - 1400 Â°F	
	14.9 Âµm/m-Â°C	8.28 Âµin/in-Â°F	
	@Temperature 20.0 - 871 Â°C	@Temperature 68.0 - 1600 Â°F	
	15.5 Âµm/m-Â°C	8.61 Âµin/in-Â°F	
	@Temperature 20.0 - 982 Â°C	@Temperature 68.0 - 1800 Â°F	
	16.0 Âµm/m-Â°C	8.89 Âµin/in-Â°F	
	@Temperature 20.0 - 1093 Â°C	@Temperature 68.0 - 1999 Â°F	
	0.398 J/g-Â°C	0.0951 BTU/lb-Â°F	

Thermal Properties	Metric	English	Comments
	@ Temperature 0.000 Â°C	@ Temperature 32.0 Â°F	
	0.414 J/g-Â°C	0.0989 BTU/lb-Â°F	
	@ Temperature 50.0 Â°C	@ Temperature 122 Â°F	
	0.440 J/g-Â°C	0.105 BTU/lb-Â°F	
	@ Temperature 150 Â°C	@ Temperature 302 Â°F	
	0.456 J/g-Â°C	0.109 BTU/lb-Â°F	
	@ Temperature 250 Â°C	@ Temperature 482 Â°F	
	0.473 J/g-Â°C	0.113 BTU/lb-Â°F	
	@ Temperature 350 Â°C	@ Temperature 662 Â°F	
	0.481 J/g-Â°C	0.115 BTU/lb-Â°F	
	@ Temperature 450 Â°C	@ Temperature 842 Â°F	
	0.494 J/g-Â°C	0.118 BTU/lb-Â°F	
	@ Temperature 550 Â°C	@ Temperature 1020 Â°F	
	0.502 J/g-Â°C	0.120 BTU/lb-Â°F	
	@ Temperature 650 Â°C	@ Temperature 1200 Â°F	
	0.590 J/g-Â°C	0.141 BTU/lb-Â°F	
	@ Temperature 800 Â°C	@ Temperature 1470 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@ Temperature 850 Â°C	@ Temperature 1560 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@ Temperature 900 Â°C	@ Temperature 1650 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@ Temperature 700 Â°C	@ Temperature 1290 Â°F	
	0.594 J/g-Â°C	0.142 BTU/lb-Â°F	
	@ Temperature 750 Â°C	@ Temperature 1380 Â°F	
	0.598 J/g-Â°C	0.143 BTU/lb-Â°F	
		@ Temperature 1740	

Thermal Properties	@Temperature 950 Â°C Metric	Â°F English	Comments
	0.598 J/g-Â°C	0.143 BTU/lb-Â°F	
	@Temperature 1000 Â°C	@Temperature 1830 Â°F	
	0.598 J/g-Â°C	0.143 BTU/lb-Â°F	
	@Temperature 1050 Â°C	@Temperature 1920 Â°F	
	0.603 J/g-Â°C	0.144 BTU/lb-Â°F	
	@Temperature 1100 Â°C	@Temperature 2010 Â°F	
Thermal Conductivity	14.0 W/m-K	97.2 BTU-in/hr-ftÂ²- Â°F	
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	16.1 W/m-K	112 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 300 Â°C	@Temperature 572 Â°F	
	17.9 W/m-K	124 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 400 Â°C	@Temperature 752 Â°F	
	19.5 W/m-K	135 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 500 Â°C	@Temperature 932 Â°F	
	21.0 W/m-K	146 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 600 Â°C	@Temperature 1110 Â°F	
	26.1 W/m-K	181 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 700 Â°C	@Temperature 1290 Â°F	
	26.1 W/m-K	181 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 800 Â°C	@Temperature 1470 Â°F	
	26.1 W/m-K	181 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 900 Â°C	@Temperature 1650 Â°F	
	27.1 W/m-K	188 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 950 Â°C	@Temperature 1740 Â°F	
	28.0 W/m-K	194 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 1000 Â°C	@Temperature 1830 Â°F	

Thermal Properties	Metric	English	Comments
Melting Point	1335 - 1380 Â°C	2435 - 2520 Â°F	
Solidus	1335 Â°C	2435 Â°F	
Liquidus	1380 Â°C	2520 Â°F	
Maximum Service Temperature, Air	1093 Â°C	1999 Â°F	

Component Elements Properties	Metric	English	Comments
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 %	
Tungsten, W	<= 1.0 %	<= 1.0 %	

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

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