

Haynes Hastelloy® C-4 alloy, sheet, aged 100 hours at 899°C

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

Material Notes:

Nickel-chromium-molybdenum alloy with outstanding high-temperature stability as evidenced by high ductility and corrosion resistance even after aging in the 1200 to 1900°F (649 to 1038°C) range. This alloy resists the formation of grain-boundary precipitates in the weld heat-affected zone, thus making it suitable for most chemical process applications in the as-welded condition. C-4 alloy also has excellent resistance to stress-corrosion cracking and to oxidizing atmospheres up to 1900°F (1038°C). HASTELLOY C-4 alloy has exceptional resistance to wide variety of chemical process environments. These include hot contaminated mineral acids, solvents, chlorine and chlorine contaminated media (organic and inorganic), dry chlorine, formic and acetic acids, acetic anhydride, and seawater and brine solutions. Laboratory precipitation studies on C-4 alloy indicate that the intermetallic precipitates (Mu phase) associated with other nickel alloys in the 1200 to 2000°F (649 to 1093°C) temperature range have not been detected. Fine intergranular M6C carbides can form but their damaging effect is minimal. HASTELLOY C-4 alloy can be forged, hot-upset, and impact extruded. Although the alloy tends to work-harden, it can be successfully deep-drawn, spun, press formed or punched. All of the common methods of welding can be used to weld HASTELLOY C-4 alloy, although the oxy-acetylene and submerged arc processes are not recommended when the fabricated item is intended for use in corrosion service. Special precautions should be taken to avoid excessive heat input. Wrought forms of HASTELLOY C-4 alloy are furnished in the solution heat-treated condition unless otherwise specified. C-4 alloy is solution heat-treated at 1950°F (1066°C) and rapid quenched. Data provided by the manufacturer, Haynes International, Inc.

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http://www.lookpolymers.com/polymer_Haynes-Hastelloy-C-4-alloy-sheet-aged-100-hours-at-899C.php

Physical Properties	Metric	English	Comments
Density	8.64 g/cc	0.312 lb/in ³	at RT

Mechanical Properties	Metric	English	Comments
Tensile Strength, Ultimate	507 MPa	73500 psi	
	@Thickness 9.50 mm, Temperature 760 °C	@Thickness 0.374 in, Temperature 1400 °F	
	525 MPa	76100 psi	
	@Thickness 3.20 mm, Temperature 760 °C	@Thickness 0.126 in, Temperature 1400 °F	
	597 MPa	86600 psi	
	@Thickness 3.20 mm, Temperature 649 °C	@Thickness 0.126 in, Temperature 1200 °F	
	618 MPa	89600 psi	
	@Thickness 9.50 mm, Temperature 538 °C	@Thickness 0.374 in, Temperature 1000 °F	
	618 MPa	89600 psi	

Mechanical Properties	@Thickness 9.50 mm, Metric Temperature 649 °C	@Thickness 0.374 in, English Temperature 1200 °F	Comments
	643 MPa	93300 psi	
	@Thickness 3.20 mm, Temperature 538 °C	@Thickness 0.126 in, Temperature 1000 °F	
	669 MPa	97000 psi	
	@Thickness 3.20 mm, Temperature 427 °C	@Thickness 0.126 in, Temperature 801 °F	
	670 MPa	97200 psi	
	@Thickness 9.50 mm, Temperature 427 °C	@Thickness 0.374 in, Temperature 801 °F	
	676 MPa	98000 psi	
	@Thickness 9.50 mm, Temperature 316 °C	@Thickness 0.374 in, Temperature 601 °F	
	686 MPa	99500 psi	
	@Thickness 3.20 mm, Temperature 316 °C	@Thickness 0.126 in, Temperature 601 °F	
	694 MPa	101000 psi	
	@Thickness 9.50 mm, Temperature 204 °C	@Thickness 0.374 in, Temperature 399 °F	
	712 MPa	103000 psi	
	@Thickness 3.20 mm, Temperature 204 °C	@Thickness 0.126 in, Temperature 399 °F	
	771 MPa	112000 psi	
	@Thickness 9.50 mm, Temperature 20.0 °C	@Thickness 0.374 in, Temperature 68.0 °F	
	790 MPa	115000 psi	
	@Thickness 3.20 mm, Temperature 20.0 °C	@Thickness 0.126 in, Temperature 68.0 °F	
Tensile Strength, Yield	205 MPa	29700 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 760 °C	@Thickness 0.374 in, Temperature 1400 °F	
	221 MPa	32100 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 538 °C	@Thickness 0.374 in, Temperature 1000 °F	
	235 MPa	34100 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 649 °C	@Thickness 0.374 in, Temperature 1200 °F	

Mechanical Properties	250 MPa Metric	36300 psi English	Comments 0.2% offset
	@Thickness 3.20 mm, Temperature 760 °C	@Thickness 0.126 in, Temperature 1400 °F	
	255 MPa	37000 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 316 °C	@Thickness 0.374 in, Temperature 601 °F	
	256 MPa	37100 psi	0.2% offset
	@Thickness 3.20 mm, Temperature 649 °C	@Thickness 0.126 in, Temperature 1200 °F	
	256 MPa	37100 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 427 °C	@Thickness 0.374 in, Temperature 801 °F	
	272 MPa	39500 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 204 °C	@Thickness 0.374 in, Temperature 399 °F	
	275 MPa	39900 psi	0.2% offset
	@Thickness 3.20 mm, Temperature 538 °C	@Thickness 0.126 in, Temperature 1000 °F	
	280 MPa	40600 psi	0.2% offset
	@Thickness 3.20 mm, Temperature 427 °C	@Thickness 0.126 in, Temperature 801 °F	
	297 MPa	43100 psi	0.2% offset
	@Thickness 3.20 mm, Temperature 316 °C	@Thickness 0.126 in, Temperature 601 °F	
	325 MPa	47100 psi	0.2% offset
	@Thickness 3.20 mm, Temperature 204 °C	@Thickness 0.126 in, Temperature 399 °F	
	336 MPa	48700 psi	0.2% offset
	@Thickness 9.50 mm, Temperature 20.0 °C	@Thickness 0.374 in, Temperature 68.0 °F	
	376 MPa	54500 psi	0.2% offset
	@Thickness 3.20 mm, Temperature 20.0 °C	@Thickness 0.126 in, Temperature 68.0 °F	
Elongation at Break	51 %	51 %	in 50.8 mm
	@Thickness 9.50 mm, Temperature 204 °C	@Thickness 0.374 in, Temperature 399 °F	
	53 %	53 %	in 50.8 mm
	@Thickness 9.50 mm,	@Thickness 0.374 in,	

Mechanical Properties	Temperature 538 °C	Temperature 1000 °F	Comments
	Metric	English	
	54 % @Thickness 3.20 mm, Temperature 204 °C	54 % @Thickness 0.126 in, Temperature 399 °F	in 50.8 mm
	56 % @Thickness 3.20 mm, Temperature 20.0 °C	56 % @Thickness 0.126 in, Temperature 68.0 °F	in 50.8 mm
	56 % @Thickness 3.20 mm, Temperature 649 °C	56 % @Thickness 0.126 in, Temperature 1200 °F	in 50.8 mm
	56 % @Thickness 3.20 mm, Temperature 760 °C	56 % @Thickness 0.126 in, Temperature 1400 °F	in 50.8 mm
	56 % @Thickness 9.50 mm, Temperature 316 °C	56 % @Thickness 0.374 in, Temperature 601 °F	in 50.8 mm
	56 % @Thickness 9.50 mm, Temperature 649 °C	56 % @Thickness 0.374 in, Temperature 1200 °F	in 50.8 mm
	57 % @Thickness 3.20 mm, Temperature 316 °C	57 % @Thickness 0.126 in, Temperature 601 °F	in 50.8 mm
	57 % @Thickness 3.20 mm, Temperature 538 °C	57 % @Thickness 0.126 in, Temperature 1000 °F	in 50.8 mm
	57 % @Thickness 9.50 mm, Temperature 427 °C	57 % @Thickness 0.374 in, Temperature 801 °F	in 50.8 mm
	60 % @Thickness 3.20 mm, Temperature 427 °C	60 % @Thickness 0.126 in, Temperature 801 °F	in 50.8 mm
	62 % @Thickness 9.50 mm, Temperature 20.0 °C	62 % @Thickness 0.374 in, Temperature 68.0 °F	in 50.8 mm
	70 % @Thickness 9.50 mm, Temperature 760 °C	70 % @Thickness 0.374 in, Temperature 1400 °F	in 50.8 mm
Modulus of Elasticity	211 GPa	30600 ksi	RT

Mechanical Properties	Metric	English	Comments
	@Temperature 982 °C	@Temperature 1800 °F	
	152 GPa	22000 ksi	
	@Temperature 871 °C	@Temperature 1600 °F	
	162 GPa	23500 ksi	
	@Temperature 760 °C	@Temperature 1400 °F	
	171 GPa	24800 ksi	
	@Temperature 649 °C	@Temperature 1200 °F	
	179 GPa	26000 ksi	
	@Temperature 538 °C	@Temperature 1000 °F	
	187 GPa	27100 ksi	
	@Temperature 427 °C	@Temperature 801 °F	
	194 GPa	28100 ksi	
	@Temperature 316 °C	@Temperature 601 °F	
	201 GPa	29200 ksi	
	@Temperature 204 °C	@Temperature 399 °F	
	207 GPa	30000 ksi	
	@Temperature 93.0 °C	@Temperature 199 °F	

Thermal Properties	Metric	English	Comments
CTE, linear	10.8 µm/m-°C	6.00 µin/in-°F	
	@Temperature 20.0 - 93.0 °C	@Temperature 68.0 - 199 °F	
	11.9 µm/m-°C	6.61 µin/in-°F	
	@Temperature 20.0 - 204 °C	@Temperature 68.0 - 399 °F	
	12.6 µm/m-°C	7.00 µin/in-°F	
	@Temperature 20.0 - 316 °C	@Temperature 68.0 - 601 °F	
	13.3 µm/m-°C	7.39 µin/in-°F	
	@Temperature 20.0 - 427 °C	@Temperature 68.0 - 801 °F	
	13.3 µm/m-°C	7.39 µin/in-°F	

Thermal Properties	Metric @Temperature 20.0 - 338 °C	English @Temperature 68.0 - 1000 °F	Comments
	13.5 µm/m-°C	7.50 µin/in-°F	
	@Temperature 20.0 - 649 °C	@Temperature 68.0 - 1200 °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	
	@Temperature 24.0 - 871 °C	@Temperature 75.2 - 1600 °F	

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.000125 ohm-cm	0.000125 ohm-cm	
	@Temperature 23.0 °C	@Temperature 73.4 °F	
	0.000125 ohm-cm	0.000125 ohm-cm	
	@Temperature 100 °C	@Temperature 212 °F	
	0.000126 ohm-cm	0.000126 ohm-cm	
	@Temperature 200 °C	@Temperature 392 °F	
	0.000127 ohm-cm	0.000127 ohm-cm	
	@Temperature 300 °C	@Temperature 572 °F	
	0.000128 ohm-cm	0.000128 ohm-cm	
	@Temperature 400 °C	@Temperature 752 °F	
	0.000129 ohm-cm	0.000129 ohm-cm	
	@Temperature 500 °C	@Temperature 932 °F	
	0.000132 ohm-cm	0.000132 ohm-cm	
	@Temperature 600 °C	@Temperature 1110 °F	

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