Haynes HastelloyÂ® C-22HSâ„¢ Nickel Alloy Plate, Annealed

Category : Metal , Nonferrous Metal , Nickel Alloy

Material Notes:

Outstanding Corrosion Resistance, High Strength HASTELLOYÂ® C-22HSTM alloy is corrosion-resistant, nickel-chromium-molybdenum alloy which can be heat treated to obtain a strength approximately double that of other C-type alloys. Importantly, the corrosion resistance and ductility of the alloy remain excellent when in the high strength condition. In addition to its high uniform corrosion resistance in oxidizing as well as reducing environments, the as-heat treated C-22HS alloy possesses high resistance to chloride-induced pitting and crevice corrosion attack.C-22HS alloy is available in the form of plate, sheet, strip, billet, bar, wire, pipe, and tube. Heat Treatment: The high strength of C-22HS alloy is derived from the formation of strengthening particles of Ni2(Mo,Cr) which form during the patented two-step age-hardening heat treatment. The approximately 48 hour heat treatment, 1300Â°F (705Â°C) FC to 1125Â°F (605Â°C)/32 hours/AC, is described in more detail on page 14. Solution Annealed and Filler Wire Applications: C-22HS alloy may also be considered for applications which do not require the high strength imparted by the heat treatment. In the annealed condition, C-22HS alloy has even higher corrosion-resistance, particularly with regard to localized corrosive attack. This localized attack resistance also makes the alloy an attractive candidate as a general-purpose filler metal or weld overlay. Applications: Agitators and blenders Shafting Fan blades and hubs Fasteners Springs Valves Dies Screws Wellhead parts Rings and gaskets Heat Treatment: Wrought forms of C-22HS alloy are furnished in the solution annealed condition, unless otherwise specified. The standard solution annealing treatment consists of heating to 1975Â°F (1080Â°C) followed by rapid air-cooling or water quenching. Parts which have been hot formed should be solution annealed prior to final fabrication or installation. To use the alloy in the high-strength condition, it is necessary to age-harden using a two step treatment of 1300Â°F (705Â°C) for 16 hours, furnace cooling to 1125Â°F (605Â°C) and holding at that temperature for 32 hours, followed by an air cool. Cold or hot-worked structures should normally be given a full solution anneal prior to performing the age-hardening treatment. Forming: C-22HS alloy has excellent forming characteristics, and cold forming is the preferred method of shaping. The alloy can be easily cold worked due to its good ductility. The alloy is generally stiffer than the austenitic stainless steels; therefore more energy is required during cold forming. For further information on the fabrication of C-type alloys, please consult publication H-2010. Machining: C-22HS alloy may be machined in either the solution annealed or age-hardened condition. Carbide or ceramic tools are recommended. For use in the age-hardened condition, it is suggested to rough machine in the annealed condition. After performing the age-hardening heat treatment, light machining may be performed to achieve desired final dimensions.Data provided by the manufacturer, Haynes International, Inc.

Order this product through the following link:
http://www.lookpolymers.com/polymer_Haynes-Hastelloy-C-22HS-Nickel-Alloy-Plate-Annealed.php

Physical Properties	Metric	English	Comments
Density	8.60 g/cc	0.311 lb/inÂ³	annealed
	8.64 g/cc	0.312 lb/inÂ³	age-hardened

Mechanical Properties	Metric	English	Comments
Hardness, Rockwell B	92	92	Average Mill-annealed
Tensile Strength, Ultimate	822 MPa	119000 psi	No thermal exposure
	814 MPa	118000 psi	

Mechanical Properties	Metric	English	Comments
	@Treatment Temp. 427 Â°C, Time 2.88e+7 sec	@Treatment Temp. 801 Â°F, Time 8000 hour	Room temp test after thermal exposure
	817 MPa @Treatment Temp. 427 Â°C, Time 3.60e+6 sec	118000 psi @Treatment Temp. 801 Â°F, Time 1000 hour	Room temp test after thermal exposure
	821 MPa @Treatment Temp. 427 Â°C, Time 1.44e+7 sec	119000 psi @Treatment Temp. 801 Â°F, Time 4000 hour	Room temp test after thermal exposure
	1194 MPa @Treatment Temp. 593 Â°C, Time 3.60e+6 sec	173200 psi @Treatment Temp. 1100 Â°F, Time 1000 hour	Room temp test after thermal exposure
	1269 MPa @Treatment Temp. 593 Â°C, Time 1.44e+7 sec	184100 psi @Treatment Temp. 1100 Â°F, Time 4000 hour	Room temp test after thermal exposure
	1284 MPa @Treatment Temp. 593 Â°C, Time 2.88e+7 sec	186200 psi @Treatment Temp. 1100 Â°F, Time 8000 hour	Room temp test after thermal exposure
Tensile Strength, Yield	392 MPa @Treatment Temp. 427 Â°C, Time 3.60e+6 sec	56900 psi @Treatment Temp. 801 Â°F, Time 1000 hour	0.2%. Room temp test after thermal exposure
	396 MPa @Treatment Temp. 427 Â°C, Time 1.44e+7 sec	57400 psi @Treatment Temp. 801 Â°F, Time 4000 hour	0.2%. Room temp test after thermal exposure
	401 MPa @Treatment Temp. 427 Â°C, Time 2.88e+7 sec	58200 psi @Treatment Temp. 801 Â°F, Time 8000 hour	0.2%. Room temp test after thermal exposure
	680 MPa @Treatment Temp. 593 Â°C, Time 3.60e+6 sec	98600 psi @Treatment Temp. 1100 Â°F, Time 1000 hour	0.2%. Room temp test after thermal exposure
	785 MPa @Treatment Temp. 593 Â°C, Time 1.44e+7 sec	114000 psi @Treatment Temp. 1100 Â°F, Time 4000 hour	0.2%. Room temp test after thermal exposure

Mechanical Properties	Metric	English	Comments
	@Treatment Temp. 593 Â°C, Time 2.88e+7 sec	@Treatment Temp. 1100 Â°F, Time 8000 hour	0.2%. Room temp test after thermal exposure
	406 MPa @Strain 0.200 %	58900 psi @Strain 0.200 %	No thermal exposure
Elongation at Break	60.8 %	60.8 %	No thermal exposure
	40.2 % @Treatment Temp. 593 Â°C, Time 2.88e+7 sec	40.2 % @Treatment Temp. 1100 Â°F, Time 8000 hour	Room temp test after thermal exposure
	42 % @Treatment Temp. 593 Â°C, Time 1.44e+7 sec	42 % @Treatment Temp. 1100 Â°F, Time 4000 hour	Room temp test after thermal exposure
	46.2 % @Treatment Temp. 593 Â°C, Time 3.60e+6 sec	46.2 % @Treatment Temp. 1100 Â°F, Time 1000 hour	Room temp test after thermal exposure
	62.6 % @Treatment Temp. 427 Â°C, Time 2.88e+7 sec	62.6 % @Treatment Temp. 801 Â°F, Time 8000 hour	Room temp test after thermal exposure
	62.9 % @Treatment Temp. 427 Â°C, Time 1.44e+7 sec	62.9 % @Treatment Temp. 801 Â°F, Time 4000 hour	Room temp test after thermal exposure
	63.5 % @Treatment Temp. 427 Â°C, Time 3.60e+6 sec	63.5 % @Treatment Temp. 801 Â°F, Time 1000 hour	Room temp test after thermal exposure
Reduction of Area	75.1 %	75.1 %	No thermal exposure
	58.1 % @Treatment Temp. 593 Â°C, Time 2.88e+7 sec	58.1 % @Treatment Temp. 1100 Â°F, Time 8000 hour	Room temp test after thermal exposure
	60.7 % @Treatment Temp. 593 Â°C, Time 1.44e+7 sec	60.7 % @Treatment Temp. 1100 Â°F, Time 4000 hour	Room temp test after thermal exposure
	61.6 %	61.6 %	

Mechanical Properties	Metric	English	Comments
	@Treatment Temp. 593 Â°C, Time 3.60e+6 sec	@Treatment Temp. 1100 Â°F, Time 1000 hour	Room temp test after thermal exposure
	74.7 % @Treatment Temp. 427 Â°C, Time 1.44e+7 sec	74.7 % @Treatment Temp. 801 Â°F, Time 4000 hour	Room temp test after thermal exposure
	75 % @Treatment Temp. 427 Â°C, Time 2.88e+7 sec	75 % @Treatment Temp. 801 Â°F, Time 8000 hour	Room temp test after thermal exposure
	75.3 % @Treatment Temp. 427 Â°C, Time 3.60e+6 sec	75.3 % @Treatment Temp. 801 Â°F, Time 1000 hour	Room temp test after thermal exposure
Modulus of Elasticity	181 GPa @Temperature 600 Â°C	26300 ksi @Temperature 1110 Â°F	Dynamic
	195 GPa @Temperature 500 Â°C	28300 ksi @Temperature 932 Â°F	Dynamic
	205 GPa @Temperature 400 Â°C	29700 ksi @Temperature 752 Â°F	Dynamic
	209 GPa @Temperature 300 Â°C	30300 ksi @Temperature 572 Â°F	Dynamic
	211 GPa @Temperature 200 Â°C	30600 ksi @Temperature 392 Â°F	Dynamic
	218 GPa @Temperature 100 Â°C	31600 ksi @Temperature 212 Â°F	Dynamic
	223 GPa @Temperature 25.0 Â°C	32300 ksi @Temperature 77.0 Â°F	Dynamic
Charpy Impact	306 J @Temperature -196 Â°C	226 ft-lb @Temperature -321 Â°F	No thermal exposure
	>= 353 J @Temperature 25.0 Â°C	>= 260 ft-lb @Temperature 77.0 Â°F	No thermal exposure

Mechanical Properties	Metric	English	Comments
	81.0 J @Treatment Temp. 593 Â°C, Time 2.88e+7 sec	67.1 ft-lb @Treatment Temp. 1100 Â°F, Time 8000 hour	Room temp test after thermal exposure
	121 J @Treatment Temp. 593 Â°C, Time 1.44e+7 sec	89.2 ft-lb @Treatment Temp. 1100 Â°F, Time 4000 hour	Room temp test after thermal exposure
	174 J @Treatment Temp. 593 Â°C, Time 3.60e+6 sec	128 ft-lb @Treatment Temp. 1100 Â°F, Time 1000 hour	Room temp test after thermal exposure
	331 J @Treatment Temp. 427 Â°C, Time 1.44e+7 sec	244 ft-lb @Treatment Temp. 801 Â°F, Time 4000 hour	Room temp test after thermal exposure
	>= 353 J @Treatment Temp. 427 Â°C, Time 3.60e+6 sec	>= 260 ft-lb @Treatment Temp. 801 Â°F, Time 1000 hour	Room temp test after thermal exposure
	>= 353 J @Treatment Temp. 427 Â°C, Time 2.88e+7 sec	>= 260 ft-lb @Treatment Temp. 801 Â°F, Time 8000 hour	Room temp test after thermal exposure

Thermal Properties	Metric	English	Comments
CTE, linear	11.6 Âµm/m-Â°C @Temperature 25.0 - 100 Â°C	6.44 Âµin/in-Â°F @Temperature 77.0 - 212 Â°F	
	12.0 Âµm/m-Â°C @Temperature 25.0 - 200 Â°C	6.67 Âµin/in-Â°F @Temperature 77.0 - 392 Â°F	
	12.4 Âµm/m-Â°C @Temperature 25.0 - 300 Â°C	6.89 Âµin/in-Â°F @Temperature 77.0 - 572 Â°F	
	12.7 Âµm/m-Â°C @Temperature 25.0 - 400 Â°C	7.06 Âµin/in-Â°F @Temperature 77.0 - 752 Â°F	
	13.1 Âµm/m-Â°C @Temperature 25.0 -	7.28 Âµin/in-Â°F @Temperature 77.0 -	

Thermal Properties	Metric	English	Comments
	500 Â°C	932 Â°F	
	13.3 Âµm/m-Â°C @Temperature 25.0 - 600 Â°C	7.39 Âµin/in-Â°F @Temperature 77.0 - 1110 Â°F	
Specific Heat Capacity	0.412 J/g-Â°C @Temperature 25.0 Â°C	0.0985 BTU/lb-Â°F @Temperature 77.0 Â°F	
	0.434 J/g-Â°C @Temperature 100 Â°C	0.104 BTU/lb-Â°F @Temperature 212 Â°F	
	0.451 J/g-Â°C @Temperature 200 Â°C	0.108 BTU/lb-Â°F @Temperature 392 Â°F	
	0.465 J/g-Â°C @Temperature 300 Â°C	0.111 BTU/lb-Â°F @Temperature 572 Â°F	
	0.477 J/g-Â°C @Temperature 400 Â°C	0.114 BTU/lb-Â°F @Temperature 752 Â°F	
	0.488 J/g-Â°C @Temperature 500 Â°C	0.117 BTU/lb-Â°F @Temperature 932 Â°F	
	0.504 J/g-Â°C @Temperature 600 Â°C	0.120 BTU/lb-Â°F @Temperature 1110 Â°F	
Thermal Conductivity	11.8 W/m-K @Temperature 25.0 Â°C	81.9 BTU-in/hr-ftÂ²-Â°F @Temperature 77.0 Â°F	

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.0000980 ohm-cm @Temperature 25.0 Â°C	0.0000980 ohm-cm @Temperature 77.0 Â°F	
	0.000100 ohm-cm @Temperature 100 Â°C	0.000100 ohm-cm @Temperature 212 Â°F	
	0.000104 ohm-cm @Temperature 200 Â°C	0.000104 ohm-cm @Temperature 392 Â°F	
	0.000108 ohm-cm @Temperature 300 Â°C	0.000108 ohm-cm @Temperature 572 Â°F	

Electrical Properties	Metric	English	Comments
	0.000112 ohm-cm @Temperature 400 Â°C	0.000112 ohm-cm @Temperature 752 Â°F	
	0.000115 ohm-cm @Temperature 500 Â°C	0.000115 ohm-cm @Temperature 932 Â°F	
	0.000117 ohm-cm @Temperature 600 Â°C	0.000117 ohm-cm @Temperature 1110 Â°F	

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