Haynes HastelloyÂ® C-22HSâ„¢ Nickel Alloy Sheet, Cold-rolled, Solution Annealed, Age-hardened

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.

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http://www.lookpolymers.com/polymer_Haynes-Hastelloy-C-22HS-Nickel-Alloy-Sheet-Cold-rolled-Solution-Annealed-Age-hardened.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 C	30	30	Average Age-hardened
	35	35	20% Cold Work without aging

Mechanical Properties	Metric	English	Comments
	40	40	40% Cold Work without aging
	45	45	50% Cold Work without aging
	<= 20 @Treatment Temp. 607.2 Â°C	<= 20 @Treatment Temp. 1125 Â°F	0% Cold Work and aging 0 - 24 hrs at 1125Â°F
	33 @Treatment Temp. 607.2 Â°C	33 @Treatment Temp. 1125 Â°F	20% Cold Work and aging 1-4 hrs at 1125Â°F
	40 @Treatment Temp. 607.2 Â°C	40 @Treatment Temp. 1125 Â°F	20% Cold Work and aging 10 hrs at 1125Â°F
	41 @Treatment Temp. 607.2 Â°C	41 @Treatment Temp. 1125 Â°F	40% Cold Work and aging 1-4 hrs at 1125Â°F
	43 @Treatment Temp. 607.2 Â°C	43 @Treatment Temp. 1125 Â°F	20% Cold Work and aging 24 hrs at 1125Â°F
	45 @Treatment Temp. 607.2 Â°C	45 @Treatment Temp. 1125 Â°F	40% Cold Work and aging 10 hrs at 1125Â°F
	48 @Treatment Temp. 607.2 Â°C	48 @Treatment Temp. 1125 Â°F	40% Cold Work and aging 24 hrs at 1125Â°F
	52 @Treatment Temp. 607.2 Â°C	52 @Treatment Temp. 1125 Â°F	50% Cold Work and aging 24 hrs at 1125Â°F
Tensile Strength, Ultimate	928 MPa @Temperature 600 Â°C	135000 psi @Temperature 1110 Â°F	
	1003 MPa @Temperature 500 Â°C	145500 psi @Temperature 932 Â°F	
	1049 MPa @Temperature 400 Â°C	152100 psi @Temperature 752 Â°F	
	1103 MPa @Temperature 300 Â°C	160000 psi @Temperature 572 Â°F	
	1131 MPa	164000 psi	

Mechanical Properties	Metric	English	Comments
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	1190 MPa @Temperature 100 Â°C	173000 psi @Temperature 212 Â°F	
	1230 MPa @Temperature 25.0 Â°C	178000 psi @Temperature 77.0 Â°F	
Tensile Strength, Yield	547 MPa @Strain 0.200 %, Temperature 600 Â°C	79300 psi @Strain 0.200 %, Temperature 1110 Â°F	
	572 MPa @Strain 0.200 %, Temperature 500 Â°C	83000 psi @Strain 0.200 %, Temperature 932 Â°F	
	590 MPa @Strain 0.200 %, Temperature 400 Â°C	85600 psi @Strain 0.200 %, Temperature 752 Â°F	
	630 MPa @Strain 0.200 %, Temperature 300 Â°C	91400 psi @Strain 0.200 %, Temperature 572 Â°F	
	658 MPa @Strain 0.200 %, Temperature 200 Â°C	95400 psi @Strain 0.200 %, Temperature 392 Â°F	
	710 MPa @Strain 0.200 %, Temperature 100 Â°C	103000 psi @Strain 0.200 %, Temperature 212 Â°F	
	759 MPa @Strain 0.200 %, Temperature 25.0 Â°C	110000 psi @Strain 0.200 %, Temperature 77.0 Â°F	
Elongation at Break	40.9 % @Temperature 25.0 Â°C	40.9 % @Temperature 77.0 Â°F	
	43.4 % @Temperature 200 Â°C	43.4 % @Temperature 392 Â°F	
	43.6 % @Temperature 100 Â°C	43.6 % @Temperature 212 Â°F	
	46.3 %	46.3 % @Temperature 1110	

Mechanical Properties	Metric	English	Comments
	@Temperature 600 Â°C	Â°F	
	47.1 % @Temperature 500 Â°C	47.1 % @Temperature 932 Â°F	
	47.8 % @Temperature 300 Â°C	47.8 % @Temperature 572 Â°F	
	48.2 % @Temperature 400 Â°C	48.2 % @Temperature 752 Â°F	
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

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	

Thermal Properties	Metric	English	Comments
	12.7 Âµm/m-Â°C	7.06 Âµin/in-Â°F	
	@Temperature 25.0 - 400 Â°C	@Temperature 77.0 - 752 Â°F	
	13.1 Âµm/m-Â°C @Temperature 25.0 - 500 Â°C	7.28 Âµin/in-Â°F @Temperature 77.0 - 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	
	13.5 W/m-K @Temperature 100 Â°C	93.7 BTU-in/hr-ftÂ²-Â°F @Temperature 212 Â°F	
	15.4 W/m-K @Temperature 200 Â°C	107 BTU-in/hr-ftÂ²-Â°F @Temperature 392 Â°F	
	17.1 W/m-K @Temperature 300 Â°C	119 BTU-in/hr-ftÂ²-Â°F @Temperature 572 Â°F	

Thermal Properties	Metric	English	Comments
	@Temperature 400 Â°C	@Temperature 752 Â°F	
	20.5 W/m-K @Temperature 500 Â°C	142 BTU-in/hr-ftÂ²-Â°F @Temperature 932 Â°F	
	22.4 W/m-K @Temperature 600 Â°C	155 BTU-in/hr-ftÂ²-Â°F @Temperature 1110 Â°F	
Melting Point	1304 - 1368 Â°C	2379 - 2494 Â°F	
Solidus	1304 Â°C	2379 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	
	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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