

Haynes Hastelloy® Hybrid-BC1® Nickel Alloy Synergic Gas Metal Arc Welded (GMAW) All Weld Cruciform

Category : Metal , Nonferrous Metal , Nickel Alloy

Material Notes:

HASTELLOY® HYBRID-BC1® alloy possesses much higher resistance to hydrochloric and sulfuric acids than the nickel-chromium-molybdenum (C-type) alloys, and can tolerate the presence of oxidizing species. The alloy also exhibits extremely high resistance to pitting and crevice corrosion. HYBRID-BC1 alloy is available in the form of plate, sheet, strip, billet, bar, wire, pipe, and tube. HYBRID-BC1 alloy is suitable for the following applications in the chemical processing, pharmaceutical, agricultural, food, petrochemical, and power industries: Reaction vessels Heat exchangers Valves Pumps Piping Storage tanks The alloy is suitable for use at temperatures up to approximately 427°C (800°F). HYBRID-BC1 alloy excels in reducing acids and acid mixtures (with or without halides) open to oxygen and other oxidizing residuals/contaminants. Heat Treatment: Wrought forms of HYBRID-BC1 alloy are furnished in the solution annealed condition, unless otherwise specified. The standard solution annealing treatment consists of heating to 1149°C (2100°F) followed by rapid air-cooling or (preferably) water quenching. Parts which have been hot formed should be solution annealed prior to final fabrication or installation. The minimum hot forming temperature of the alloy is 954°C (1750°F). Forming: HYBRID-BC1 alloy has excellent forming characteristics, and cold forming is the preferred method of shaping. The alloy can be easily cold worked due to its high ductility; however, the alloy is stronger than the austenitic stainless steels and therefore requires more energy during cold forming. Tensile properties reported are for Synergic Gas Metal Arc (GMAW) welded bar samples from cruciform. Other properties are typical of the alloy. Data provided by the manufacturer, Haynes International, Inc.

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Physical Properties	Metric	English	Comments
Density	8.83 g/cc	0.319 lb/in ³	

Mechanical Properties	Metric	English	Comments
Tensile Strength, Ultimate	613 MPa	88900 psi	
	@Diameter 12.7 mm, Temperature 427 °C	@Diameter 0.500 in, Temperature 801 °F	
	632 MPa	91700 psi	
	@Diameter 12.7 mm, Temperature 371 °C	@Diameter 0.500 in, Temperature 700 °F	
	647 MPa	93800 psi	
	@Diameter 12.7 mm, Temperature 260 °C	@Diameter 0.500 in, Temperature 500 °F	
	651 MPa	94400 psi	
	@Diameter 12.7 mm, Temperature 316 °C	@Diameter 0.500 in, Temperature 601 °F	

Mechanical Properties	667 MPa Metric	96700 psi English	Comments
	@Diameter 12.7 mm, Temperature 204 Â°C	@Diameter 0.500 in, Temperature 399 Â°F	
	701 MPa	102000 psi	
	@Diameter 12.7 mm, Temperature 149 Â°C	@Diameter 0.500 in, Temperature 300 Â°F	
	723 MPa	105000 psi	
	@Diameter 12.7 mm, Temperature 93.0 Â°C	@Diameter 0.500 in, Temperature 199 Â°F	
	764 MPa	111000 psi	
	@Diameter 12.7 mm, Temperature 25.0 Â°C	@Diameter 0.500 in, Temperature 77.0 Â°F	
Tensile Strength, Yield	405 MPa	58700 psi	
	@Diameter 12.7 mm, Temperature 427 Â°C	@Diameter 0.500 in, Temperature 801 Â°F	0.2% Offset
	412 MPa	59800 psi	
	@Diameter 12.7 mm, Temperature 371 Â°C	@Diameter 0.500 in, Temperature 700 Â°F	0.2% Offset
	422 MPa	61200 psi	
	@Diameter 12.7 mm, Temperature 316 Â°C	@Diameter 0.500 in, Temperature 601 Â°F	0.2% Offset
	430 MPa	62400 psi	
	@Diameter 12.7 mm, Temperature 204 Â°C	@Diameter 0.500 in, Temperature 399 Â°F	0.2% Offset
	432 MPa	62700 psi	
	@Diameter 12.7 mm, Temperature 260 Â°C	@Diameter 0.500 in, Temperature 500 Â°F	0.2% Offset
	447 MPa	64800 psi	
	@Diameter 12.7 mm, Temperature 149 Â°C	@Diameter 0.500 in, Temperature 300 Â°F	0.2% Offset
	475 MPa	68900 psi	
	@Diameter 12.7 mm, Temperature 93.0 Â°C	@Diameter 0.500 in, Temperature 199 Â°F	0.2% Offset
	509 MPa	73800 psi	
	@Diameter 12.7 mm, Temperature 25.0 Â°C	@Diameter 0.500 in, Temperature 77.0 Â°F	0.2% Offset
Elongation at Break	46 %	46 %	
	46.1 %	46.1 %	

Mechanical Properties	Metric	English	Comments
	47.2 %	47.2 %	
	47.7 %	47.7 %	
	49.5 %	49.5 %	
	50.8 %	50.8 %	
	50.9 %	50.9 %	
	51.3 %	51.3 %	
Modulus of Elasticity	188 GPa	27300 ksi	Dynamic
	@Temperature 600 Â°C	@Temperature 1110 Â°F	
	191 GPa	27700 ksi	Dynamic
	@Temperature 500 Â°C	@Temperature 932 Â°F	
	197 GPa	28600 ksi	Dynamic
	@Temperature 400 Â°C	@Temperature 752 Â°F	
	200 GPa	29000 ksi	Dynamic
	@Temperature 300 Â°C	@Temperature 572 Â°F	
	205 GPa	29700 ksi	Dynamic
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	211 GPa	30600 ksi	Dynamic
	@Temperature 100 Â°C	@Temperature 212 Â°F	
	217 GPa	31500 ksi	Dynamic
	@Temperature 25.0 Â°C	@Temperature 77.0 Â°F	

Thermal Properties	Metric	English	Comments
CTE, linear	11.5 Âµm/m-Â°C	6.39 Âµin/in-Â°F	
	@Temperature 25.0 - 100 Â°C	@Temperature 77.0 - 212 Â°F	
	11.9 Âµm/m-Â°C	6.61 Âµin/in-Â°F	
	@Temperature 25.0 - 200 Â°C	@Temperature 77.0 - 392 Â°F	
	12.2 Âµm/m-Â°C	6.78 Âµin/in-Â°F	
	@Temperature 25.0 - 300 Â°C	@Temperature 77.0 - 572 Â°F	

Thermal Properties	Metric	English	Comments
	@Temperature 25.0 - 400 Â°C	@Temperature 77.0 - 752 Â°F	
	12.7 Âµm/m-Â°C	7.06 Âµin/in-Â°F	
	@Temperature 25.0 - 500 Â°C	@Temperature 77.0 - 932 Â°F	
	12.7 Âµm/m-Â°C	7.06 Âµin/in-Â°F	
	@Temperature 25.0 - 600 Â°C	@Temperature 77.0 - 1110 Â°F	
Specific Heat Capacity	0.403 J/g-Â°C	0.0963 BTU/lb-Â°F	
	@Temperature 25.0 Â°C	@Temperature 77.0 Â°F	
	0.416 J/g-Â°C	0.0994 BTU/lb-Â°F	
	@Temperature 100 Â°C	@Temperature 212 Â°F	
	0.429 J/g-Â°C	0.103 BTU/lb-Â°F	
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	0.439 J/g-Â°C	0.105 BTU/lb-Â°F	
	@Temperature 300 Â°C	@Temperature 572 Â°F	
	0.449 J/g-Â°C	0.107 BTU/lb-Â°F	
	@Temperature 400 Â°C	@Temperature 752 Â°F	
Thermal Conductivity	0.457 J/g-Â°C	0.109 BTU/lb-Â°F	
	@Temperature 600 Â°C	@Temperature 1110 Â°F	
	0.461 J/g-Â°C	0.110 BTU/lb-Â°F	
	@Temperature 500 Â°C	@Temperature 932 Â°F	
	9.30 W/m-K	64.5 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 25.0 Â°C	@Temperature 77.0 Â°F	
	10.5 W/m-K	72.9 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 100 Â°C	@Temperature 212 Â°F	
	11.9 W/m-K	82.6 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	13.5 W/m-K	93.7 BTU-in/hr-ftÂ²-Â°F	

Thermal Properties	Metric	English	Comments
	14.9 W/m-K	103 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 300 Â°C	@Temperature 572 Â°F	
	16.4 W/m-K	114 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 400 Â°C	@Temperature 752 Â°F	
	17.5 W/m-K	121 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 500 Â°C	@Temperature 932 Â°F	
	17.5 W/m-K	121 BTU-in/hr-ftÂ²-Â°F	
	@Temperature 600 Â°C	@Temperature 1110 Â°F	
Maximum Service Temperature, Air	427 Â°C	800 Â°F	

Component Elements Properties	Metric	English	Comments
Aluminum, Al	<= 0.50 %	<= 0.50 %	
Carbon, C	<= 0.010 %	<= 0.010 %	
Chromium, Cr	15 %	15 %	
Iron, Fe	<= 1.25 %	<= 1.25 %	
Manganese, Mn	0.25 %	0.25 %	
Molybdenum, Mo	22 %	22 %	
Nickel, Ni	60.91 %	60.91 %	as balance
Silicon, Si	<= 0.080 %	<= 0.080 %	

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.000126 ohm-cm	0.000126 ohm-cm	
	@Temperature 25.0 Â°C	@Temperature 77.0 Â°F	
	0.000127 ohm-cm	0.000127 ohm-cm	
	@Temperature 100 Â°C	@Temperature 212 Â°F	
	0.000127 ohm-cm	0.000127 ohm-cm	
	@Temperature 200 Â°C	@Temperature 392 Â°F	
	0.000128 ohm-cm	0.000128 ohm-cm	
	@Temperature 300 Â°C	@Temperature 572 Â°F	
	0.000128 ohm-cm	0.000128 ohm-cm	
	@Temperature 400 Â°C	@Temperature 752 Â°F	

Electrical Properties	Metric	English	Comments
	0.000129 ohm-cm	0.000129 ohm-cm	
	@Temperature 500 Â°C	@Temperature 932 Â°F	
	0.000131 ohm-cm	0.000131 ohm-cm	
	@Temperature 600 Â°C	@Temperature 1110 Â°F	

Descriptive Properties	Value	Comments
Consumable Diameter	1.1	
Thermal Diffusivity	0.0264 cm ² /s	23Â°C
	0.0291 cm ² /s	at 100Â°C
	0.0319 cm ² /s	at 200Â°C
	0.0352 cm ² /s	at 300Â°C
	0.0382 cm ² /s	at 400Â°C
	0.0412 cm ² /s	at 500Â°C
	0.0435 cm ² /s	at 600Â°C

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