

## Haynes Hastelloy® C-276 alloy, solution heat treated flat products

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

### Material Notes:

Hastelloy® C-276 alloy is a nickel-molybdenum-chromium wrought alloy that is a versatile corrosion-resistant alloy. C-276 alloy is an improved wrought version of alloy C in that it usually doesn't need to be solution heat-treated after welding and has vastly improved fabricability. 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. However, in environments where attack of the C-276 alloy weld joint is experienced. C-22® weld filler materials should be considered. C-276 alloy has excellent resistance to localized corrosion and to both oxidizing and reducing media. Because of its versatility, C-276 alloy can be used where "upset" conditions are likely to occur or in multipurpose plants. Hastelloy C-276 alloy excellent resistance to a wide variety of chemical process environments, including strong oxidizers such as ferric and cupric chlorides, hot contaminated media (organic and inorganic), chlorine, formic and acetic acids, acetic anhydride, and seawater and brine solutions. It is used in flue gas desulfurizations systems because of its excellent resistance to sulfur compounds and chloride ions encountered in most scrubbers. C-276 alloy has excellent resistance to pitting and to stress-corrosion cracking. It is also one of the few materials that withstands the corrosive effects of wet chlorine gas, hypochlorite, and chlorine dioxide. Hastelloy C-276 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-276 alloy, although the oxyacetylene process is not recommended. Special precautions should be taken to avoid excessive heat input. Hastelloy C-276 is available in the form of plate, sheet, strip, billet, bar, wire, covered electrodes, pipe, tubing, pipe fittings, flanges, fittings. Heat Treatment: C-276 alloy is normally solution heat-treated at 2050°F (1121°C) and rapid quenched. If possible, parts which have been hot-formed should be solution heat-treated prior to final fabrication or installation. Data provided by the manufacturer, Haynes International, Inc.

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Physical Properties	Metric	English	Comments
Density	8.89 g/cc	0.321 lb/in <sup>3</sup>	at RT

Mechanical Properties	Metric	English	Comments
Hardness, Rockwell B	87	87	plate
	90	90	sheet
Tensile Strength, Ultimate	601.2 MPa	87200 psi	
	@Thickness 4.80 - 25.4 mm, Temperature 538 °C	@Thickness 0.189 - 1.00 in, Temperature 1000 °F	
	613 MPa	88900 psi	
	@Thickness 1.60 - 4.70 mm, Temperature 538 °C	@Thickness 0.0630 - 0.185 in, Temperature 1000 °F	
	630.9 MPa	91500 psi	

Mechanical Properties	Metric	English	Comments
	@Thickness 4.80 - 25.4 mm, Temperature 427 Â°C	@Thickness 0.189 - 1.00 in, Temperature 801 Â°F	
	<b>644.7 MPa</b>	<b>93510 psi</b>	
	@Thickness 2.40 mm, Temperature 427 Â°C	@Thickness 0.0945 in, Temperature 801 Â°F	
	<b>650.2 MPa</b>	<b>94300 psi</b>	
	@Thickness 2.00 mm, Temperature 427 Â°C	@Thickness 0.0787 in, Temperature 801 Â°F	
	<b>650.2 MPa</b>	<b>94300 psi</b>	
	@Thickness 4.80 - 25.4 mm, Temperature 316 Â°C	@Thickness 0.189 - 1.00 in, Temperature 601 Â°F	
	<b>653.6 MPa</b>	<b>94800 psi</b>	
	@Thickness 25.4 mm, Temperature 427 Â°C	@Thickness 1.00 in, Temperature 801 Â°F	
	<b>655 MPa</b>	<b>95000 psi</b>	
	@Thickness 1.60 - 4.70 mm, Temperature 427 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 801 Â°F	
	<b>664 MPa</b>	<b>96300 psi</b>	
	@Thickness 25.4 mm, Temperature 316 Â°C	@Thickness 1.00 in, Temperature 601 Â°F	
	<b>668.8 MPa</b>	<b>97000 psi</b>	
	@Thickness 1.60 - 4.70 mm, Temperature 316 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 601 Â°F	
	<b>673 MPa</b>	<b>97600 psi</b>	
	@Thickness 2.40 mm, Temperature 316 Â°C	@Thickness 0.0945 in, Temperature 601 Â°F	
	<b>681.2 MPa</b>	<b>98800 psi</b>	
	@Thickness 2.00 mm, Temperature 316 Â°C	@Thickness 0.0787 in, Temperature 601 Â°F	
	<b>681.9 MPa</b>	<b>98900 psi</b>	
	@Thickness 4.80 - 25.4 mm, Temperature 204 Â°C	@Thickness 0.189 - 1.00 in, Temperature 399 Â°F	
	<b>693.6 MPa</b>	<b>100600 psi</b>	
	@Thickness 2.00 mm, Temperature 204 Â°C	@Thickness 0.0787 in, Temperature 399 Â°F	

Mechanical Properties	695 MPa Metric	101000 psi English	Comments
	@Thickness 1.60 - 4.70 mm, Temperature 204 Å°C	@Thickness 0.0630 - 0.185 in, Temperature 399 Å°F	
	<b>696.4 MPa</b>	<b>101000 psi</b>	
	@Thickness 2.40 mm, Temperature 204 Å°C	@Thickness 0.0945 in, Temperature 399 Å°F	
	<b>792.2 MPa</b>	<b>114900 psi</b>	
	@Thickness 2.00 mm, Temperature 20.0 Å°C	@Thickness 0.0787 in, Temperature 68.0 Å°F	
	<b>826.7 MPa</b>	<b>119900 psi</b>	
	@Thickness 25.4 mm, Temperature 20.0 Å°C	@Thickness 1.00 in, Temperature 68.0 Å°F	
<b>Tensile Strength, Yield</b>	<b>204.8 MPa</b>	<b>29700 psi</b>	<b>0.2% offset</b>
	@Thickness 2.40 mm, Temperature 427 Å°C	@Thickness 0.0945 in, Temperature 801 Å°F	
	<b>210.3 MPa</b>	<b>30500 psi</b>	<b>0.2% offset</b>
	@Thickness 25.4 mm, Temperature 427 Å°C	@Thickness 1.00 in, Temperature 801 Å°F	
	<b>225.5 MPa</b>	<b>32710 psi</b>	<b>0.2% offset</b>
	@Thickness 2.00 mm, Temperature 427 Å°C	@Thickness 0.0787 in, Temperature 801 Å°F	
	<b>225.5 MPa</b>	<b>32710 psi</b>	<b>0.2% offset</b>
	@Thickness 4.80 - 25.4 mm, Temperature 427 Å°C	@Thickness 0.189 - 1.00 in, Temperature 801 Å°F	
	<b>226.2 MPa</b>	<b>32810 psi</b>	<b>0.2% offset</b>
	@Thickness 4.80 - 25.4 mm, Temperature 538 Å°C	@Thickness 0.189 - 1.00 in, Temperature 1000 Å°F	
	<b>231 MPa</b>	<b>33500 psi</b>	<b>0.2% offset</b>
	@Thickness 2.40 mm, Temperature 316 Å°C	@Thickness 0.0945 in, Temperature 601 Å°F	
	<b>233.1 MPa</b>	<b>33810 psi</b>	<b>0.2% offset</b>
	@Thickness 1.60 - 4.70 mm, Temperature 538 Å°C	@Thickness 0.0630 - 0.185 in, Temperature 1000 Å°F	
	<b>235.1 MPa</b>	<b>34100 psi</b>	<b>0.2% offset</b>
	@Thickness 4.80 - 25.4 mm,	@Thickness 0.189 - 1.00 in,	

Mechanical Properties	Temperature 316 Â°C Metric	Temperature 601 Â°F English	Comments
	239.9 MPa	34790 psi	
	@Thickness 1.60 - 4.70 mm, Temperature 427 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 801 Â°F	0.2% offset
	247.5 MPa	35900 psi	
	@Thickness 2.00 mm, Temperature 316 Â°C	@Thickness 0.0787 in, Temperature 601 Â°F	0.2% offset
	249.6 MPa	36200 psi	
	@Thickness 25.4 mm, Temperature 316 Â°C	@Thickness 1.00 in, Temperature 601 Â°F	0.2% offset
	259.9 MPa	37700 psi	
	@Thickness 1.60 - 4.70 mm, Temperature 316 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 601 Â°F	0.2% offset
	263.4 MPa	38200 psi	
	@Thickness 4.80 - 25.4 mm, Temperature 204 Â°C	@Thickness 0.189 - 1.00 in, Temperature 399 Â°F	0.2% offset
	275.1 MPa	39900 psi	
	@Thickness 2.40 mm, Temperature 204 Â°C	@Thickness 0.0945 in, Temperature 399 Â°F	0.2% offset
	289.6 MPa	42000 psi	
	@Thickness 2.00 mm, Temperature 204 Â°C	@Thickness 0.0787 in, Temperature 399 Â°F	0.2% offset
	290.3 MPa	42100 psi	
	@Thickness 1.60 - 4.70 mm, Temperature 204 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 399 Â°F	0.2% offset
	355.8 MPa	51600 psi	
	@Thickness 2.00 mm, Temperature 20.0 Â°C	@Thickness 0.0787 in, Temperature 68.0 Â°F	0.2% offset
	364.7 MPa	52900 psi	
	@Thickness 25.4 mm, Temperature 20.0 Â°C	@Thickness 1.00 in, Temperature 68.0 Â°F	0.2% offset
Elongation at Break	56 %	56 %	
	@Thickness 1.60 - 4.70 mm, Temperature 204 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 399 Â°F	in 50.8 mm
	58 %	58 %	

Mechanical Properties	Metric	English	in 50.8 mm Comments
	@Thickness 2.40 mm, Temperature 204 Â°C	@Thickness 0.0945 in, Temperature 399 Â°F	
	59 %	59 %	
	@Thickness 25.4 mm, Temperature 20.0 Â°C	@Thickness 1.00 in, Temperature 68.0 Â°F	in 50.8 mm
	59 %	59 %	
	@Thickness 2.00 mm, Temperature 204 Â°C	@Thickness 0.0787 in, Temperature 399 Â°F	in 50.8 mm
	59 %	59 %	
	@Thickness 4.80 - 25.4 mm, Temperature 538 Â°C	@Thickness 0.189 - 1.00 in, Temperature 1000 Â°F	in 50.8 mm
	60 %	60 %	
	@Thickness 1.60 - 4.70 mm, Temperature 538 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 1000 Â°F	in 50.8 mm
	60 %	60 %	
	@Thickness 4.80 - 25.4 mm, Temperature 427 Â°C	@Thickness 0.189 - 1.00 in, Temperature 801 Â°F	in 50.8 mm
	61 %	61 %	
	@Thickness 2.00 mm, Temperature 20.0 Â°C	@Thickness 0.0787 in, Temperature 68.0 Â°F	in 50.8 mm
	61 %	61 %	
	@Thickness 4.80 - 25.4 mm, Temperature 204 Â°C	@Thickness 0.189 - 1.00 in, Temperature 399 Â°F	in 50.8 mm
	61 %	61 %	
	@Thickness 25.4 mm, Temperature 427 Â°C	@Thickness 1.00 in, Temperature 801 Â°F	in 50.8 mm
	63 %	63 %	
	@Thickness 25.4 mm, Temperature 316 Â°C	@Thickness 1.00 in, Temperature 601 Â°F	in 50.8 mm
	64 %	64 %	
	@Thickness 2.40 mm, Temperature 316 Â°C	@Thickness 0.0945 in, Temperature 601 Â°F	in 50.8 mm
	64 %	64 %	
	@Thickness 2.40 mm, Temperature 427 Â°C	@Thickness 0.0945 in, Temperature 801 Â°F	in 50.8 mm
	64 %	64 %	

Mechanical Properties	Metric @Thickness 1.60 - 4.70 mm, Temperature 316 Â°C	English @Thickness 0.0630 - 0.185 in, Temperature 601 Â°F	Comments
	65 %	65 %	
	@Thickness 1.60 - 4.70 mm, Temperature 427 Â°C	@Thickness 0.0630 - 0.185 in, Temperature 801 Â°F	in 50.8 mm
	66 %	66 %	
	@Thickness 4.80 - 25.4 mm, Temperature 316 Â°C	@Thickness 0.189 - 1.00 in, Temperature 601 Â°F	in 50.8 mm
	67 %	67 %	
	@Thickness 2.00 mm, Temperature 427 Â°C	@Thickness 0.0787 in, Temperature 801 Â°F	in 50.8 mm
	68 %	68 %	
	@Thickness 2.00 mm, Temperature 316 Â°C	@Thickness 0.0787 in, Temperature 601 Â°F	in 50.8 mm
<b>Modulus of Elasticity</b>	<b>205 GPa</b>	<b>29700 ksi</b>	<b>RT</b>
	176 GPa	25500 ksi	heat treated at 1121Â°C (2050Â°F) and rapid quenched
	@Temperature 538 Â°C	@Temperature 1000 Â°F	
	182 GPa	26400 ksi	heat treated at 1121Â°C (2050Â°F) and rapid quenched
	@Temperature 427 Â°C	@Temperature 801 Â°F	
	188 GPa	27300 ksi	heat treated at 1121Â°C (2050Â°F) and rapid quenched
	@Temperature 316 Â°C	@Temperature 601 Â°F	
	195 GPa	28300 ksi	heat treated at 1121Â°C (2050Â°F) and rapid quenched
	@Temperature 204 Â°C	@Temperature 399 Â°F	
<b>Charpy Impact</b>	87.0 J	64.2 ft-lb	V Notch; plate; aged 1000 hours at 538Â°C (1000Â°F)
	@Temperature -196 Â°C	@Temperature -321 Â°F	
	130 J	95.9 ft-lb	V Notch; plate; aged 100 hours at 538Â°C (1000Â°F)
	@Temperature -196 Â°C	@Temperature -321 Â°F	
	339 J	250 ft-lb	V Notch; plate; aged 100 hours at 260Â°C
	@Temperature -196 Â°C	@Temperature -321 Â°F	
	357 J	263 ft-lb	V Notch; plate; solution heat treated

Mechanical Properties	Metric	English	Comments
	@Temperature -196 Â°C	@Temperature -321 Â°F	at 1121Â°C (2050Â°F), rapid (0.001121)

Thermal Properties	Metric	English	Comments
CTE, linear	11.2 Âµm/m-Â°C	6.22 Âµin/in-Â°F	
	@Temperature 24.0 - 93.0 Â°C	@Temperature 75.2 - 199 Â°F	
	12.0 Âµm/m-Â°C	6.67 Âµin/in-Â°F	
	@Temperature 24.0 - 204 Â°C	@Temperature 75.2 - 399 Â°F	

Electrical Properties	Metric	English	Comments
Electrical Resistivity	0.000130 ohm-cm	0.000130 ohm-cm	
	@Temperature 24.0 Â°C	@Temperature 75.2 Â°F	

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