HASTELLOY® X

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Material & Process Capability

HASTELLOY® X alloy (UNS N06002) is a nickel-chromium-iron-molybdenum solution strengthened alloy widely used in high temperature and corrosive atmosphere applications. The alloy is commonly used in gas turbine engines. Its corrosion resistance also makes it an excellent candidate for applications in petrochemical and energy generation applications, such as transition duct, combustor cans, afterburners, and spray bars.

The Velo3D fully integrated additive printing solution uniquely enables companies to build the parts they need without compromising design or quality - resulting in complex, higher performance parts than traditional casting techniques or other additive methods.

General Process

HASTELLOY® X possesses excellent forming and welding characteristics and is easy to fabricate. It offers outstanding localized corrosion resistance and oxidation resistance up to 2200°F (1200°C) along with excellent stress corrosion crack resistance.

This data sheet specifies the expected mechanical properties and characteristics of this alloy when manufactured on a Velo3D Sapphire System. All data is based on parts built using Velo3D standard 50 µm layer thickness parameters, using Praxair TruForm HXLC, a Velo3D-approved HASTELLOY® X powder. HASTELLOY® is a registered trademark of Haynes International, Inc.

Density, g/cc (lbs/cubic in)	8.22 (0.297)
Relative Density, percent	99.9+
Surface Finish[1], S_a, µm (µin)	<15 (590)

Mechanical Properties at Room Temperature

Property[2]			Modulus of Elasticity, GPa (msi)		Ultimate Tensile Strength, MPa (ksi)		Yield (0.2% Offset), MPa (ksi)		Elongation At Break, percent	
Process Recipe	TBR (cc/h)[3]		Mean-3σ	Mean	Mean-3σ	Mean	Mean-3σ	Mean	Mean-3σ	Mean
1kW/50 µm	45	As Printed	131 (19)	179 (26)	665 (96)	674 (98)	461 (67)	487 (71)	40	45.6
		After Heat Treatment[4]	132 (19)	227 (33)	625 (91)	644 (94)	320 (47)	336 (49)	52.6	57.8
		After HIP[5]	148 (22)	204 (30)	643 (93)	658 (95)	303 (44)	323 (47)	51	57.7

1. Depends on orientation and process selected; for angles >25° from horizontal. **2.** Mechanical & test samples printed in vertical orientation, machined to ASTM E8 (round specimen #3). **3.** TBR: Theoretical Build Rate (TBR) is a per-laser build rate calculated from the process conditions of bulk core as *scan speed x hatch spacing x layer thickness*. This value represents a single laser only and is reported for comparison purposes across different materials and recipes, but does not correspond to true build rate, which is dependent on geometry and system characteristics (i.e. number of lasers, recoat times, etc.) **4.** Solution annealed at 1177°C (2150°F) for two hours followed by rapid air cool. **5.** Hot Isostatic Pressing at 1177°C (2150°F) and 14.5 ksi for 3-5 hrs, followed by cooling at 150-200°C/min (300-390°F/min), processed at Quintus Technologies.