

forAM[®] HAYNES[®] 282[®]

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Headquarters
 2710 Lakeview Court
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Material & Process Capability

This powder is produced by Höganäs under license from Haynes International Inc. It is a vacuum induction melted, argon gas atomized, spherical powder for additive manufacturing. Velo3D has qualified this powder, produced by Höganäs AB, a world leader in metal powder production, under license from Haynes International, for use in the Sapphire[®] family of printers.

The Velo3D fully integrated metal AM solution uniquely enables companies to build the parts they need without compromising design or quality - resulting in complex parts higher in performance than casting or other methods. This alloy is a gamma-prime strengthened nickel-chromium-cobalt superalloy for high temperature applications and shows a good balance of creep strength at high temperatures, thermal stability, weldability, and fabricability.

General Process

In addition to its strength, the alloy is characterized by its superb fatigue, creep, and corrosion resistance under extreme conditions; it is ideal for high temperature applications such as gas turbine and power/process industry parts.

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. Parts built with this alloy on a Sapphire System can be heat treated like those manufactured by other methods.



Density, g/cc (lbs/cubic in)	8.28 (0.299)
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	53	As Printed	126 (18)	152 (22)	850 (123)	862 (125)	547 (79)	573 (83)	44.9	47.3
		After Heat Treatment and HIP ⁴	186 (27)	201 (29)	1141 (166)	1158 (168)	711 (103)	743 (108)	29.3	34.5

1. For angles >25° from horizontal, actual finish depends on orientation and process selected.

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.)

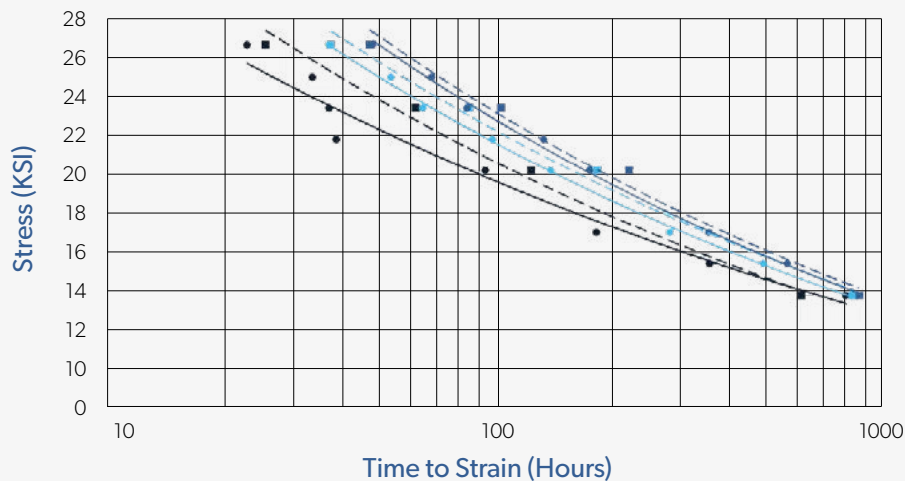
4. Hot Isostatic Pressing at 1175 °C (2150 °F) & 14750 psi +/-250 psi for 4 hours, rapid cool. Vacuum Solution Heat Treat at 1135 °C (2075 °F) for 30 min. Two-step vacuum age, first at 1010 °C (1850 °F) for two hours followed by rapid air cool, then at 790 °C (1450 °F) for eight hours, followed by rapid air cool.

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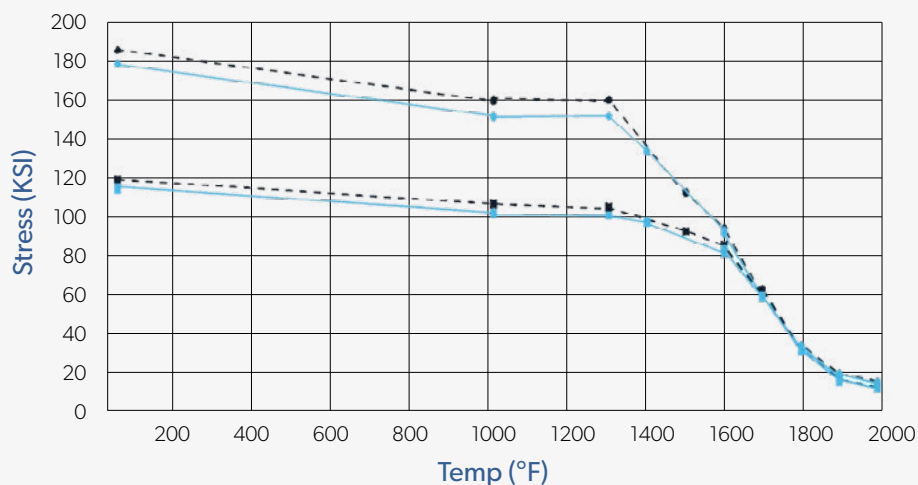
Creep at 1600°F



Creep Legend

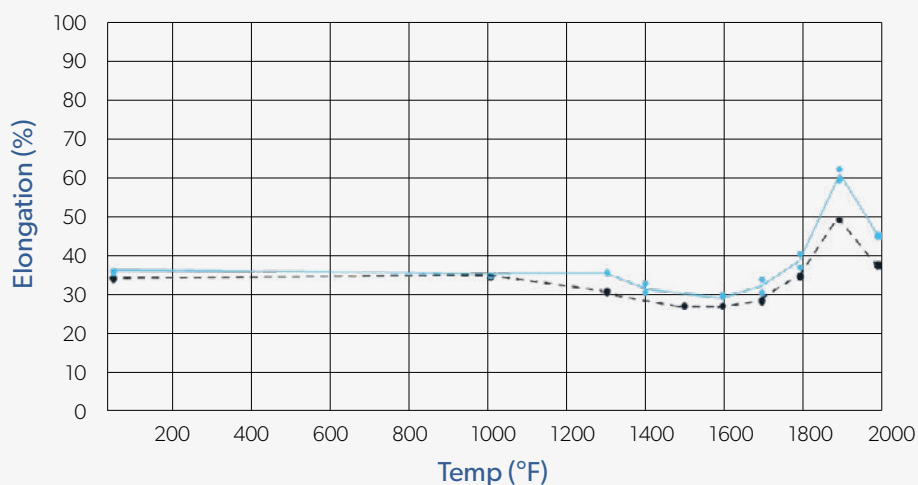
1.0% Strain	—■—	Horizontal
0.5% Strain	—●—	Vertical
0.2% Strain	—→	Runout

Tensile Strength vs Temperature



Tensile-Temp Legend

Horizontal	—■—	0.2% Yield
Vertical	—●—	Ultimate



Tensile-Temp Legend

Horizontal	—■—	0.2% Yield
Vertical	—●—	Ultimate