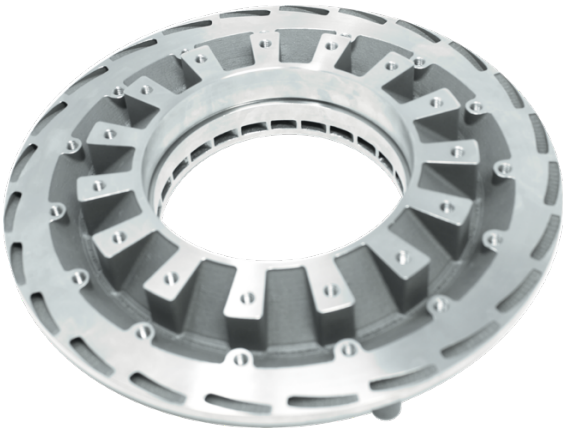


# Ti 6Al-4V

## Material & Process Capability

Ti 6Al-4V ELL is an alpha-beta titanium alloy characterized by its strength-to-mass ratio and corrosion resistance. It is a lightweight yet strong alloy suitable for highly loaded structures, including aerospace jet engines, gas turbines, pressure vessels and biomechanical components.

The VELO3D intelligent 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

Three common heat treatment processes for Ti 6Al-4V include mill annealing, duplex annealing, and solution treating and aging. Parts built with Ti 6Al-4V on a VELO3D Sapphire printer can be heat treated similar to other manufacturing methods.

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 with VELO3D standard 50 µm layer thickness parameters, using standard 15-53 µm Ti 6Al-4V ELL grade 23 powder.

Accuracy, Small Parts	±0.050 (±0.002)	mm (in)
Accuracy, Large Parts	±0.2	percent
Minimum Wall Thickness; up to 500:1 aspect ratio	0.200 (0.008) mm	mm (in)
Typical Volume Rate <sup>1</sup>	45	cc per hr
Density	4.43 (0.16)	g/cc (lbs/in <sup>3</sup> )
Relative Density	99.9+	percent
Surface Finish, Sa <sup>2</sup>	6 (240)	µm (µin)

### Mechanical Properties at Room Temperature

Property <sup>3</sup>	After Heat Treatment <sup>5</sup>		After Hot Isostatic Pressing <sup>6</sup>		
	Mean -3σ/ Min	Average	Mean -3σ/ Min	Average	
Modulus of Elasticity <sup>4</sup>	95 (13.8)	115 (16.7)	107 (15.5)	112 (16.2)	GPa (MSI)
Ultimate Tensile Strength	970 (141)	994 (144)	988 (143)	1009 (146)	MPa (KSI)
Yield (0.2% Offset)	798 (116)	819 (119)	822 (119)	838 (122)	MPa (KSI)
Elongation At Break	17	21	13	17	percent

1. Geometry-dependent. 2. Depends on orientation and process selected. 3. Mechanical & test samples printed in vertical orientation. 4. For reference; estimated from ASTM E8 tensile testing. 5. Heat treatment anneal 2 hours at 800°C in argon atmosphere. 6. Hot isostatic pressing: 2 hours at 800°C and 200 MPa, processed at Quintus Technologies.