

# Material & Process Capability

## Ti 6Al-4V ELI

Ti 6Al-4V is an alpha-beta titanium alloy. This data sheet specifies the expected mechanical properties and characteristics of this alloy when manufactured on a VELO<sup>3D</sup> Sapphire<sup>®</sup> System.

Ti 6Al-4V is characterized by having excellent corrosion resistance, strength, and toughness. ELI (extra low interstitial) grade designates that interstitial elements are controlled to improve ductility and fracture toughness. Parts built from Ti 6Al-4V on a Sapphire system can be heat treated similarly to those manufactured by other methods. All data is based on parts built with VELO<sup>3D</sup> standard 50 µm layer thickness parameters, using standard 15-53 µm Ti 6Al-4V ELI grade 23 powder.

### General Process Data

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 (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

### Notes

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.