



Ti64 ELI GRADE 23+

For Additive Manufacturing

**NOVEL TITANIUM SOLUTION FOR MEDICAL
DEVICES WITH COMPLEX GEOMETRIES**



TITANIUM

Ti64 ELI Grade 23+

Titanium alloys exhibit high strength and outstanding corrosion resistance along with favorable biocompatibility, making them suitable for a wide variety of biomedical applications. Most 3D-printed implantable medical devices use Ti64 ELI, the extra-low interstitial variant known by its standard designation, Grade 23 (ASTM F3001). In the printed and hot isostatically pressed (HIP) condition, this alloy demonstrates very good tensile strength of over 130 ksi (890 MPa) and elongation greater than 10%. However, manufacturers struggle with two key challenges with Ti64 ELI during additive manufacturing (AM):

- ✘ Ti64 powder readily oxidizes during the high temperature AM process, causing brittleness and cracking, especially at thin-walled or fine-resolution part features
- ✘ This inherent oxidation process limits the reusability of Ti64 Grade 23, since as-built components must contain less than 0.13 wt% oxygen to conform to specification

Carpenter's Ti64 Grade 23+ additive manufacturing solution:

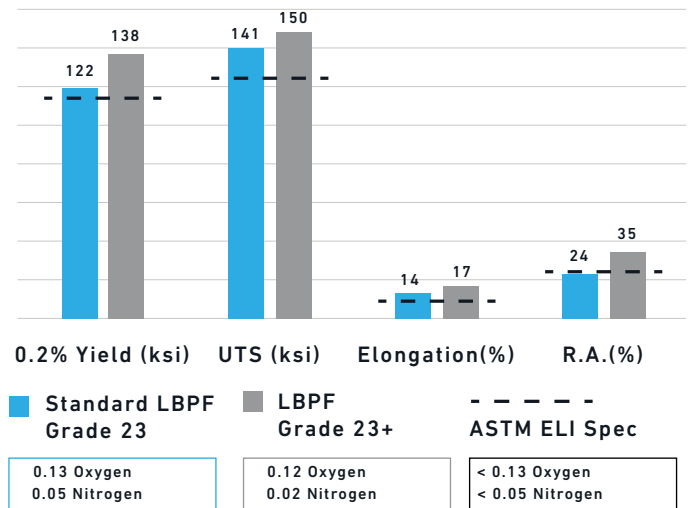
- Combines controlled powder chemistry with lower oxygen content and optimized print parameters
- Provides a 15–20% improvement in mechanical properties
- Delivers consistent, high-quality results
- Enables state-of-the-art device designs through improved mechanical properties coupled with topology optimization, lattice structures, and other advanced geometries

Innovating the next generation of titanium-based medical devices

In order to achieve complex geometries with Ti64, Carpenter Additive's material experts developed an integrated printing solution to control the entire additive lifecycle — from powder chemistry to additive build parameters to the recycling process.

Ti64 ELI Grade 23+ allows 3D printing of complex, high-quality medical devices with increased mechanical strength and improved ductility.

L-PBF + HIP: 13% STRENGTH IMPROVEMENT OVER GRADE 23



TI64 GRADE 23+ / ASTM F3001

MATERIAL	FORM	0.2% YIELD STRENGTH	ULTIMATE TENSILE STRENGTH	ELONGATION	REDUCTION AREA
		ksi	ksi	%	%
Carpenter Grade 23+	As-Printed	175	196	10	21
	As-HIP	138	150	17	35
ASTM F3001		115	130	10	25