

## METAL SOLUTIONS

# EOS Titanium Ti64 Grade 23

## Material Data Sheet

**EOS TITANIUM Ti64 GRADE 23**

EOS Titanium Ti64 Grade 23 is a Ti6Al4V alloy with lower amount of oxygen and iron compared to the standard Ti64 alloy. The material is well-known for having excellent mechanical properties: low density with high strength and excellent corrosion resistance. EOS Titanium Ti64 Grade 23 is a titanium alloy powder intended for manufacturing parts on EOS metal systems with EOS DMLS processes.

Compared to Ti64, Ti64ELI has better elongation and toughness, but lower strength. Generally, Ti64ELI alloys are considered to be biocompatible and have low specific weight compared to CoCr alloys.

Parts built with EOS Titanium Ti64 Grade 23 powder can be machined, shot peened and polished in as manufactured and heat treated states. Due to the layerwise building method, the parts have a certain anisotropy. Heat treatment is recommended to reduce internal stresses and increase ductility.

EOS Titanium Ti64 Grade 23 powder can be used on the EOS M 290 with a 40 µm and 80 µm process and on the EOS M 400-4 with an 80 µm process.

**MAIN CHARACTERISTICS**

- Low weight combined with high strength
- Excellent corrosion resistance
- High fatigue resistance compared to other lightweight alloys
- The parts fulfill chemical requirements for Grade 23 alloy

**TYPICAL APPLICATIONS**

- Medical components
- Implants
- Other industrial applications where low weight in combination with high strength are required

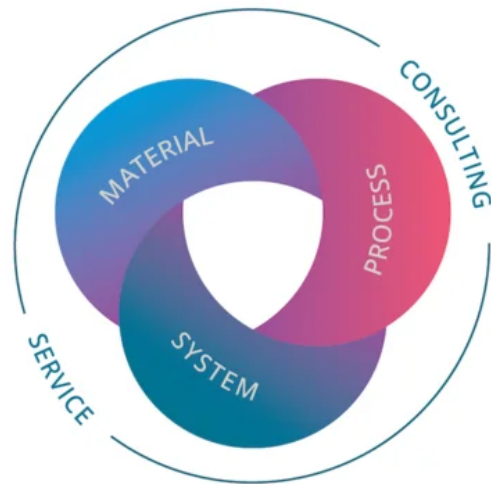
# The EOS Quality Triangle

EOS uses an approach that is unique in the AM industry, taking each of the three central technical elements of the production process into account: the system, the material and the process. The data resulting from each combination is assigned a Technology Readiness Level (TRL) which makes the expected performance and production capability of the solution transparent.

EOS incorporates these TRLs into the following two categories:

- Premium products (TRL 7-9): offer highly validated data, proven capability and reproducible part properties.
- Core products (TRL 3 and 5): enable early customer access to newest technology still under development and are therefore less mature with less data.

All of the data stated in this material data sheet is produced according to EOS Quality Management System and international standards



# POWDER PROPERTIES

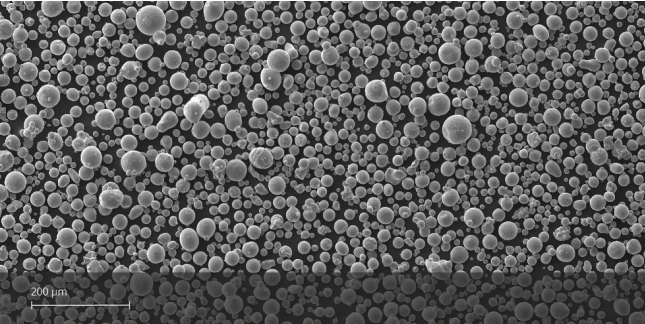
EOS Titanium Ti64 Grade 23 powder is classified as Grade 23 titanium alloy according to ASTM B348. The chemical composition is in compliance with standards ASTM F136, ASTM F3001, and ASTM F3302.

## Powder Chemical Composition (wt.-%)

Element	Min.	Max.
Ti		Balance
Al	5.5	6.5
V	3.5	4.5
O	-	0.13
N	-	0.05
C	-	0.08
H	-	0.012
Fe	-	0.25
Y	-	0.005
Other Elements Each	-	0.1
Other Elements Total	-	0.4

## Powder Particle Size

GENERIC PARTICLE SIZE DISTRIBUTION	20 - 80 µm
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SEM micrograph of EOS Titanium Ti64 Grade 23 powder

# HEAT TREATMENT

## Description

As manufactured microstructure for additively manufactured Ti64 consists of fully acicular alpha prime ( $\alpha'$ ) phase. Standard heat treatments for titanium do not necessarily produce desired microstructures due to this different starting microstructure. Heat treatment is recommended to relieve stresses and to increase ductility. Use of vacuum furnace is highly recommended to avoid the formation of alpha case on the surface of the parts.

## Steps

120min ( $\pm$  30 min) at 800 °C ( $\pm$  10°C) measured from the part in vacuum ( $1.3 \times 10^{-3}$ - $1.3 \times 10^{-5}$  mbar) followed by cooling under vacuum or argon quenching. Material mechanical properties are relatively insensitive to changes in heating and cooling rates, but longer treatment times may result in decreased strength and increased elongation.

Parts heat treated according to the recommended heat treatment have a microstructure consisting of fine alpha + beta ( $\alpha + \beta$ ) phase.

## HEADQUARTERS

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This powder has not been developed, tested or certified as a medical device according to Directive 93/42/EEC (MDD) or Regulation (EU) 2017/745 (MDR) and is not intended to be used as a medical device, in particular for the purposes specified in Art. 2 No. 1 MDR. Insofar as you intend to use the powder as raw material for the manufacture of pharmaceutical products or medical devices (e.g. as raw material which as a material must meet the requirements of Annex 1, Chapter II MDR), the responsibility and liability for all analyses, tests, evaluations, procedures, risk assessments, conformity assessments, approval and certification procedures as well as for all other official and regulatory measures required for this purpose shall lie solely with you both with regard to the pharmaceutical product and/or medical device manufactured by you and with regard to the properties, suitability, testing, evaluation, risk assessment, other requirements for use of the powder as raw material. In this respect, the limitations of liability pursuant to our General Terms and Conditions and the system sales or material contracts shall apply.

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Status as of 03.09.2024. Subject to technical modifications. EOS is certified according to ISO 9001.

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