

MATERIAL DATA SHEET



This well-known light alloy is characterized by having excellent mechanical properties and corrosion resistance combined with low specific weight and bio-compatibility. This material is ideal for many high-performance engineering applications, for example in aerospace and motor racing, and also for the production of biomedical implants (note: subject to fulfillment of statutory validation requirements where appropriate). Due to the layer-wise building method, the parts have a certain anisotropy, which can be reduced or removed by appropriate heat treatment.

GENERAL PROCESS DATA

Typical achievable part accuracy ^[1]	± 50 µm
Smallest wall thickness ^[2]	approx. 0.3 – 0.4 mm approx. 0.012 – 0.016 inch
Surface roughness, <i>as built</i> , ^[3]	
- Ti64_30_030_default.job - Ti64 Performance (30 µm)	Ra 9 - 12 µm, Rz 40 - 80 µm Ra 0.36 – 0.47 x 10 ⁻³ inch Rz 1.6 – 3.2 x 10 ⁻³ inch
- Ti64 Speed 1.0 (60 µm)	Ra 6 - 10 µm, Rz 35 - 40 µm Ra 0.23 – 0.39 x 10 ⁻³ inch, Rz 1.37 – 1.57 x 10 ⁻³ inch
Volume rate ^[4]	
- Ti64_30_030_default.job - Ti64 Performance (30 µm)	3.75 mm ³ /s (13.5 cm ³ /h) 0.82 in ³ /h
- Ti64 Speed 1.0 (60 µm)	9 mm ³ /s (32.4 cm ³ /h) 1.98 in ³ /h

PHYSICAL & CHEMICAL PROPERTIES OF PARTS

Material composition	Ti (balance)	O (< 2000 ppm)	H (< 150 ppm)
	Al (5.5 – 6.75 wt.-%)	N (< 500 ppm)	Fe (< 3000 ppm)
	V (3.5 – 4.5 wt.-%)	C (< 800 ppm)	
Relative density	approx. 100 %		
Density	4.41 g/cm ³		
	0.159 lb/in ³		



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MECHANICAL PROPERTIES OF PARTS - AS BUILT

	<i>Horizontal axis (XY)</i>	<i>Vertical axis (Z)</i>
Tensile strength ^[5]	typ. 1230 ± 50 MPa typ. 178 ± 7 ksi	typ. 1200 ± 50 MPa typ. 174 ± 7 ksi
Yield strength (Rp 0.2 %) ^[5]	typ. 1060 ± 50 MPa typ. 154 ± 7 ksi	typ. 1070 ± 50 MPa typ. 155 ± 7 ksi
Modulus of elasticity ^[5]	typ. 110 ± 10 GPa typ. 16 ± 1.5 Msi	typ. 110 ± 10 GPa typ. 16 ± 1.5 Msi
Elongation at break ^[5]	typ. [10 ± 2] %	typ. [11 ± 3] %
Hardness ^[7]	typ. 320 ± 12 HV5	

MECHANICAL PROPERTIES OF PARTS - HEAT TREATED ^[6]

	<i>Horizontal axis (XY)</i>	<i>Vertical axis (Z)</i>
Tensile strength ^[5]	min. 930 MPa [134.8 ksi] typ. 1050 ± 20 MPa [152 ± 3 ksi]	min. 930 MPa [134.8 ksi] typ. 1060 ± 20 MPa [154 ± 3 ksi]
Yield strength (Rp 0.2 %) ^[5]	min. 860 MPa [124.7 ksi] typ. 1000 ± 20 MPa [145 ± 3 ksi]	min. 860 MPa [124.7 ksi] typ. 1000 ± 20 MPa [145 ± 3 ksi]
Modulus of elasticity ^[5]	typ. 116 ± 10 GPa typ. 17 ± 1.5 Msi	typ. 114 ± 10 GPa typ. 17 ± 1.5 Msi
Elongation at break ^[5]	min. 10 % typ. [14 ± 1%]	min. 10 % typ. [15 ± 1%]

THERMAL PROPERTIES OF PARTS

Maximum long-term operating temperature	approx. 350 °C approx. 660 °F
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- [1] Based on users' experience of dimensional accuracy for typical geometries. Part accuracy is subject to appropriate data preparation and post-processing.
- [2] Mechanical stability is dependent on geometry (wall height etc.) and application.
- [3] Due to the layer-wise building, the surface structure depends strongly on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect. The values also depend on the measurement method used. The values quoted here given an indication of what can be expected for horizontal (up-facing) or vertical surfaces.
- [4] Volume rate is a measure of build speed during laser exposure. The total build speed depends on the average volume rate, the re-coating time (related to the number of layers) and other factors such as DMLS-Start settings.
- [5] Tensile testing according to ISO 6892-1:2009 (B) Annex D, proportional test pieces, diameter of the neck area 5mm (0.2 inch), original gauge length 25 mm (1 inch). [6] Specimens were treated at 800 °C (1 470 °F) for 4 hours in argon inert atmosphere. Mechanical properties are expressed as minimum values to indicate that mechanical properties exceed the minimum requirements of material specification standards. ASTM F1 472-08. By fulfilling these minimum values, also the specifications of standards ASTM B348-09 and ISO 5832-3:2000 are meet.
- [7] Vickers hardness measurement (HV) according to EN ISO 6507-1 on polished surface. Note that measured hardness can vary significantly depending on how the specimen has been prepared.

