BAKER INDUSTRIES

Titanium Ti64 ELI

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 [3] *- as built*	Ra 3 – 20 µm, Rz 16 – 126 µm Ra 0.120.79 x 10^{-3} inch, Rz 0.634.96 x 10^{-3} inch
- peened	Ra 4 – 9 µm, Rz 22 – 56 µm Ra 0.160.35 x 10^{-3} inch, Rz 0.872.20 x 10^{-3} inch
Volume rate [4]	5 mm^3/s (18 cm^3/h) 1.1 in^3/h

Physical & chemical properties of parts

Material composition	Ti (balance) Al (5.5 – 6.75%) V (3.5 – 4.5%)	O (< 0.13%) N (< 0.05%) C (< 0.08%)	H (< 0.012%) Fe (< 0.25%)
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

	Horizontal axis (XY)	*Vertical axis (Z)*
Tensile strength [5]	1260 ± 40 MPa 183 ± 6 ksi	1250 ± 50 MPa 181 ± 7 ksi
Yield strength (Rp 0.2 %) [5]	1125 ± 65 MPa 163 ± 9 ksi	1130 ± 75 MPa 164 ± 11 ksi
Modulus of elasticity [5]	108 ± 20 GPa 16 ± 2.9.0 Msi	112 ± 13 GPa 16 ± 1.9 Msi
Elongation at break [5]	(7 ± 3) %	(9 ± 3) %

Mechanical properties of parts - heat treated [6]

	Horizontal axis (XY)	*Vertical axis (Z)*
Tensile strength [5]	min. 860 MPa (124.7 ksi) 1075 ± 30 MPa (156 ±4 ksi)	min. 860 MPa (124.7 ksi) 1080 ± 30 MPa (157 ± 4 ksi)
Yield strength (Rp 0.2 %) [5]	min. 795 MPa (115.3 ksi) typ. 1000 ± 40 MPa (145 ± 6 ksi)	min. 795 MPa (115.3 ksi) 1005 ± 40 MPa (146 ± 6 ksi)
Modulus of elasticity [5]	111 ± 20 GPa 16 ± 2.9 Msi	typ. 115 ± 20 GPa typ. ± 2.9 Msi
Elongation at break [5]	min. 10 % (13 ± 3 %)	min. 10 % (15 ± 4 %)

Thermal properties of parts

Maximum long-term operating temperature	approx. 350 °C approx. 660 °F

[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 (1470 °F) for 2hours in argon inert atmosphere. The minimum values refer standards ASTM F136-08l1.