GNEE METAL

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Grade 5 Titanium (Ti-6Al-4V) Datasheet

Titanium Grade 5 — Alpha-Beta Alloy, High Strength, Heat Treatable, Most Widely Used Titanium Alloy

Equivalent designations: Grade 5 / Ti-6Al-4V / UNS R56400 / W.Nr. 3.7165

1. Grade Overview

Grade 5 titanium (Ti-6Al-4V) is the most widely used titanium alloy in the world, accounting for roughly half of all titanium consumption. It is an alpha-beta alloy strengthened by the addition of 6% aluminum (alpha stabilizer) and 4% vanadium (beta stabilizer). It combines high tensile and yield strength (roughly twice that of CP titanium) with excellent fatigue performance, good weldability, and strong resistance to corrosion in a wide range of environments. Grade 5 is supplied in mill-annealed, solution-treated-and-aged (STA), or duplex-annealed conditions depending on the application and product form. It is the standard alloy for aerospace structural and engine components, high-performance fasteners, marine hardware, medical implants, and demanding chemical process applications.

2. Chemical Composition

ASTM B265 / B348 / B338 / B381 — Composition limits for Grade 5 (Ti-6Al-4V) titanium (wt %, max or range):

Element	Composition (wt %)	ASTM Limit
Titanium (Ti)	Balance	Remainder
Aluminum (Al)	5.5 – 6.75	5.5 – 6.75
Vanadium (V)	3.5 – 4.5	3.5 – 4.5
Iron (Fe)	≤ 0.30	0.30 max
Oxygen (O)	≤ 0.20	0.20 max
Carbon (C)	≤ 0.08	0.08 max
Nitrogen (N)	≤ 0.05	0.05 max
Hydrogen (H)	≤ 0.015	0.015 max
Other elements, total	≤ 0.40	0.40 max
Other elements, each	≤ 0.10	0.10 max

3. Mechanical Properties

Values shown below are typical ASTM room-temperature minima for mill-annealed material. Solution-treated-and-aged (STA) products deliver higher strength (Tensile approx. 1,100 MPa; Yield approx. 1,035 MPa) but reduced ductility. Do not substitute bar data for plate or tube design without verification.

Product Form / Standard	Condition	Tensile Strength	Yield Strength (0.2% Offset)	Elongation in 2 in. (50 mm)
Sheet & Plate (ASTM B265)	Annealed	≥ 895 MPa (130 ksi)	≥ 828 MPa (120 ksi)	≥ 10 %
Bar & Billet (ASTM B348)	Annealed	≥ 895 MPa (130 ksi)	≥ 828 MPa (120 ksi)	≥ 10 %
Seamless & Welded Tube (ASTM B338)	Annealed	≥ 895 MPa (130 ksi)	≥ 828 MPa (120 ksi)	≥ 10 %*
Forgings (ASTM B381)	Annealed	≥ 895 MPa (130 ksi)	≥ 828 MPa (120 ksi)	≥ 10 %

* Elongation for tubes may be adjusted for wall thickness under 0.175 in. per ASTM B338; verify on the MTR. Solution-treated-and-aged (STA) condition typically reaches Tensile >= 1,100 MPa (160 ksi) and Yield >= 1,035 MPa (150 ksi) per AMS 4928.

4. Physical Properties

Property	Typical Value	Notes
Density	4.43 g/cm3 (0.160 lb/in3)	At 20 degC
Beta Transus	1,668 +/- 20 degC (3,034 degF)	Approximate
Solidus / Liquidus	~1,660 / 1,720 degC	Approximate
Elastic Modulus	113.8 GPa (16.5 x 10^6 psi)	Young's modulus; annealed
Shear Modulus	44 GPa (6.4 x 10^6 psi)	Approximate
Poisson's Ratio	0.31	Typical
Mean Coefficient of Thermal Expansion	8.6 x 10^-6 /degC (4.8 x 10^-6 /degF)	20-100 degC
Thermal Conductivity	6.7 W/(m-K)	At 20 degC
Specific Heat	0.56 J/(g-degC)	At 20 degC
Electrical Resistivity	0.000178 ohm-cm (1.78 micro-ohm-m)	At 20 degC

5. Corrosion Resistance

Ti-6Al-4V offers essentially the same corrosion resistance as CP titanium in oxidizing media — seawater, brines, chlorides, wet chlorine, and nitric acid — thanks to a stable, self-healing passive oxide film. It is highly resistant to pitting, crevice corrosion, and stress corrosion cracking in chloride service. Performance in strongly reducing acids (e.g., hydrochloric, sulfuric) is lower than CP titanium; in those environments, the higher palladium-content Grade 7 or the higher ruthenium-content Grade 26 are typically preferred.

6. Typical Applications

• Aerospace structural components, engine parts, landing-gear fittings, and fasteners

• Aircraft hydraulic and fuel-system tubing (ASTM B356 / B338)

• Medical implants: hip and knee joints, bone plates, spinal fusion devices, dental implants

• Marine hardware: propeller shafts, subsea connectors, hydrofoils, fasteners

• Chemical process equipment: pressure vessels, reactors, pumps, valves

• Oil and gas downhole tools, drill collars, and logging instruments

• High-performance automotive, motorsport, and bicycle components

• Sports equipment, golf clubs, and bicycle frames

7. Available Product Forms from GNEE METAL

Product Form	Common Size Range	Typical Condition
Titanium Tube / Pipe	OD 3–219 mm; WT 0.3–20 mm	Seamless / welded; annealed or STA
Titanium Sheet / Plate	Thickness 0.3–60 mm; max width 2,000 mm	Annealed; pickled or polished
Titanium Bar / Rod	Dia. 3–300 mm; length per request	Annealed; centerless ground available
Titanium Wire	Dia. 0.1–6.0 mm	Annealed / cold drawn
Titanium Strip / Coil	Thickness 0.05–3.0 mm; width per request	Annealed
Forgings / Discs / Rings	Custom dimensions	Annealed; machined finish

8. Applicable Standards by Product Form

Product Form	Common Standards
Sheet, Strip & Plate	ASTM B265, AMS 4911, AMS 4907, AMS 4905
Bar & Billet	ASTM B348, AMS 4928, AMS 4930, AMS 4965, AMS 4967
Seamless & Welded Tube	ASTM B338, ASTM B861, ASTM B862, AMS 4941, AMS 4942
Fittings & Forgings	ASTM B363, ASTM B381, AMS 4920, AMS 4966
Wire	ASTM B863, AMS 4951, AMS 4954
Medical Implants (ELI)	ASTM F136 (Ti-6Al-4V ELI), ISO 5832-3

Disclaimer: The mechanical-property values in this datasheet are typical minima for mill-annealed Grade 5 (Ti-6Al-4V) titanium under the stated ASTM/AMS standards. STA, duplex-annealed, and other specialty tempers deliver different strength/ductility balances. Actual values may vary with product form, thickness/diameter, heat lot, and testing direction. Always request a Mill Test Report (MTR) for the specific heat and certify conformance to the required standard before purchase.

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