
7075 T6 Aluminum Aerospace Alloy – Technical Material Specification

1.0 Material Overview & Common Uses

7075 T6 is a precipitation-hardened aluminum alloy with zinc as the primary alloying element. It offers the highest strength of any commercially available aluminum alloy, comparable to many steels, while maintaining a low density. The T6 temper indicates solution heat-treated and artificially aged, providing maximum strength and hardness.

This alloy is the standard for aerospace structural components, including aircraft fuselage frames, wing spars, bulkheads, and landing gear parts. It is also used in high-performance automotive racing components, bicycle frames, rock climbing equipment, and tooling fixtures where high strength-to-weight ratio is critical.

2.0 Core Technical Properties & Sizing

- Density: 2.81 g/cm³ (0.1015 lb/in³)
- Ultimate Tensile Strength: 572 MPa (83,000 psi)
- Yield Strength (0.2% offset): 503 MPa (73,000 psi)
- Elongation at Break: 11% (in 50mm)
- Modulus of Elasticity: 71.7 GPa (10,400 ksi)
- Shear Strength: 331 MPa (48,000 psi)
- Fatigue Strength (5e8 cycles): 159 MPa (23,000 psi)
- Hardness: Brinell 150 (500 kg load, 10mm ball)
- Melting Point Range: 477°C to 635°C (890°F to 1175°F)
- Thermal Conductivity: 130 W/m·K at 25°C
- Coefficient of Thermal Expansion: 23.6 µm/m·°C (20-100°C)
- Electrical Resistivity: 5.15e-6 ohm·cm at 20°C
- Standard Stock Forms: Plate, sheet, bar, rod, tube, and extruded profiles
- Standard Plate Thickness Tolerances (per AMS-QQ-A-250/12): ±0.005 inches for thickness up to 0.250 inches; ±0.010 inches for 0.251-0.500 inches
- Flatness Tolerance: 0.005 inches per foot maximum deviation
- Surface Finish: As-rolled or machined, typical Ra 63 microinches maximum

3.0 Processing, Machinability & Application

7075 T6 is considered to have good machinability, rated at 70% of free-machining brass. It produces tight, continuous chips that require proper chip control. The alloy is abrasive to tooling due to its hardness, so carbide or diamond-coated tools are recommended for production runs. High-speed steel tools can be used for light cuts but will wear rapidly.

- Recommended Cutting Speed (Carbide): 300-600 SFM (90-180 m/min) for roughing; 600-900 SFM (180-275 m/min) for finishing

- Feed Rate: 0.005-0.015 inches per tooth (0.13-0.38 mm/tooth) for roughing; 0.002-0.005 inches per tooth (0.05-0.13 mm/tooth) for finishing
- Depth of Cut: Up to 0.200 inches (5 mm) for roughing; 0.010-0.050 inches (0.25-1.27 mm) for finishing
- Coolant: Flood coolant with water-soluble oil or synthetic coolant at 5-10% concentration; mist cooling acceptable for light cuts
- Tool Geometry: Use positive rake angles (10-15°) and sharp edges to reduce work hardening; polished flutes reduce chip adhesion
- Welding: Not recommended for structural applications due to risk of stress corrosion cracking; if required, use 5356 or 5556 filler and preheat to 150-200°C (300-400°F); post-weld aging may restore some strength
- Forming: Limited cold formability; hot forming at 200-300°C (400-570°F) improves ductility; bend radius should be at least 3x material thickness
- Heat Treatment: T6 temper is final; any subsequent heating above 100°C (212°F) will overage and reduce strength; stress relief at 120°C (250°F) for 2-4 hours is permissible
- Surface Treatment: Anodizing (Type II or III) is common for corrosion protection; hard anodizing increases wear resistance but reduces fatigue life by 10-20%

4.0 Common Defects & Quality Control

- Reject if any surface cracks, tears, or laps are visible under 5x magnification, especially in the rolling direction
- Reject if surface pitting exceeds 0.005 inch (0.13 mm) depth or 0.020 inch (0.5 mm) diameter
- Reject if intergranular corrosion is detected via metallographic examination per ASTM G110
- Reject if exfoliation corrosion is present on any surface (common in improperly heat-treated stock)
- Reject if flatness deviation exceeds 0.010 inches per foot (0.83 mm/m) on plate stock
- Reject if thickness is out of tolerance by more than ± 0.005 inches for nominal thickness under 0.250 inches
- Reject if hardness (Brinell) is below 140 or above 160, indicating incorrect temper
- Reject if electrical conductivity exceeds 32% IACS, indicating overaging or incorrect heat treatment
- Reject if ultrasonic inspection reveals any internal voids, inclusions, or delaminations exceeding 0.030 inch (0.76 mm) in diameter
- Reject if chemical composition deviates from AMS 4045 or QQ-A-250/12 limits for zinc (5.1-6.1%), magnesium (2.1-2.9%), copper (1.2-2.0%), or chromium (0.18-0.28%)

5.0 Storage, Handling & WHMIS Guidelines

T6 aluminum is stable under normal conditions but requires careful handling to prevent corrosion and mechanical damage. The material is classified under WHMIS as a hazardous product due to the potential for generating combustible dust during machining. Fine aluminum dust is a fire and explosion hazard.

- Store in a dry, climate-controlled environment with relative humidity below 50% and temperature between 10°C and 30°C (50°F to 86°F)
- Shelf life: Indefinite when stored properly; FIFO rotation recommended to avoid surface oxidation from prolonged storage
- Separate from copper, brass, and stainless steel to prevent galvanic corrosion; use plastic or wood dunnage
- WHMIS Classification: Flammable Solids (H228) for dust; Combustible Dust (H205) for fine particles; Specific Target Organ Toxicity (H335) for inhalation of fumes from welding or grinding
- Mandatory PPE: Safety glasses with side shields, cut-resistant gloves (ANSI A4 or higher), and steel-toed boots during handling
- During machining: Use local exhaust ventilation to capture dust; avoid creating airborne dust clouds; use spark-resistant tools and grounding to prevent static ignition

- Welding or grinding: Wear N95 or P100 respirator, welding helmet with appropriate shade, and flame-resistant clothing; ensure adequate ventilation
- Fire suppression: Use Class D extinguisher (dry powder) for aluminum fires; never use water, CO2, or foam as they can cause violent reactions
- First aid: For dust inhalation, move to fresh air; for skin contact, wash with soap and water; for eye contact, flush with water for 15 minutes; seek medical attention for persistent irritation
- Disposal: Recycle as scrap aluminum; do not dispose in landfill; follow local regulations for metal waste

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