
6061 T6 Aluminum Alloy Sheet and Extrusion – Technical Material Specification

1.0 Material Overview & Common Uses

6061 T6 aluminum is a precipitation-hardened wrought aluminum alloy in the 6000 series, containing magnesium and silicon as its primary alloying elements. The T6 temper indicates solution heat-treated and artificially aged condition, providing high strength-to-weight ratio, excellent corrosion resistance, and good machinability.

This material is widely used in structural applications, aerospace components, automotive parts, marine fittings, bicycle frames, and general fabrication. It is available in sheet, plate, and extruded profiles, making it a versatile choice for both prototyping and production runs.

- Common applications include truck and trailer frames, railings, scaffolding, electronic enclosures, and architectural trim.
- Preferred for welded assemblies where moderate strength and good corrosion resistance are required.

2.0 Core Technical Properties & Sizing

- Density: 2.70 g/cm³ (0.0975 lb/in³)
- Ultimate Tensile Strength: 310 MPa (45,000 psi) minimum
- Yield Strength (0.2% offset): 276 MPa (40,000 psi) minimum
- Elongation at Break: 12% minimum in 50 mm (2 in)
- Brinell Hardness: 95 HB (500 kg load, 10 mm ball)
- Melting Range: 582°C to 652°C (1,080°F to 1,205°F)
- Modulus of Elasticity: 68.9 GPa (10,000 ksi)
- Thermal Conductivity: 167 W/m·K at 25°C
- Electrical Resistivity: 0.040 x 10⁻⁶ Ω·m at 20°C
- Coefficient of Thermal Expansion: 23.6 µm/m·°C (20-100°C)
- Standard Sheet Thicknesses: 0.032 in (0.81 mm) to 0.250 in (6.35 mm) in increments of 0.032 in, 0.040 in, 0.050 in, 0.063 in, 0.080 in, 0.090 in, 0.100 in, 0.125 in, 0.160 in, 0.190 in, 0.250 in
- Standard Sheet Widths: 48 in (1,219 mm) and 60 in (1,524 mm); lengths: 96 in (2,438 mm) or 120 in (3,048 mm)
- Extrusion Tolerances per ASTM B221: Cross-sectional dimensions ±0.010 in for dimensions up to 3 in, ±0.015 in for 3-6 in, ±0.020 in for 6-10 in
- Flatness Tolerance for Sheet: 0.125 in over 48 in length (per ASTM B209)
- Thickness Tolerance for Sheet: ±0.005 in for 0.032-0.063 in, ±0.006 in for 0.064-0.125 in, ±0.008 in for 0.126-0.250 in

3.0 Processing, Machinability & Application

6061 T6 aluminum offers good machinability with a rating of 70% relative to free-cutting brass. It produces continuous chips that require proper chip breakers or high-pressure coolant. Carbide tooling is recommended for production runs, while high-speed steel (HSS) can be used for low-volume work.

- Recommended cutting speed for carbide tools: 600-1,000 surface feet per minute (SFM) for roughing, 800-1,200 SFM for finishing.
- Feed rate: 0.005-0.020 in/rev for turning; 0.002-0.010 in/tooth for milling.
- Use a 30-40 degree helix angle end mill for optimal chip evacuation in slotting and profiling.
- Flood coolant with water-soluble oil or mist coolant recommended to prevent built-up edge.
- Welding: Use ER4043 or ER5356 filler wire; preheat not required for sections under 1 in; use TIG or MIG with AC current and argon shielding gas.
- Post-weld heat treatment may be required to restore T6 properties in critical applications; natural aging at room temperature for 30 days yields T4 properties.
- Forming: Bend radius should be at least 2x material thickness for sheet; use progressive dies for complex shapes.
- Chemical etching and anodizing are common surface treatments; remove surface oxides before anodizing.

4.0 Common Defects & Quality Control

- Reject if surface scratches exceed 0.010 in depth or are visible after light sanding with 400 grit.
- Reject if delamination or blistering is visible on sheet edges.
- Reject if extrusion has visible die lines deeper than 0.005 in or surface pitting exceeding 0.003 in depth.
- Reject if flatness deviation exceeds 0.125 in over any 48 in length for sheet.
- Reject if thickness is outside specified tolerance range (see Section 2.0).
- Reject if extrusion twist exceeds 1 degree per 10 ft of length.
- Reject if chemical composition deviates from ASTM B209 (sheet) or ASTM B221 (extrusion) limits for Si, Fe, Cu, Mn, Mg, Cr, Zn, Ti.
- Reject if hardness is below 85 HB or above 105 HB.
- Acceptance sampling per ANSI/ASQ Z1.4 (AQL 1.0 for major defects, AQL 4.0 for minor defects).

5.0 Storage, Handling & WHMIS Guidelines

- Store in a dry, indoor environment with relative humidity below 60% to prevent surface oxidation.
- Temperature range: 10°C to 40°C; avoid condensation by allowing material to acclimate before unpacking.
- Shelf life: Indefinite under proper storage; FIFO recommended to avoid age-related surface staining.
- Separate from copper, brass, and steel to prevent galvanic corrosion; use plastic or wood dunnage.
- WHMIS Classification: Not classified as hazardous under WHMIS 2015 (no GHS pictograms required).
- Potential hazards: Sharp edges during cutting; fine dust from machining may be combustible.
- Mandatory PPE: Cut-resistant gloves (ANSI A2 or higher) when handling raw edges; safety glasses with side shields during cutting or grinding.
- Respiratory protection: Use N95 mask if machining generates airborne particles exceeding occupational exposure limits (OSHA PEL 15 mg/m³ total dust, 5 mg/m³ respirable).
- Fire safety: Aluminum dust is combustible; use Class D extinguisher (e.g., Met-L-X) for metal fires; do not use water.
- Spill procedure: Sweep up dry dust carefully to avoid airborne dispersion; dispose in sealed metal container.

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