

3003 H14 Aluminum Sheet – Technical Material Specification

1.0 Material Overview & Common Uses

3003 H14 aluminum is a non-heat-treatable wrought alloy composed primarily of aluminum (98.6% min) with 1.0–1.5% manganese as the principal alloying element. The H14 temper indicates a strain-hardened condition to a half-hard state, providing a good balance of strength and formability. This alloy is widely used in sheet form for applications requiring moderate strength, excellent corrosion resistance, and superior workability.

- Common applications include: chemical equipment, storage tanks, heat exchangers, roofing and siding, ductwork, kitchen equipment, and general sheet metal fabrication.
- Preferred for deep drawing, spinning, and bending operations due to its high ductility and low work-hardening rate compared to 1100 or 5052 alloys.

2.0 Core Technical Properties & Sizing

- Density: 2.73 g/cm³ (0.0986 lb/in³)
- Melting Range: 643–654 °C (1190–1210 °F)
- Tensile Strength (H14 temper): 150–200 MPa (22–29 ksi)
- Yield Strength (0.2% offset): 125–170 MPa (18–25 ksi)
- Elongation in 50 mm (2 in): 10–20% (depending on thickness)
- Hardness (Brinell): 40–50 HB
- Modulus of Elasticity: 69 GPa (10,000 ksi)
- Thermal Conductivity: 160 W/m·K (at 25 °C)
- Electrical Resistivity: $0.034 \times 10^{-6} \Omega \cdot m$ (at 20 °C)
- Standard Sheet Thicknesses: 0.016 in (0.406 mm) to 0.125 in (3.175 mm) in common increments (e.g., 0.025, 0.032, 0.040, 0.050, 0.063, 0.080, 0.090, 0.100 in)
- Standard Sheet Widths: 48 in (1219 mm) and 60 in (1524 mm); custom widths available up to 72 in (1829 mm)
- Standard Sheet Lengths: 96 in (2438 mm) and 120 in (3048 mm); custom lengths available
- Thickness Tolerance (per ASTM B209): ± 0.002 in for thicknesses up to 0.063 in; ± 0.003 in for 0.064–0.125 in
- Flatness Tolerance (per ASTM B209): Maximum deviation of 0.125 in over any 48 in length for sheets up to 0.063 in thick; 0.100 in for thicker sheets
- Width Tolerance: +0.125 in, -0.000 in for sheared edges; +0.0625 in, -0.000 in for sawed edges
- Length Tolerance: +0.250 in, -0.000 in for sheared ends; +0.125 in, -0.000 in for sawed ends

3.0 Processing, Machinability & Application

3003 H14 aluminum offers excellent machinability for a non-heat-treatable alloy, though it is softer than 6061 and can produce stringy chips if not properly controlled. It is highly formable and can be bent, drawn, spun, or stamped with minimal cracking. Welding is straightforward using common filler alloys.

- **Machining:** Use sharp, polished carbide or high-speed steel (HSS) tooling with positive rake angles (10–15°). Recommended cutting speed: 300–600 SFM (90–180 m/min) for turning; 200–400 SFM (60–120 m/min) for milling. Feed rate: 0.005–0.015 in/rev (0.13–0.38 mm/rev). Use flood coolant or mist to prevent chip welding.
- **Drilling:** Use a 118–135° point angle with a split point to reduce thrust. Speed: 200–400 SFM (60–120 m/min). Peck drilling recommended for holes deeper than 3× diameter.
- **Bending:** Minimum bend radius for 0.063 in thick sheet: 1× thickness (0.063 in) for 90° bends; 2× thickness for 180° bends. For thicker sheets, use 1.5–2× thickness.
- **Welding:** Gas Tungsten Arc Welding (GTAW/TIG) with 1100 or 4043 filler rod is preferred. Gas Metal Arc Welding (GMAW/MIG) with 4043 or 5356 wire is also common. Preheat not required for thicknesses under 0.5 in. Use argon shielding gas at 15–20 CFH.
- **Brazing:** Suitable with 4047 or 4343 filler alloys. Use flux to remove oxide layer. Brazing temperature range: 580–620 °C (1075–1150 °F).
- **Adhesive Bonding:** Clean surface with acetone or isopropyl alcohol. Use structural acrylic or epoxy adhesives. Surface preparation with mechanical abrasion (120–180 grit) improves bond strength.
- **Heat Treatment:** Not applicable for 3003 H14; the H14 temper is achieved by strain hardening. Annealing (O temper) can be done at 345 °C (650 °F) for 2–3 hours, followed by slow cooling.

4.0 Common Defects & Quality Control

- Reject if surface has visible scratches deeper than 0.002 in (0.05 mm) that cannot be removed by light sanding (180 grit).
- Reject if surface pits or gouges exceed 0.005 in (0.13 mm) depth or 0.125 in (3.2 mm) diameter.
- Reject if delamination or laminations are visible on sheared edges under 5× magnification.
- Reject if flatness deviation exceeds ASTM B209 limits: more than 0.125 in over 48 in for sheets ≤0.063 in thick; more than 0.100 in for thicker sheets.
- Reject if thickness is outside ±0.002 in for nominal thickness ≤0.063 in, or ±0.003 in for 0.064–0.125 in.
- Reject if width or length is outside specified tolerances: width +0.125 in / -0.000 in (sheared), +0.0625 in / -0.000 in (sawed); length +0.250 in / -0.000 in (sheared), +0.125 in / -0.000 in (sawed).
- Reject if edge burr height exceeds 0.010 in (0.25 mm) for sheared edges.
- Reject if oil staining or corrosion (white rust) covers more than 5% of the surface area.
- Reject if hardness (Brinell) is outside 40–50 HB range.
- Reject if tensile strength is below 150 MPa or above 200 MPa.

5.0 Storage, Handling & WHMIS Guidelines

- Store in a dry, indoor environment with relative humidity below 60% to prevent surface oxidation and white rust formation.
- Temperature range: 10–35 °C (50–95 °F). Avoid direct contact with concrete floors; use wooden pallets or rubber mats to prevent moisture wicking.
- Shelf life: Indefinite under proper storage conditions. Use FIFO (First In, First Out) to minimize surface handling marks and oxidation from prolonged storage.
- Separate sheets with interleaving paper or plastic film to prevent scratching. Do not stack heavy loads on thin sheets (≤0.040 in) to avoid permanent deformation.
- WHMIS Classification: Not classified as a hazardous material under WHMIS 2015. However, dust and fumes from machining or welding may be hazardous.
- WHMIS Hazard Statements: H372 (May cause damage to lungs through prolonged or repeated inhalation of aluminum dust). H335 (May cause respiratory irritation from fine airborne particles).
- Mandatory PPE: Safety glasses with side shields, cut-resistant gloves (ANSI A2 or higher) when handling sheet edges,

and steel-toed boots. For machining/welding: use N95 respirator or local exhaust ventilation to control airborne aluminum dust/fume.

- First Aid: For dust inhalation, move to fresh air. For skin contact with sharp edges, clean wound and apply antiseptic. For eye contact with dust, flush with water for 15 minutes.
- Spill Procedure: Sweep up dry aluminum chips/dust using non-sparking tools. Do not use compressed air for cleaning to avoid airborne dust. Dispose in sealed metal containers.
- Fire Hazard: Aluminum dust is combustible. Avoid creating dust clouds. In case of fire, use Class D extinguisher (dry powder) or sand. Do not use water.

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