

ER4043 Aluminum MIG/TIG Welding Wire Technical Material Specification

1.0 Material Overview & Common Uses

ER4043 is a general-purpose aluminum-silicon filler alloy (nominal composition: 5% Si, balance Al) used for MIG and TIG welding of 2xxx, 3xxx, 5xxx, 6xxx, and cast aluminum alloys. It offers excellent fluidity, crack resistance, and corrosion resistance, making it the most widely used aluminum filler metal in fabrication, automotive repair, marine components, and structural assemblies.

- Primary applications: welding of 6061, 6063, 3003, 356.0, and 319.0 aluminum alloys.
- Common end uses: truck bodies, boat hulls, piping, heat exchangers, railings, and architectural extrusions.
- Not recommended for welding 5xxx series alloys (e.g., 5083, 5052) due to potential for reduced ductility in service.

2.0 Core Technical Properties & Sizing

- Density: 2.69 g/cm³ (0.097 lb/in³)
- Melting range: 573°C to 625°C (1065°F to 1157°F)
- Tensile strength (as-welded): 170–200 MPa (25–29 ksi)
- Elongation in 2 inches: 8–18% depending on base metal and heat treatment
- Hardness (Brinell): 45–55 HB
- Standard wire diameters: 0.030 in (0.8 mm), 0.035 in (0.9 mm), 0.045 in (1.2 mm), 1/16 in (1.6 mm), 3/32 in (2.4 mm)
- Diameter tolerance: ±0.001 in (0.025 mm) for diameters up to 0.045 in; ±0.002 in (0.05 mm) for larger diameters
- Packaging: 1 lb (0.45 kg) spools, 10 lb (4.5 kg) spools, 33 lb (15 kg) spools, and 60 lb (27 kg) bulk reels
- Cast and helix: maximum cast of 15 in (380 mm) and maximum helix of 1 in (25 mm) per AWS A5.10

3.0 Processing, Machinability & Application

ER4043 is designed for gas metal arc welding (GMAW/MIG) and gas tungsten arc welding (GTAW/TIG) processes. It feeds smoothly through standard aluminum drive rolls and requires proper shielding gas selection for optimal arc stability and weld quality.

- Shielding gas: 100% argon (recommended) or argon-helium mixtures (25–75% He) for thicker sections.
- MIG parameters (0.035 in wire): 150–200 A, 19–23 V, wire feed speed 300–500 in/min (7.6–12.7 m/min).
- MIG parameters (0.045 in wire): 180–250 A, 22–26 V, wire feed speed 250–400 in/min (6.4–10.2 m/min).
- TIG parameters (1/16 in wire): 100–180 A AC, 15–20 V, argon flow 15–25 CFH (7–12 L/min).
- Pre-weld cleaning: Remove oxide layer with stainless steel brush (dedicated to aluminum) and degrease with acetone or isopropyl alcohol.
- Contact tip setback: 0.5–1.0 in (12–25 mm) for MIG to prevent burnback.
- Drive rolls: Use U-groove or knurled rolls designed for aluminum; maintain 10–15% less tension than steel wire.

- Post-weld cleaning: Remove flux residue (if any) with warm water and wire brush; no heat treatment required for most applications.

4.0 Common Defects & Quality Control

- Reject wire if surface exhibits longitudinal scratches, pits, or die marks deeper than 0.001 in (0.025 mm).
- Reject if cast exceeds 15 in (380 mm) or helix exceeds 1 in (25 mm) per AWS A5.10.
- Reject if wire diameter is outside ± 0.001 in tolerance for sizes ≤ 0.045 in, or ± 0.002 in for larger sizes.
- Reject if spool has kinks, bird-nesting, or tangles that prevent free feeding.
- Reject if chemical composition deviates from AWS A5.10 limits: Si 4.5–6.0%, Fe $\leq 0.8\%$, Cu $\leq 0.3\%$, Mn $\leq 0.05\%$, Mg $\leq 0.05\%$, Zn $\leq 0.10\%$, Ti $\leq 0.20\%$, Al balance.
- Acceptable porosity in weld: maximum 3 pores per linear inch, each ≤ 0.03 in (0.8 mm) diameter per AWS D1.2.
- Reject weld if cracking (centerline or crater) is visible under 10x magnification.

5.0 Storage, Handling & WHMIS Guidelines

ER4043 wire is non-hazardous in solid form, but welding fumes contain aluminum oxide and silicon compounds that require ventilation and respiratory protection. Follow WHMIS 2015 requirements for handling and storage.

- Store in original packaging in a dry, climate-controlled environment (temperature 10–30°C, relative humidity <50%).
- Shelf life: indefinite if stored properly; discard if wire shows white oxidation powder or surface corrosion.
- Use FIFO (first-in, first-out) inventory rotation to prevent long-term storage degradation.
- WHMIS classification: Not classified as hazardous in solid form. Welding fume is classified as a hazardous substance (CAS 1344-28-1 for aluminum oxide).
- Mandatory PPE during welding: Welding helmet with shade 10–12 filter, flame-resistant gloves, leather apron, and hearing protection.
- Respiratory protection: Use NIOSH-approved N95 or P100 respirator if ventilation is inadequate; local exhaust ventilation recommended.
- First aid: For eye contact, flush with water for 15 minutes. For skin contact, wash with soap and water. For fume inhalation, move to fresh air and seek medical attention if symptoms persist.
- Spill procedure: Sweep or vacuum solid wire; do not use compressed air to avoid airborne particles.

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