ER5356 Aluminum MIG/TIG Welding Wire Technical Material Specification

1.0 Material Overview & Common Uses

ER5356 is a non-heat-treatable aluminum-magnesium alloy welding wire (nominal composition: Al balance, Mg 4.5-5.5%, Mn 0.05-0.20%, Cr 0.05-0.20%, Ti 0.06-0.20%, Si ≤0.25%, Fe ≤0.40%, Cu ≤0.10%, Zn ≤0.10%) designed for gas metal arc welding (GMAW/MIG) and gas tungsten arc welding (GTAW/TIG) of aluminum alloys. It offers high strength, good corrosion resistance, and excellent color match after anodizing, making it the preferred filler metal for marine, automotive, structural, and architectural applications.

- Primary applications: welding of 5xxx series alloys (e.g., 5052, 5083, 5086, 5456), 6xxx series alloys (e.g., 6061, 6063) when higher weld strength is required, and dissimilar joints between 5xxx and 6xxx alloys.
- Common end uses: boat hulls and decks, truck trailers, railcars, pressure vessels, storage tanks, piping systems, structural beams, and architectural railings.
- Not recommended for welding 2xxx or 7xxx series alloys due to risk of hot cracking or reduced mechanical properties.

2.0 Core Technical Properties & Sizing

- Density: 2.64 g/cm³ (0.095 lb/in³) at 20°C.
- Melting range: 571°C to 635°C (1060°F to 1175°F).
- Tensile strength (as-welded): typically 270-310 MPa (39-45 ksi).
- Yield strength (as-welded): typically 120-180 MPa (17-26 ksi).
- Elongation in 2 inches (as-welded): 17-25%.
- Hardness: approximately 70-80 HB (Brinell) in the as-welded condition.
- Electrical conductivity: approximately 29% IACS (International Annealed Copper Standard).
- Standard wire diameters: 0.030 in (0.8 mm), 0.035 in (0.9 mm), 0.045 in (1.2 mm), 0.062 in (1.6 mm), 0.094 in (2.4 mm), 0.125 in (3.2 mm).
- Diameter tolerance: ±0.001 in (0.025 mm) for diameters ≤0.062 in; ±0.002 in (0.05 mm) for larger diameters per AWS A5.10.
- Standard packaging: 1 lb (0.45 kg) spools, 10 lb (4.5 kg) spools, 30 lb (13.6 kg) spools, 60 lb (27.2 kg) coils, and 500 lb (227 kg) drums.
- Cast and helix: cast diameter must be 15-25 in (380-635 mm) for spooled wire; helix (offset) must not exceed 1 in (25 mm) per 10 ft (3 m) of wire.

3.0 Processing, Machinability & Application

ER5356 is a free-feeding aluminum wire with good arc stability and low spatter when using proper parameters. It requires clean, dry shielding gas (100% argon for MIG, 100% argon or argon-helium mixes for TIG) and a clean base material free of oxides, oil, and moisture. The wire is not machined in the traditional sense but is consumed during welding; however, the deposited weld metal can be machined or ground using standard aluminum tooling.

- MIG welding parameters (0.045 in / 1.2 mm wire): wire feed speed 250-450 in/min (6.4-11.4 m/min), voltage 22-26 V, current 180-280 A, gas flow 25-35 CFH (12-17 L/min).

- TIG welding parameters (0.062 in / 1.6 mm wire): current 180-250 A (AC), gas flow 15-25 CFH (7-12 L/min), use 2% thoriated or lanthanated tungsten electrode.
- Pre-weld cleaning: remove oxide layer using stainless steel brush (dedicated to aluminum) or chemical etch; degrease with acetone or isopropyl alcohol.
- Post-weld cleaning: brush weld with stainless steel brush and rinse with water to remove flux residues if any; for anodized finishes, mechanical polishing may be required.
- Machining of weld deposits: use sharp carbide or polycrystalline diamond (PCD) tools with positive rake angles; recommended cutting speed 600-1200 SFM (180-365 m/min), feed 0.005-0.015 in/rev (0.13-0.38 mm/rev).
- Not recommended for heat treatment after welding; strength is derived from magnesium content and strain hardening.

4.0 Common Defects & Quality Control

- Reject wire if surface exhibits longitudinal scratches, die marks, or gouges deeper than 0.001 in (0.025 mm) per AWS A5.10.
- Reject if wire has kinks, birdcaging, or tangling that prevents free feeding through standard conduit and gun liners.
- Reject spools if the wire cast diameter is outside 15-25 in (380-635 mm) or helix exceeds 1 in (25 mm) per 10 ft (3 m).
- Reject if visible surface oxidation (white or gray powder) covers more than 10% of the wire surface on a 1 ft (0.3 m) sample.
- Reject if chemical composition deviates from AWS A5.10 limits: Mg 4.5-5.5%, Mn 0.05-0.20%, Cr 0.05-0.20%, Ti 0.06-0.20%, Si ≤0.25%, Fe ≤0.40%, Cu ≤0.10%, Zn ≤0.10%.
- Reject if tensile strength of deposited weld metal (all-weld-metal test specimen) is below 270 MPa (39 ksi) or elongation below 17%.
- Reject if weld metal exhibits porosity exceeding 5 pores per linear inch (2.5 cm) with diameter >0.020 in (0.5 mm) on a radiograph per ASTM E155.
- Reject if wire diameter is out of tolerance: ±0.001 in (0.025 mm) for diameters ≤0.062 in; ±0.002 in (0.05 mm) for larger diameters.

5.0 Storage, Handling & WHMIS Guidelines

- Store in original sealed packaging in a dry, climate-controlled environment at 15-25°C (59-77°F) and relative humidity below 50%.
- Shelf life: indefinite if stored properly; however, use within 2 years of manufacture for optimal feeding and weld quality. Implement FIFO (First-In, First-Out) inventory rotation.
- Do not store near acids, alkalis, or chlorinated solvents that can cause corrosion or contamination.
- WHMIS classification: Not classified as a hazardous product under WHMIS 2015 when in solid wire form. However, welding fumes generated during use are classified as hazardous.
- Welding fume hazards: may contain aluminum oxide, magnesium oxide, and trace metal fumes. Exposure limits: ACGIH TLV-TWA for aluminum oxide fume is 5 mg/m³ (respirable), for magnesium oxide fume is 10 mg/m³ (inhalable).
- Mandatory PPE during welding: welding helmet with appropriate shade (10-12 for MIG, 9-11 for TIG), flame-resistant clothing, welding gloves, and hearing protection. Use local exhaust ventilation or respiratory protection (N95 or P100 respirator) if ventilation is inadequate.
- Handling PPE: cut-resistant gloves and safety glasses when handling spools or coils to avoid cuts from wire ends.
- Spill and disposal: collect loose wire and place in designated metal recycling container. Do not incinerate. Follow local regulations for disposal of welding consumables.

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