

ER70S-6 MIG Welding Solid Wire Technical Material Specification

1.0 Material Overview & Common Uses

ER70S-6 is a copper-coated, solid carbon steel filler wire designed for gas metal arc welding (GMAW) of mild and low-alloy steels. It is classified under AWS A5.18 and is the most widely used MIG wire in general fabrication due to its high deoxidizer content (silicon and manganese), which provides excellent weld quality on rusty, oily, or scaled base materials.

Common applications include automotive repair, structural steel fabrication, pipe welding, heavy equipment manufacturing, and shipbuilding. It is suitable for single-pass and multi-pass welding on carbon steel up to 80 ksi tensile strength, and is often used with 75% Argon / 25% CO₂ shielding gas for optimal arc stability and minimal spatter.

2.0 Core Technical Properties & Sizing

- AWS Classification: ER70S-6 per AWS A5.18 / ASME SFA-5.18
- Wire Diameter Options: 0.023 in (0.6 mm), 0.030 in (0.8 mm), 0.035 in (0.9 mm), 0.045 in (1.1 mm), 0.052 in (1.3 mm), 1/16 in (1.6 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
- Copper Coating Thickness: 0.0001 to 0.0003 in (2.5 to 7.6 μm) nominal
- Chemical Composition (wt%): Carbon 0.06-0.15, Manganese 1.40-1.85, Silicon 0.80-1.15, Phosphorus ≤ 0.025 , Sulfur ≤ 0.035 , Copper (coating) ≤ 0.50
- Tensile Strength (as-welded): Minimum 70,000 psi (480 MPa)
- Yield Strength (as-welded): Minimum 60,000 psi (415 MPa)
- Elongation in 2 in: Minimum 22%
- Impact Toughness: 20 ft-lbf (27 J) minimum at -20°F (-29°C) per Charpy V-notch
- Density: 7.85 g/cm³ (0.284 lb/in³)
- Melting Range: 2,600-2,750°F (1,427-1,510°C)
- Standard Packaging: 2 lb (0.9 kg) spools, 10 lb (4.5 kg) spools, 33 lb (15 kg) spools, 60 lb (27 kg) coils, 500 lb (227 kg) drums
- Spool Dimensions: 4 in (100 mm) ID x 1.125 in (28.6 mm) arbor hole for small spools; 12 in (305 mm) ID for bulk drums

3.0 Processing, Machinability & Application

ER70S-6 is designed for automatic or semi-automatic GMAW using direct current electrode positive (DCEP). It feeds smoothly through standard MIG guns and liners. The high silicon and manganese content improves wetting action and reduces porosity on contaminated surfaces. No preheat is typically required for thicknesses under 1 in (25 mm) unless ambient temperature is below 32°F (0°C).

- Shielding Gas: 75% Argon / 25% CO₂ (C25) recommended for short-circuit transfer; 90% Argon / 10% CO₂ for spray transfer; 100% CO₂ acceptable but increases spatter.
- Gas Flow Rate: 20-30 CFH (9-14 L/min) for indoor use; increase to 35-45 CFH (16-21 L/min) in drafty conditions.

- Wire Feed Speed (0.035 in diameter): 200-600 in/min (5-15 m/min) for short-circuit; 600-1,200 in/min (15-30 m/min) for spray transfer.
- Voltage Range (0.035 in diameter): 16-22 V for short-circuit; 24-30 V for spray transfer.
- Amperage Range (0.035 in diameter): 90-180 A for short-circuit; 180-350 A for spray transfer.
- Contact Tip to Work Distance (CTWD): 3/8 to 5/8 in (10-16 mm) for short-circuit; 1/2 to 3/4 in (13-19 mm) for spray transfer.
- Travel Speed: 10-30 in/min (4-13 mm/s) depending on material thickness and joint configuration.
- Preheat and Interpass Temperature: Not required for thicknesses ≤ 1 in (25 mm); for thicker sections, preheat to 150-300°F (66-149°C) per AWS D1.1.
- Post-Weld Heat Treatment: Not required for most applications; stress relief may be performed at 1,100-1,200°F (593-649°C) if specified by code.
- Tooling: Use U-groove or V-groove drive rolls designed for solid wire; replace contact tips when bore wear exceeds 0.005 in (0.13 mm) over nominal diameter.

4.0 Common Defects & Quality Control

- Reject wire if copper coating is flaking, peeling, or missing in continuous lengths exceeding 12 in (305 mm).
- Reject if surface rust, pitting, or oxidation is visible on the wire under 10x magnification.
- Reject if wire diameter is out of tolerance by more than ± 0.002 in (0.05 mm) at any point along a 10 ft (3 m) sample.
- Reject if cast (helix diameter) is less than 15 in (381 mm) or greater than 50 in (1,270 mm) when measured per AWS A5.18.
- Reject if wire exhibits kinks, bird-nesting, or tangling that prevents smooth feeding through a standard 10 ft (3 m) MIG gun cable.
- Reject if chemical composition deviates from specified ranges per certified mill test report (MTR).
- Reject if tensile strength of deposited weld metal is below 70,000 psi (480 MPa) on a transverse weld test coupon.
- Reject if weld metal exhibits porosity, slag inclusions, or lack of fusion in a visual inspection per AWS D1.1 acceptance criteria.
- Reject if spatter index exceeds 1.5 times the manufacturer's published baseline when tested under standard conditions (250 A, 26 V, C25 gas).
- Reject if packaging is damaged, exposing wire to moisture or contaminants; spools must be sealed in vacuum-pack or with desiccant.

5.0 Storage, Handling & WHMIS Guidelines

ER70S-6 wire is not classified as a hazardous material under WHMIS 2015 in its solid form, but welding fumes generated during use contain hazardous substances. Storage must prevent moisture absorption and copper coating degradation.

- Store in a dry, climate-controlled environment at 40-80°F (4-27°C) and relative humidity below 60%.
- Keep wire in original sealed packaging until ready for use; once opened, use within 30 days or store in a heated cabinet at 100-120°F (38-49°C).
- Implement FIFO (First-In, First-Out) inventory rotation; shelf life is 2 years from date of manufacture when stored properly.
- Do not store near acids, solvents, or chlorine-based compounds that can corrode the copper coating.
- WHMIS Classification (welding fumes): Not classified as a dangerous good in solid form; fumes are classified as carcinogenic (Category 1A) per GHS.
- Hazard Statements (fumes): H350 (May cause cancer), H372 (Causes damage to lungs through prolonged or repeated inhalation), H335 (May cause respiratory irritation).
- Precautionary Statements: P201 (Obtain special instructions before use), P202 (Do not handle until all safety precautions

have been read and understood), P260 (Do not breathe fumes), P271 (Use only outdoors or in a well-ventilated area), P284 (Wear respiratory protection).

- Mandatory PPE during welding: Welding helmet with appropriate shade filter (shade 10-13), flame-resistant clothing, welding gloves, leather apron, and steel-toed boots.
- Respiratory Protection: Use NIOSH-approved N95 or P100 respirator when ventilation is inadequate; use supplied-air respirator in confined spaces.
- Ventilation: Local exhaust ventilation required to maintain fume levels below ACGIH TLV of 5 mg/m³ (total fume) and 0.05 mg/m³ (manganese).
- First Aid: For fume inhalation, move to fresh air; if symptoms persist, seek medical attention. For eye contact with wire dust, flush with water for 15 minutes.
- Spill Procedure: Sweep or vacuum spilled wire; do not use compressed air to clean up fine wire fragments.
- Disposal: Recycle scrap wire as ferrous metal; do not incinerate copper-coated wire.

Regulatory Disclaimer: This document is a generic technical material specification provided for educational purposes. The end-user assumes all liability for reviewing, adapting, and validating all tolerances, properties, and safety protocols against specific OEM data sheets and local regulations before deployment.