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# E7018 Low Hydrogen Stick Welding Electrode – Technical Material Specification

## 1.0 Material Overview & Common Uses

E7018 is a low hydrogen, iron powder, mild steel stick welding electrode classified under AWS A5.1 / ASME SFA-5.1. The electrode features a low moisture content coating that minimizes hydrogen-induced cracking in the weld deposit, making it suitable for high-strength and restrained joints. It is designed for all-position welding (flat, horizontal, vertical up, and overhead) using direct current reverse polarity (DCEP) or alternating current (AC).

- Primary applications include structural steel fabrication, pressure vessel welding, heavy equipment repair, shipbuilding, and pipeline construction where low hydrogen levels are critical.
- Commonly used on carbon steel grades such as A36, A572, A516, and A588, as well as on high-strength low-alloy (HSLA) steels.
- Preferred for welding thick sections, highly restrained joints, and applications requiring Charpy V-notch impact toughness at subzero temperatures (e.g., -20°F or -29°C).

## 2.0 Core Technical Properties & Sizing

- AWS Classification: E7018 (E indicates electrode, 70 indicates 70,000 psi minimum tensile strength, 1 indicates all-position, 8 indicates low hydrogen coating with iron powder).
- Typical weld metal tensile strength: 70,000 – 80,000 psi (483 – 552 MPa).
- Yield strength: 58,000 – 65,000 psi (400 – 448 MPa).
- Elongation in 2 inches: 22% minimum.
- Charpy V-notch impact toughness: 20 ft-lbs (27 J) minimum at -20°F (-29°C) typical.
- Standard diameters: 1/16" (1.6 mm), 5/64" (2.0 mm), 3/32" (2.4 mm), 1/8" (3.2 mm), 5/32" (4.0 mm), 3/16" (4.8 mm), and 1/4" (6.4 mm).
- Standard length: 14 inches (356 mm) for diameters up to 3/16", 18 inches (457 mm) for larger diameters.
- Coating type: Low hydrogen, iron powder, rutile-basic flux coating.
- Moisture content (as manufactured): ≤ 0.6% by weight (per AWS A5.1).
- Operating current range (typical for 1/8" electrode): 90 – 160 amps DCEP or AC.
- Polarity: Direct Current Electrode Positive (DCEP) preferred; Alternating Current (AC) acceptable with minimum open-circuit voltage of 80V.

## 3.0 Processing, Machinability & Application

E7018 electrodes require proper storage and conditioning to maintain low hydrogen levels. The electrode coating absorbs moisture from the air, which can lead to hydrogen-induced cracking. Preheating and interpass temperature control are often required for thick sections or high-strength steels.

- Storage: Store in a heated cabinet at 250°F – 300°F (121°C – 149°C) after opening the hermetically sealed container. Electrodes exposed to ambient air for more than 4 hours must be reconditioned.

- Reconditioning: Bake at 500°F – 700°F (260°C – 371°C) for 1 hour, then store at 250°F – 300°F until use. Do not exceed 800°F (427°C) to avoid coating damage.
- Preheat temperature: Typically 50°F – 300°F (10°C – 149°C) depending on base metal thickness, carbon equivalent, and ambient conditions. Refer to AWS D1.1 or project WPS.
- Interpass temperature: Maintain between 150°F – 350°F (66°C – 177°C) for most applications.
- Welding technique: Use a short arc length (1/8" – 3/16" or 3 – 5 mm) to minimize atmospheric contamination. Travel angle: 5° – 15° drag for flat and horizontal positions; 0° – 10° push for vertical up.
- Typical deposition rate (1/8" electrode at 130 amps): 2.5 – 3.5 lbs per hour (1.1 – 1.6 kg/h).
- Slag removal: Easy, self-peeling slag. Use a chipping hammer and wire brush between passes.
- Post-weld heat treatment (PWHT): Not typically required for thicknesses under 1.5 inches (38 mm) unless specified by code.

## 4.0 Common Defects & Quality Control

- Reject electrodes with cracked or chipped coating exposing more than 1/4" (6 mm) of core wire.
- Reject electrodes with visible rust or pitting on the core wire.
- Reject electrodes that have been exposed to ambient air for more than 4 hours without reconditioning (unless used within that window).
- Reject electrodes that have been reconditioned more than 3 times (coating degradation).
- Reject if the coating is soft, crumbly, or shows signs of moisture absorption (e.g., white powdery residue).
- Reject if the electrode diameter deviates more than  $\pm 0.005$ " (0.13 mm) from nominal.
- Reject if the electrode length deviates more than  $\pm 1/4$ " (6 mm) from standard.
- In weld deposit: reject if hydrogen-induced cracking (HIC) is detected via visual inspection or NDT (e.g., magnetic particle or dye penetrant).
- In weld deposit: reject if porosity exceeds 1/16" (1.6 mm) diameter or more than 3 pores per linear inch (25 mm) of weld.
- In weld deposit: reject if slag inclusions exceed 1/32" (0.8 mm) width or are longer than 1/8" (3 mm).

## 5.0 Storage, Handling & WHMIS Guidelines

- Store in original hermetically sealed containers in a dry, climate-controlled environment below 50% relative humidity and between 60°F – 80°F (15°C – 27°C).
- Once opened, transfer electrodes to a heated holding oven at 250°F – 300°F (121°C – 149°C) within 30 minutes.
- Electrodes removed from the oven but not used within 4 hours must be returned to the oven or reconditioned.
- Shelf life: 2 years from date of manufacture when stored in unopened containers under recommended conditions.
- FIFO protocol: Use oldest stock first; label containers with receipt date and oven exposure log.
- WHMIS 2015 Classification: Not classified as hazardous under normal use, but welding fume is classified as carcinogenic (IARC Group 1).
- Hazard statements: H315 (Causes skin irritation), H319 (Causes serious eye irritation), H335 (May cause respiratory irritation), H372 (Causes damage to lungs through prolonged or repeated exposure via inhalation of welding fume).
- Precautionary statements: P261 (Avoid breathing dust/fume/gas/mist/vapours/spray), P264 (Wash hands thoroughly after handling), P271 (Use only outdoors or in a well-ventilated area), P280 (Wear protective gloves/protective clothing/eye protection/face protection).
- Mandatory PPE: Welding helmet with appropriate shade lens (shade 10-12 for arc welding), flame-resistant welding jacket or apron, welding gloves (leather), safety glasses with side shields, and hearing protection if noise levels exceed 85 dBA.
- Respiratory protection: Use NIOSH-approved N95 or P100 respirator when ventilation is inadequate or when welding in confined spaces.

- Ventilation: Use local exhaust ventilation (LEV) to maintain fume levels below ACGIH TLV of 5 mg/m<sup>3</sup> (as welding fume, total particulate).
- First aid: For eye contact, flush with water for 15 minutes. For skin contact, wash with soap and water. For inhalation, move to fresh air and seek medical attention if symptoms persist.
- Spill/disposal: Collect spilled electrodes and dispose of as non-hazardous industrial waste. Do not incinerate.

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