
E6010 Cellulose Stick Welding Electrode – Technical Material Specification

1.0 Material Overview & Common Uses

E6010 is a high-cellulose sodium-based stick welding electrode classified under AWS A5.1. The electrode coating contains approximately 30-40% cellulose, which decomposes during welding to produce a shielding gas that protects the weld pool. It is designed for use with direct current electrode positive (DCEP) polarity and is known for its deep penetration and fast-freezing slag characteristics.

Common industrial applications include pipeline welding, structural steel fabrication, shipbuilding, and repair welding where high-strength joints and the ability to weld through rust, scale, or moisture are required. It is particularly favoured for root passes in pipe welding due to its excellent arc control and ability to produce sound welds in all positions.

2.0 Core Technical Properties & Sizing

- AWS Classification: A5.1 E6010
- Tensile Strength (as-welded): Minimum 60,000 psi (414 MPa)
- Yield Strength: Minimum 50,000 psi (345 MPa)
- Elongation in 2 inches: Minimum 22%
- Impact Toughness (Charpy V-notch at -20°F): Minimum 20 ft-lbs (27 J)
- Electrode Diameters Available: 1/16 in (1.6 mm), 5/64 in (2.0 mm), 3/32 in (2.4 mm), 1/8 in (3.2 mm), 5/32 in (4.0 mm), 3/16 in (4.8 mm)
- Standard Length: 14 inches (356 mm) for diameters up to 3/32 in; 18 inches (457 mm) for diameters 1/8 in and above
- Core Wire Composition: Low-carbon steel with manganese and silicon additions
- Coating Thickness: Approximately 1.0-1.5 mm, cellulose-based with sodium silicate binder
- Polarity: Direct Current Electrode Positive (DCEP) only
- Storage Condition (unopened): Store in dry environment below 50% relative humidity, temperature 10-30°C
- Shelf Life: 2 years from date of manufacture when stored properly in sealed containers

3.0 Processing, Machinability & Application

E6010 electrodes are used exclusively in shielded metal arc welding (SMAW). The high cellulose content produces a voluminous gas shield that protects the weld pool, but also generates significant spatter and fumes. Proper technique and parameter control are essential to achieve sound welds.

- Welding Current Range (DCEP): 1/8 in (3.2 mm) electrode: 75-120 A; 5/32 in (4.0 mm): 110-160 A; 3/16 in (4.8 mm): 140-200 A
- Arc Voltage: 22-28 V typical, depending on electrode diameter and welding position
- Travel Speed: 10-20 inches per minute (4-8 mm/s) for flat position; slower for vertical and overhead
- Stickout Length: 1/4 to 3/8 inch (6-10 mm) for optimal arc control

- Preheat Requirements: Not typically required for thicknesses under 1 inch (25 mm); for thicker sections or high-restraint joints, preheat to 100-200°F (38-93°C) to reduce hydrogen cracking risk
- Interpass Temperature: Maintain below 500°F (260°C) to avoid excessive heat input and loss of toughness
- Welding Positions: All positions (flat, horizontal, vertical-up, overhead) – excellent for vertical-up root passes
- Slag Removal: Slag is fast-freezing and easily removed with a chipping hammer and wire brush; light grinding may be needed for multi-pass welds
- Fume Extraction: Mandatory local exhaust ventilation or fume extraction system due to high cellulose decomposition fumes containing carbon monoxide and hydrogen
- Post-Weld Heat Treatment: Not required for most applications; however, for high-strength steels or critical service, stress relief at 1100-1200°F (593-649°C) may be specified

4.0 Common Defects & Quality Control

- Reject if electrode coating shows cracks, chips, or delamination exceeding 1/8 inch (3 mm) in length or depth
- Reject if core wire is exposed at the tip or along the length due to coating damage
- Reject if electrode has been exposed to moisture (e.g., condensation, wet storage) – cellulose coating is hygroscopic and moisture causes hydrogen cracking
- Reject if diameter tolerance exceeds ± 0.005 inch (0.13 mm) from nominal
- Reject if length tolerance exceeds $\pm 1/4$ inch (6 mm) from standard length
- Reject if coating is soft, powdery, or shows signs of degradation (e.g., discoloration, mould)
- Reject if electrode has been subjected to temperatures above 50°C (122°F) for extended periods, which can degrade the cellulose binder
- Reject if the electrode fails to produce a stable arc during qualification testing (e.g., excessive spatter, arc blow, or erratic burn-off)
- Reject if weld deposit fails to meet minimum tensile strength or impact toughness requirements per AWS A5.1
- Reject if visual inspection reveals excessive porosity, slag inclusions, or lack of fusion in test welds

5.0 Storage, Handling & WHMIS Guidelines

E6010 electrodes are classified as hazardous materials under WHMIS 2015 due to the cellulose coating and welding fume hazards. Proper storage, handling, and disposal procedures must be followed to ensure worker safety and material integrity.

- WHMIS Classification: Combustible dust (cellulose), toxic fumes (carbon monoxide, hydrogen, metal oxides) during welding
- Hazard Statements: H228 (Combustible solid), H315 (Skin irritation), H319 (Eye irritation), H335 (Respiratory irritation), H373 (May cause damage to lungs through prolonged exposure to fumes)
- Precautionary Statements: P210 (Keep away from heat/sparks/open flames), P261 (Avoid breathing dust/fumes), P280 (Wear protective gloves/eye protection), P304+P340 (IF INHALED: Remove to fresh air), P501 (Dispose of contents/container in accordance with local regulations)
- Mandatory PPE: Welding helmet with appropriate shade filter (shade 10-12), flame-resistant welding jacket, welding gloves (leather), safety glasses under helmet, hearing protection, and respirator (N95 or better) when ventilation is inadequate
- Storage Conditions: Store in original sealed containers in a dry, climate-controlled area (10-30°C, <50% RH). Do not store near combustibles or heat sources.
- Shelf Life: 2 years from date of manufacture in unopened containers. Once opened, use within 6 months if stored properly.
- FIFO Protocol: Rotate stock using first-in-first-out; label containers with receipt date and use-by date
- Disposal: Unused or expired electrodes should be disposed of as industrial waste per local regulations. Do not incinerate

due to cellulose content.

- **Spill Procedure:** Sweep up dry material (avoid dust generation) and place in sealed container for disposal. Do not flush to drains.
- **First Aid:** For fume inhalation, move to fresh air and seek medical attention if symptoms persist. For skin contact, wash with soap and water. For eye contact, flush with water for 15 minutes.

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