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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5031D
Superseding AMS 5031C

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WELDING ELECTRODES, COVERED, STEEL 0.07 - 0.15C

1. SCOPE:

1.1 Form: This specification covers a low-carbon steel in the form of covered welding electrodes.

1.2 Application: Primarily for use as filler metal for metal arc welding of low-carbon steels.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tension Testing of Metallic Materials
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Specifications:

MIL-W-10430 - Welding Rods and Electrodes, Preparation for Delivery of

2.4 AWS Publications: Available from American Welding Society, P.O. Box 351040, Miami, FL 33135.

AWS A5.1 - Mild Steel Covered Arc Welding Electrodes

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Weld metal deposited from electrodes shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Carbon	0.07 -	0.15
Manganese	0.25 -	0.60
Silicon	0.10 -	0.50
Phosphorus	--	0.04
Sulfur	--	0.04
Copper	--	0.15

3.1.1 Weld Pads for Chemical Analysis: The referee procedure for making pads of weld metal and removing samples for chemical analysis shall be in accordance with AWS A5.1.

3.2 Type: Electrodes shall be suitable for welding in all positions using AC or using DC straight polarity (electrode negative).

3.3 Properties: Electrodes shall conform to the following requirements:

3.3.1 Tensile Properties: All-weld-metal tensile specimens, prepared in accordance with AWS A5.1 and tested in accordance with ASTM E8 in the as-welded condition, shall have the following properties:

Tensile Strength, min	67,000 psi (460 MPa)
Yield Strength at 0.2% Offset, min	55,000 psi (380 MPa)
Elongation in 2 in. (50 mm) or 4D, min	17%

3.3.2 Weldability: Electrodes shall flow smoothly and evenly under the Ø conditions specified in 3.2 and shall produce acceptable welds, determined by a procedure agreed upon by purchaser and vendor.

3.3.3 Burn-Off: The covering shall be consumed uniformly all around and shall not burn back from the core wire under proper welding conditions. Heating of the electrode during welding shall not cause injurious blistering of the covering within the ranges of current values recommended by the manufacturer.

3.3.4 Grip Portion and Arc Ends: A portion of the electrode 0.75 - 1.25 in. (20 - 30 mm) long shall be bare to permit good electrical contact with the electrode holder. The arc end of the electrode shall be sufficiently bare to permit easy striking of the arc but the length of this bare section, measured from the end of the electrode to the point where the full cross-section of the covering begins, shall not exceed the diameter of the bare wire and in no case shall it exceed 1/8 in. (3 mm).

3.3.5 Cleaning: Slag produced during welding shall be readily removable with hand tools.

3.4 Quality:

3.4.1 Core Wire: Shall be uniform in quality and condition, cylindrical, clean, sound, and free from foreign materials and from imperfections detrimental to weld quality.

3.4.2 Covering: Shall be concentric, uniform in quality, tightly adherent, and free from abnormal scabs, blisters, pockmarks, bruises, and other surface defects and shall withstand normal handling without damage. It shall not be harmfully hygroscopic and shall not adversely affect weld quality.

3.5 Standard Sizes and Lengths: The sizes and lengths in Table I are standard.

TABLE I

Nominal Diameter of Core Wire Inch	Length Inches
1/16	9
5/64	9 or 12
3/32	12
1/8, 5/32, 3/16	14
7/32	14 or 18
1/4, 5/16	18

TABLE I (SI)

Nominal Diameter of Core Wire Millimetres	Length Millimetres
1.5	225
2.0	225 or 300
2.5	300
3.0, 4.0, 5.0	350
5.5	330 or 450
6.5, 8.0	450

3.5.1 Unless otherwise specified, end grip electrodes shall be supplied.

3.6 Tolerances: Shall be as follows, unless otherwise specified:

3.6.1 Ø Electrodes shall not vary in length more than ±1/4 in. (±6 mm) from the length ordered.

3.6.2 Electrode core wire shall not vary in diameter more than ±0.002 in. (±0.05 mm) from the size ordered.

3.6.3 Overall diameter of the covered electrodes shall not vary more than 4% from that of the approved sample electrode as in 4.4.1.

3.6.4 Covering shall be concentric with the core wire to the extent that the maximum core-plus-one covering dimension shall not exceed the minimum core-plus-one covering dimension by more than 5% of the minimum core-plus-one covering dimension.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Ø Responsibility for Inspection: The vendor of electrodes shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the electrodes conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Ø Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), grip portion and arc ends (3.3.4), sizes (3.5), and tolerances (3.6) are classified as acceptance tests and shall be performed on each control number of electrodes.

4.2.2 Ø Periodic Tests: Tests to determine conformance to requirements for weldability (3.3.2), burn-off (3.3.3), and cleaning (3.3.5) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Ø Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the first-article shipment of electrodes to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as agreed upon by purchaser and vendor; a control number shall be a designation indicating batch processing and core wire heat number.

4.4 Approval:

4.4.1 Sample electrodes shall be approved by purchaser before electrodes for production use are supplied, unless such approval be waived by purchaser.

4.4.2 Vendor shall use materials, manufacturing procedures, processes, and methods of inspection on production electrodes which are essentially the same as those used on the approved sample electrodes. If necessary to make any change in covering formulation or in manufacturing procedures, processes, or methods of inspection, vendor shall submit for reapproval a statement of the proposed changes in material and processing and, when requested, sample electrodes. Production electrodes incorporating the revised procedures shall not be shipped prior to receipt of reapproval.

4.5 Reports:

4.5.1 The vendor of electrodes shall furnish with each shipment three copies of a report stating that the electrodes conform to the technical requirements of this specification. This report shall include the purchase order number, AMS 5031D, control number, size, and quantity. When requested by purchaser, the vendor shall also include in the report the composition of the deposited weld metal for each heat in the shipment.

4.5.2 When assemblies requiring use of these electrodes are supplied, the assembly manufacturer shall inspect each lot of electrodes to determine conformance to the technical requirements of this specification and shall furnish with each shipment three copies of a report stating that the electrodes conform. This report shall include the purchase order number, AMS 5031D, assembly number, and quantity.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the electrodes may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the electrodes represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification:

5.1.1 Individual Electrodes:

5.1.1.1 At least one legible imprint of the AWS classification (6013) shall be applied to the electrode covering as near as practical to the grip end of the core wire and within 2-1/2 in. (65 mm) of the grip end.