Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS5684C
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UNS NO6132

WELDING ELECTRODES, COVERED, ALLOY, CORROSION AND HEAT RESISTANT
72Ni - 15Cr - 9.0Fe - 2.8(Cb+Ta)

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel alloy wire in the form of covered welding electrodes.

1.2 Application: Primarily for welding corrosion and heat resistant alloys and 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: Avaialble from Society of Automotive Engineers, Inc., 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 E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt-Base Alloys

2.3 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, Inc., 2501 North West 7th Street, Miami, FL 33125.

AWS A5.11 - Nickel and Nickel-Alloy Covered 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 E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	--	0.08
Manganese	--	1.50
Silicon	--	0.75
Phosphorus	--	0.03
Sulfur	--	0.015
Chromium	13.00	17.00
Nickel + Cobalt	68.00	--
Columbium + Tantalum	1.50	4.00
Iron	--	11.00
Cobalt (3.1.1)	--	1.00
Copper	--	0.50

3.1.1 Determination not required for routine acceptance.

3.1.2 Weld Pads for Chemical Analysis: The referee procedure for making pads of weld metal and removing samples for chemical analysis shall be AWS A5.11.

3.2 Type: Electrodes shall be suitable for welding in all positions using DC reverse polarity (electrode positive).

3.3 Properties: Electrodes shall conform to the following requirements:

3.3.1 Weldability: Electrodes shall demonstrate good weldability and shall flow smoothly and evenly under the conditions specified in 3.2.

3.3.2 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.

3.3.3 Grip Portion and Arc Ends: A portion of the electrode 0.75 - 1.25 in. (19.0 - 31.8 mm) long shall be bare to permit good electrical contact with the electrode holder. The arc end of the electrodes 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. (3.2 mm).

3.3.4 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 conditions, cylindrical, clean, sound, and free from foreign materials and from imperfections detrimental to weld quality.

3.4.2 Covering: Shall be 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
5/64, 3/32	9 and 12
1/8	12 and 14
5/32, 3/16, 1/4	14

TABLE I (SI)

Nominal Diameter of Core Wire Millimetres	Length Millimetres
2.0, 2.4	229 and 305
3.2	305 and 356
4.0, 4.8, 6.4	356

3.5.1 End-grip electrodes shall be supplied in all lengths unless otherwise specified.

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

3.6.1 Electrodes shall not vary in length more than ± 1/4 in. (±6.4 mm) from the length ordered.

3.6.2 Electrode core wire shall not vary in diameter more than ±0.003 in. (±0.08 mm) from size ordered.

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

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 Responsibility for Inspection: The vendor of electrodes shall supply all samples 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 perform such confirmatory testing as he deems necesssary to ensure that the electrodes conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to composition (3.1), grip portion and arc ends (3.3.3), size (3.5), and tolerance (3.6) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests to determine conformance to weldability (3.3.1) burn-off (3.3.2), and cleaning (3.3.4) requirements are classified as periodic tests.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests.

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

Ø 4.3 Sampling: Shall be as agreed upon by purchaser and vendor.

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.

4.4.2 Vendor shall use materials, manufacturing procedures, processes, and methods of inspection on Ø 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, material specification number and its revision letter, control number, size, and quantity. Control number shall be a designation indicating batch processing and core wire heat number. 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, material specification number and its revision letter, assembly number, and quantity.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified require- Ø ments, 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 (ENiCrFe-1) shall be applied to the electrode Ø covering as near as practical to the grip end of the core wire and within 2-1/2 in. (63.5 mm) of the grip end. The prefix letter E in the electrode classification may be omitted from the imprint on the electrode covering.

5.1.1.2 The numbers of the imprinted electrode classification shall be of bold block type and of sufficient Ø size and color contrast to be legible before and after normal welding applications.

5.1.2 Electrode Packages: Each package or container shall be legibly marked with the purchase order num- Ø ber, AMS 5684C, control number, size, quantity, recommended current value, and manufacturer's designation.