Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 5691C
Superseding AMS 5691B

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WELDING ELECTRODES, COATED, STEEL, CORROSION AND HEAT RESISTANT 18Cr - 13Ni - 2.3Mo

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant steel in the form of coated welding electrodes.

1.2 Application: Primarily for welding corrosion and heat resistant 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 Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specification:

AMS 2350 - Standards and Test Methods

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

ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 Government Publications: Available from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

2.3.1 Federal Standards:

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

2.4 AWS Publication: Available from American Welding Society, 345 East 47th St., New York, New York 10017

AWS A5.4 - Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes.

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Weld metal deposited from electrodes shall conform to the following in percentages by weight, determined by wet chemical methods in accordance with ASTM E353, 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	2.50
Silicon	--	0.75
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	17.00	19.00
Nickel	12.00	14.00
Molybdenum	2.00	2.50
Copper	--	0.50

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 AWS A5.4.

3.2 Type: Coatings shall be suitable for the following usability characteristics:

Type Designation	Weld Position	Current
A	Flat, Vertical, Overhead, and Horizontal	DC
B	Flat, Vertical, Overhead, and Horizontal	DC - AC
C	Horizontal Fillets, Flat	DC
D	Horizontal Fillets, Flat	DC - AC

3.2.1 When DC is specified, reverse polarity (electrode positive) is required.

3.2.2 Unless otherwise specified, lime type coatings are required for Types A and C electrodes.

3.2.3 Unless otherwise specified, Type A shall be supplied.

3.3 Properties:

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

3.3.2 Burn-Off: The coating shall be consumed uniformly on all sides 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 coating 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. (19.05 - 31.75 mm) long on end grip rods and 1.5 - 2.0 in. (38.1 - 50.8 mm) long on center grip rods 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 as measured from the end of the electrode to the point where the full cross section of the coating 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 condition, cylindrical, clean, sound, and free from foreign materials and from imperfections detrimental to weld quality.

3.4.2 Coating: 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
1/16, 5/64	9 and 18
3/32	9, 12, and 18
1/8, 5/32, 3/16, 1/4	14

TABLE I (SI)

Nominal Diameter of Core Wire Millimeters	Length Millimeters
1.59, 1.98	229 and 457
2.38	229, 305, and 457
3.18, 3.97, 4.76, 6.35	356

3.5.1 Unless otherwise specified, end grip electrodes shall be supplied in all lengths except 18 in. (457 mm) where center grip electrodes are required.

3.6 Tolerances:

3.6.1 Unless otherwise specified, electrodes shall not vary in length more than 1/8 in. (3.2 mm) from the length ordered.

3.6.2 Electrode core wire shall not vary in diameter more than ± 0.002 in. (0.051 mm) from the size ordered.

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

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

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor 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 necessary to assure that material conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Routine Control 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 routine control tests.

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

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 production electrodes to determine conformance to this specification which are essentially the same as those used on the approved sample electrodes. If necessary to make any change in coating formulation or in manufacturing procedures, processes, or methods of inspection which could affect quality or properties of the electrodes, vendor shall submit for reapproval a statement of the revised procedures and, when requested, sample electrodes. No production electrodes incorporating the revised procedures shall be shipped prior to receipt of reapproval.

4.5 Reports:

4.5.1 The vendor of the electrodes shall furnish with each shipment three copies of a report stating that the electrodes conform to the 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 the 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 requirements of this specification and shall furnish with each shipment three copies of a report stating that the electrodes conform to this specification. This report shall include the purchase order number, material specification number and its revision letter, part 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 product may be based on the testing of 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 material 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 (E316) shall be applied to the electrode coating 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. In the case of center grip electrodes, the imprint shall be applied to the electrode coating as above and upon both sides of the center grip (bare core wire) area. The prefix letter E in the electrode classification may be omitted from the imprint on the electrode coating.

5.1.1.2 The numbers of the imprinted electrode classification shall be of bold block type and of sufficient 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 following information: Purchase order number, AMS 5691C, control number, size, quantity, type designation, recommended current value, and manufacturer's designation.

5.2 Packaging:

5.2.1 Packaging shall be accomplished in such a manner as to ensure that the electrodes, during shipment and storage, will be protected against mechanical injury and exposure to moisture. Such packaging shall not cause loss of moisture from the coating to the extent that use of the electrodes may be impaired.