SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 6533

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Submitted for recognition as an American National Standard

WIRE, STEEL WELDING
2.0Cr - 10Ni - 14Co - 1.0Mo - (0.13 - 0.17C)
Vacuum Melted, Environment Controlled Packaging

UNS K92571

1. SCOPE:

1.1 Form: This specification covers a premium aircraft-quality alloy steel in the form of welding wire.

1.2 Application: Primarily for use as filler metal for gas-metal-arc or gas-tungsten-arc welding of steels of similar composition requiring joints with high strength and fracture toughness.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other High-Alloyed Steels, and Iron Alloys
AMS 2300 - Premium Aircraft-Quality Steel Cleanliness - Magnetic Particle Inspection Procedure
MAM 2300 - Premium Aircraft-Quality Steel Cleanliness - Magnetic Particle Inspection Procedure, Metric (SI) Measurement
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock
AMS 2813 - Packaging of Welding Wire, Standard Method
AMS 2814 - Packaging of Welding Wire, Premium Quality
AMS 2815 - Identification, Welding Wire, Line Code System
AMS 2816 - Identification, Welding Wire, Color Code System
AMS 6522 - Steel Plate, 2.0Cr - 10Ni - 14Co - 1.0Mo, (0.13 - 0.17C) Vacuum Melted, Normalized and Overaged

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2.1.2 Aerospace Recommended Practices:

ARP1876 - Weldability Test for Weld Filler Metal Wire

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8 - Tension Testing of Metallic Materials
ASTM E 8M - Tension Testing of Metallic Materials (Metric)
ASTM E 353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E 399 - Plane-Strain Fracture Toughness of Metallic Materials

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	0.13	0.17
Manganese	--	0.10
Silicon	--	0.10
Phosphorus	--	0.008
Sulfur	--	0.005
Phosphorus + Sulfur	--	0.010
Chromium	1.80	2.20
Nickel	9.50	10.50
Cobalt	13.50	14.50
Molybdenum	0.90	1.10
Copper	--	0.10
Titanium	--	0.15
Oxygen (3.1.2)	--	0.0025 (25 ppm)
Nitrogen (3.1.2)	--	0.0015 (15 ppm)
Hydrogen (3.1.2)	--	0.0005 (5 ppm)

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2248. No variation over maximum is permitted for oxygen, nitrogen, and hydrogen (See 8.1).

3.1.2 Shall be determined on finished wire.

3.2 Condition: Cold worked, bright finished, in a temper and with a surface finish which will provide proper feeding of the wire in machine welding equipment.

3.2.1 Wire shall be furnished on disposable spools for machine welding and in cut lengths for manual welding, as ordered.

3.2.2 Drawing compounds, oxides, dirt, and other foreign materials shall be removed by cleaning processes which will neither result in pitting nor cause gas absorption by the wire or deposition of substances harmful to welding operations.

3.2.3 Residual elements and dissolved gases deposited on, or absorbed by, the wire as a result of cleaning or cold working operations shall be removed by vacuum degassing.

3.2.4 Annealing, if required, shall be performed under vacuum or in an inert gas atmosphere.

3.3 Properties: Wire shall conform to the following requirements:

3.3.1 Weldability: Melted wire shall flow smoothly and evenly during welding and shall produce acceptable welds. ARP1876 may be used to resolve weldability disputes.

3.3.2 Spooled Wire: Shall conform to 3.3.2.1 and 3.3.2.2.

3.3.2.1 Cast: Wire, wound on standard 12-inch (305-mm) diameter spools, shall have imparted to it a curvature such that a specimen sufficient in length, 4 - 14 feet (1.2 - 4.3 m), to form one loop, when cut from the spool and laid on a flat surface, shall form a circle 15 - 50 inches (381 - 1270 mm) in diameter.

3.3.2.2 Helix: The specimen on which cast was determined, when laid on a flat surface and measured between adjacent turns, shall show a vertical separation not greater than 1 inch (25 mm).

3.3.3 Fracture Toughness: When specified, test specimens prepared in accordance with 4.3.1, shall be subjected to fracture toughness testing in accordance with ASTM E 399. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.3.4 Tensile Properties: When specified, specimens taken in the weld metal from a coupon prepared as in 4.3.1 shall be subjected to tensile testing in accordance with ASTM E 8 or ASTM E 8M. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4 Quality:

3.4.1 Steel shall be premium aircraft quality conforming to AMS 2300 or MAM 2300. It shall be multiple melted using vacuum induction melting followed by vacuum arc remelting.

3.4.2 Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to welding operations, operation of welding equipment, or properties of the deposited weld metal.

3.5 Sizes and Tolerances: Wire shall be supplied in the sizes and to the tolerances shown in 3.5.1 and 3.5.2.

3.5.1 Diameter:

TABLE I

Form	Nominal Diameter Inch	Tolerance, Inch plus	Tolerance, Inch minus
Cut Lengths	0.030, 0.045, 0.062, 0.078	0.002	0.002
Cut Lengths	0.094, 0.125, 0.156, 0.188	0.003	0.003
Spools	0.007, 0.010, 0.015, 0.020	0.0005	0.0005
Spools	0.030, 0.035, 0.045	0.001	0.002
Spools	0.062, 0.078, 0.094	0.002	0.002

TABLE I (SI)

Form	Nominal Diameter Millimeters	Tolerance, Millimeter plus	Tolerance, Millimeter minus
Cut Lengths	0.76, 1.14, 1.57, 1.98	0.05	0.05
Cut Lengths	2.39, 3.18, 3.96, 4.78	0.08	0.08
Spools	0.18, 0.25, 0.38, 0.51	0.013	0.013
Spools	0.76, 0.89, 1.14	0.025	0.05
Spools	1.57, 1.98, 2.39	0.05	0.05

3.5.2 Length: Cut lengths shall be furnished in 18, 27, or 36 inch (457, 686, or 914 mm) lengths, as ordered, and shall not vary more than +0, -0.5 inch (-13 mm) from the length ordered.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of wire shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), fracture toughness (3.3.3) and tensile properties (3.3.4) when specified, and sizes and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests for weldability (3.3.1), cast (3.3.2.1), and helix (3.3.2.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing: Shall be in accordance with AMS 2371 and the following: