SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 6463C

Issued JUN 1974
Revised FEB 2000
Reaffirmed DEC 2004

Superseding AMS 6463B

(R)

Wire, Steel Welding
18.5Ni - 8.5Co - 5.2Mo - 0.72Ti - 0.10Al
Vacuum Melted, Environment Controlled Packaging

K93130

1. SCOPE:

1.1 Form:

This specification covers a maraging steel in the form of welding wire.

1.2 Application:

This wire has been used typically as filler metal for gas-tungsten-arc and inert gas-metal-arc welding of maraging steels requiring a joint capable of being heat treated to 280,000 psi (1931 MPa) tensile strength, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order form a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

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

AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2370	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock
AMS 2813	Packaging and Marking of Packages of Welding Wire, Standard Method

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.1 (Continued):

AMS 2814	Packages of Welding Wire, Premium Quality
AMS 2816	Identification, Welding Wire, Tab Marking Method
AMS 2819	Identification, Welding Wire, Direct Color Code System
AMS 6514	Steel, Maraging, Bars, Forgings, Tubing and Rings 18.5Ni - 9.0Co - 4.9Mo - 0.65Ti - 0.10Al, Consumable Electrode Vacuum Melted, Annealed
ARP1876	Weldability Test for Weld Filler Metal Wire
ARP4926	Alloy Verification and Chemical Composition Inspection of Welding Wire

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 2650	Chemical Composition of Gases by Mass Spectrometry
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 1032	Radiographic Examination of Weldments

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon (3.1.2)	--	0.010
Manganese	--	0.10
Silicon	--	0.10
Phosphorus	--	0.010
Sulfur	--	0.010
Nickel	18.00	19.00
Cobalt	8.00	9.00
Molybdenum	4.50	6.00
Titanium	0.65	0.80
Aluminum	0.05	0.15
Oxygen (3.1.2)	--	0.0025 (25 ppm)
Nitrogen (3.1.2)	--	0.005 (50 ppm)
Hydrogen (3.1.2) (3.1.4)	--	0.0025 (25 ppm)

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248, except that no variation is permitted for oxygen, nitrogen, and hydrogen.

3.1.2 Shall be determined on finished wire.

3.1.3 Chemical analysis of initial ingot, bar, or rod stock before drawing, other than those analyses required to be done on the finished wire, is acceptable provided the processes used for drawing or rolling, annealing, and cleaning are controlled to ensure continued conformance to requirements.

3.1.4 The hydrogen content of the wire shall be determined at final diameter in accordance with ASTM D 2650.

3.2 Melting Practice:

Steel shall be produced by vacuum induction melting; it may be remelted using consumable electrode vacuum process, but remelting is not required.

3.3 Condition:

Cold worked, bright finish, in a temper which will provide proper feeding of the wire in machine welding equipment.

3.4 Fabrication:

3.4.1 Wire shall be formed from rod or bar descaled by a process that does not affect the composition of the wire.

3.4.2 In-process annealing, if required between cold rolling or drawing operations, shall be performed in vacuum or protective atmosphere to avoid surface oxidation and absorbtion of other extraneous elements.

3.4.3 Drawing compounds, oxides, dirt, oil, 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.

3.4.4 Butt welding is permissible provided both ends to be joined are either alloy verified using a method or methods capable of distinguishing the alloy from all others processed in the facility, or the repair is made at the wire processing station. The butt weld shall not interfere with uniform, uninterrupted feeding of the wire in machine welding equipment.

3.4.5 Residual elements and dissolved gasses picked up during wire processing that can adversely affect the welding characteristics, the operation of the equipment, or the properties of the weld metal, shall be removed.

3.5 Properties:

Wire shall conform to the following requirements:

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

3.5.2 Spooled Wire: Shall conform to 3.5.2.1 and 3.5.2.2.

3.5.2.1 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 to form one loop with a 1-inch (25 mm) overlap, when cut from the spool and laid on a flat surface, shall form a circle 15 to 50 inches (381 to 1270 mm) in diameter.

3.5.2.2 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).

3.5.3 Tensile Properties: A tensile specimen, prepared in accordance with 4.3.1, shall have the properties shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M, after being solution heat treated by heating in air to 1500 °F ± 25 (816 °C ± 14), holding at heat for not less than 30 minutes, and cooling in air, and maraged by heating to 900 °F ± 15 (482 °C ± 8), holding at heat for 3 to 5 hours, and cooling in air:

TABLE 2 - Minimum Tensile Properties

Property	
Tensile Strength	280,000 psi (1931 MPa)
Yield Strength at 0.2% Offset	270,000 psi (1862 MPa)
Elongation in 2 Inches (50.8 mm)	3%

3.6 Quality:

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.

3.7 Sizes and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in 3.7.1 and 3.7.2.

3.7.1 Diameter: Shall be as shown in Table 3.

TABLE 3A - Sizes and Diameter Tolerances, Inch/Pound Units

Form	Nominal Diameter Inch	Tolerance Inch plus	Tolerance Inch minus
Cut Lengths	0.030, 0.045	0.001	0.001
Cut Lengths	0.053, 0.062, 0.078, 0.094, 0.125, 0.156, 0.188	0.002	0.002
Spools	0.007, 0.010, 0.015, 0.020	0.0005	0.0005
Spools	0.030, 0.035, 0.045	0.001	0.001
Spools	0.062, 0.078, 0.094	0.002	0.002

TABLE 3B - Sizes and Diameter Tolerances, SI Units

Form	Nominal Diameter Millimeters	Tolerance Millimeter plus	Tolerance Millimeter minus
Cut Lengths	0.76, 1.14	0.025	0.025
Cut Lengths	1.32, 1.57, 1.98 2.39, 3.18, 3.96, 4.78	0.05	0.05
Spools	0.18, 0.25, 0.38, 0.51	0.013	0.013
Spools	0.76, 0.89, 1.14	0.025	0.025
Spools	1.57, 1.98, 2.39	0.05	0.05

3.7.2 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), sizes and tolerances (3.7), and alloy verification (5.2), are acceptance tests and shall be performed on each heat or lot as applicable.