



AEROSPACE MATERIAL SPECIFICATION	AMS6463™	REV. G
	Issued 1974-06 Reaffirmed 2004-12 Revised 2023-05	
Superseding AMS6463F		
Wire, Steel Welding 18.5Ni - 8.5Co - 5.2Mo - 0.72Ti - 0.10Al (Marage 300) Vacuum Melted, Environment Controlled Packaging (Composition similar to UNS K93130)		

RATIONALE

AMS6463G is the result of a Five-Year Review and update of the specification. The revision adds a warning on stress corrosion (1.2.1), revises composition reporting (3.1.2), updates tensile testing and adds pyrometry controls (3.5.3), and updates exception requirements (4.4.2, 8.5).

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 ksi (1931 MPa) tensile strength, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause these products to become susceptible to stress-corrosion cracking after heat treatment. ARP1110 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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<https://www.sae.org/standards/content/AMS6463G/>

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2248	Chemical Check Analysis Limits, Corrosion- and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS2370	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock
AMS2750	Pyrometry
AMS2813	Packaging and Marking of Packages of Welding Wire, Standard Method
AMS2814	Packaging and Marking of Packages of Welding Wire, Premium Quality
AMS2816	Identification, Welding Wire, Tab Marking Method
AMS2819	Identification, Welding Wire, Direct Color Code System
AMS6514	Steel, Maraging, Bars, Forgings, Mechanical Tubing, Rings and Forging Stock, 18.5Ni - 9.0Co - 4.9Mo - 0.65Ti - 0.10Al, Consumable Electrode Vacuum Melted, Annealed
ARP1110	Minimizing Stress Corrosion Cracking in Wrought Forms of Steels, and Corrosion Resistant Steels and Alloys
ARP1876	Weldability Test for Weld Filler Metal Wire
ARP4926	Alloy Verification and Chemical Composition, Inspection of Welding Wire
AS7766	Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A370	Mechanical Testing of Steel Products
ASTM A751	Chemical Analysis of Steel Products
ASTM D2650	Chemical Composition of Gases by Mass Spectrometry
ASTM E1032	Radiographic Examination of Weldments Using Industrial X-Ray Film

2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 or by other analytical methods acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Carbon ¹	--	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 ¹	--	0.0025 (25 ppm)
Nitrogen ¹	--	0.005 (50 ppm)
Hydrogen ^{1,2}	--	0.0025 (25 ppm)

¹ Determined on finished wire.

² Determined at final diameter in accordance with ASTM D2650.

3.1.1 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.

3.1.2 The producer may test for any element not listed in Table 1 and include this analysis in the report of 4.4. Reporting of any element not listed in the composition table is not a basis for rejection unless limits of acceptability are specified by the purchaser.

3.1.3 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248, except that no variation is permitted for oxygen, nitrogen, and hydrogen.

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 that 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. Surface irregularities inherent with a forming process that do not tear the wire surface are acceptable provided the wire conforms to the tolerance of 3.7.

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 absorption of other extraneous elements.

3.4.3 Drawing compounds, oxides, dirt, oil, and other foreign materials shall be removed by cleaning processes that 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 A370, after being solution heat treated by heating in air to 1500 °F ± 25 °F (816 °C ± 14 °C), holding at heat for not less than 30 minutes, and cooling in air, and maraged by heating to 900 °F ± 15 °F (482 °C ± 8 °C), holding at heat for 3 to 5 hours, and cooling in air. Pyrometry shall be in accordance with AMS2750.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	280 ksi (1931 MPa)
Yield Strength at 0.2% Offset	270 ksi (1862 MPa)
Elongation in 4D or 2 Inches (50 mm)	3%

3.5.3.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min).

3.6 Quality

Wire, as received by the 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 Inches	Tolerance	
		Inches Plus	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	
		Millimeters Plus	Millimeters 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 (+0, -13 mm) from the length ordered.

3.8 Any exceptions shall be authorized by the purchaser and reported as in 4.4.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of wire shall supply all samples for the purchaser's tests and shall be responsible for the performance of all required tests. The 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.