



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

AEROSPACE MATERIAL SPECIFICATION

AMS 5028A

Superseding AMS 5028

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STEEL WELDING WIRE

1.05Cr - 0.55Ni - 1.0Mo - 0.07V (0.34 - 0.40C)

Vacuum Melted, Environment-Controlled Packaged

1. SCOPE:

- 1.1 Form: This specification covers a premium-quality, low-alloy steel in the form of welding wire furnished in environment-controlled packages.
- 1.2 Application: Primarily for use as filler metal for gas-tungsten-arc welding of heat-treatable steels of similar composition where the weld area is required to have strength comparable to that of the parent metal.

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., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2350 - Standards and Test Methods
AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products
Except Forgings and Forging Stock
AMS 2814 - Packaging of Welding Wire, Premium Quality
AMS 2815 - Identification, Welding Wire, Line Code System

- 2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

- 2.3 U.S. 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

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3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Carbon	0.34	0.40
Manganese	0.60	0.90
Silicon	0.15	0.30
Phosphorus	--	0.008
Sulfur	--	0.008
Chromium	0.90	1.20
Nickel	0.40	0.70
Molybdenum	0.90	1.10
Vanadium	0.05	0.10
Copper	--	0.35
Hydrogen	--	0.0010 (10 ppm)
Oxygen	--	0.0025 (25 ppm)
Nitrogen	--	0.0050 (50 ppm)

- 3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

- 3.2 Condition: Cold drawn, bright finish, as-drawn temper. Wire shall be formed from bar descaled by a process which does not affect the composition of the wire. Surface irregularities inherent with a forming process which does not tear the wire surface are acceptable provided the wire conforms to the tolerances of 3.5. Surface texture of spooled wire shall be as agreed upon by purchaser and vendor.

- 3.2.1 Drawing compounds, oxides, and dirt 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.

- 3.2.2 Residual elements and dissolved gases deposited on, or absorbed by, the welding wire as a result of cleaning or drawing operations shall be removed by vacuum degassing. Annealing, if required, shall be performed under vacuum or in an inert gas atmosphere.

- 3.2.3 Wire shall be furnished on disposable spools for machine welding or in cut lengths for manual welding, as ordered.

- 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, determined by a procedure agreed upon by purchaser and vendor.

- 3.3.2 Spooled Wire: Shall conform to the following, unless otherwise agreed upon by purchaser and vendor:

- 3.3.2.1 Cast: Wire shall have imparted to it a curvature such that a specimen sufficient in length to form one loop, when cut from the spool and laid on a flat surface, shall form a circle not less than 15 in. (380 mm) and not greater than 30 in. (760 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 in. (25 mm).

- 3.4 Quality:

3.4.1 Steel shall be multiple melted under vacuum using consumable electrode practice, unless otherwise specified.

3.4.2 Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external 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

Ø	Form	Nominal Diameter Inch	Tolerance, Inch	
			plus	minus
	Cut Lengths	0.030, 0.045, 0.062, 0.078	0.002	0.002
	Cut Lengths	0.093, 0.125, 0.156	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, 0.093	0.002	0.002

TABLE I (SI)

Form	Nominal Diameter Millimetres	Tolerance, Millimetre	
		plus	minus
Cut Lengths	0.75, 1.15, 1.55, 2.00	0.05	0.05
Cut Lengths	2.35, 3.20, 4.00	0.08	0.08
Spools	0.20, 0.25, 0.40, 0.50	0.015	0.015
Spools	0.75, 0.90, 1.15	0.03	0.05
Spools	1.55, 2.00, 2.35	0.05	0.05

3.5.2 Length: Cut lengths shall be furnished in 18, 27, or 36 in. (450, 675, or 900 mm) lengths, as ordered, and shall not vary more than +0, -0.5 in. (-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. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform such confirmatory testing as he deems necessary to ensure that the wire conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1) and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

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

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed on the initial shipment of wire to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.3, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction 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 in accordance with AMS 2370 and as specified herein.

4.4 Approval:

4.4.1 Sample wire shall be approved by purchaser before wire for production use is supplied, unless such approval be waived. Results of tests on production wire shall be essentially equivalent to those on the approved sample wire.

4.4.2 Sample welds shall be made in accordance with a procedure agreed upon by purchaser and vendor and tested to determine conformance to requirements agreed upon by purchaser and vendor.

4.4.3 Vendor shall use materials, manufacturing procedures and processes, and methods of inspection on production wire which are essentially the same as those used on the approved sample wire. If necessary to make any change in materials or in manufacturing procedures and processes, vendor shall submit for reapproval a statement of the proposed changes in material and/or processing and, when requested, sample wire. Production wire made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports:

4.5.1 The vendor of wire shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat and stating that the wire conforms to the other technical requirements of this specification. This report shall include the purchase order number, heat number, AMS 5028A, nominal size, and quantity from each heat.

4.5.2 When parts made of this wire or assemblies requiring use of this welding wire are supplied, the part or assembly manufacturer shall inspect each lot of wire to determine conformance to the technical requirements of this specification and shall furnish with each shipment three copies of a report stating that the wire conforms. This report shall include the purchase order number, AMS 5028A, part or assembly number, and quantity.

Ø 4.6 Resampling and Retesting: Shall be in accordance with AMS 2370.

5. PREPARATION FOR DELIVERY:

5.1 Layer Winding: Wire furnished on spools shall be closely wound in layers but adjacent turns within a layer need not necessarily be touching; shall be wound so as to avoid producing kinks, waves, and sharp bends; and shall be free to unwind without restriction caused by overlapping or wedging. Both ends of the spooled wire shall be so treated that they may be readily located.

5.2 Heat: Wire on each spool shall be of one continuous length from the same heat of steel. No package of cut lengths shall contain wire from more than one heat of steel.

5.3 Identification: Wire shall be identified in accordance with AMS 2815. Tab marking of cut lengths is permissible.