



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 5029A

Superseding AMS 5029

Issued 5-1-69
Revised 12-15-74

STEEL WIRE, WELDING
0.78Cr - 1.8Ni - 0.35Mo - 0.20V (0.33 - 0.38C)
Vacuum Melted, Environment Controlled

1. SCOPE:

- 1.1 Form: This specification covers a low-alloy steel in the form of welding wire.
- 1.2 Application: Primarily for gas-tungsten-arc welding of base metal of similar composition and quality requiring heat treatment response up to 260,000 psi (1793 MPa) tensile strength.
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, Pennsylvania 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 2635 - Radiographic Inspection
AMS 2814 - Packaging, Welding Wire, Premium Quality
AMS 2815 - Identification, Welding Wire, Line Code System
AMS 6435 - Steel Sheet, Strip, and Plate, 0.80Cr - 1.8Ni - 0.35Mo - 0.20V (0.33 - 0.38C) Premium Quality, Consumable Electrode Melted, Annealed

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

- 2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3.1 Federal Standards:

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

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 approved analytical methods:

SAE Technical Board rules provide that: "All technical reports, including standards approved by the Board, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

Ø	min	max	Target Maxima
Carbon	0.33	0.38	
Manganese	0.60	0.90	
Silicon	--	0.25	
Phosphorus	--	0.008	0.005
Sulfur	--	0.008	0.004
Chromium	0.65	0.90	
Nickel	1.65	2.00	
Molybdenum	0.30	0.40	
Vanadium	0.17	0.23	
Oxygen	--	0.0025 (25 ppm)	10 ppm
Nitrogen	--	0.0050 (50 ppm)	15 ppm
Hydrogen	--	0.0010 (10 ppm)	1.2 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 furnished on disposable spools for machine welding and in cut lengths for manual welding operations, as ordered. Surface roughness 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.

3.3 Properties:

3.3.1 Weldability: Melted wire shall flow smoothly and evenly during welding and shall be capable of producing 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. (381 mm) and not greater than 30 in. (762 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).

3.3.3 Tensile Properties: A test specimen prepared as in 4.3.1, shall be capable of meeting the following requirements, determined in accordance with ASTM A370:

Tensile Strength Through Weld Zone,	
% of Parent Metal	90 min
Elongation in 2 in. (50.8 mm), %	3 min

3.4 Quality:

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

3.4.2 Wire shall be uniform in quality and condition, clean, 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

Form	Nominal Diameter Inch	Tolerance, Inch plus and minus
Cut Lengths	0.045, 0.062, 0.093, 0.125	0.003
Spools	0.030, 0.035, 0.045, 0.062, 0.093	0.001
Spools	0.007, 0.010, 0.015, 0.020	0.0005

TABLE I (SI)

Form	Nominal Diameter Millimetres	Tolerance, Millimetre plus and minus
Cut Lengths	1.14, 1.57, 2.36, 3.18	0.08
Spools	0.76, 0.89, 1.14, 1.57, 2.36	0.03
Spools	0.18, 0.25, 0.38, 0.51	0.013

3.5.2 Length: Cut lengths shall be furnished in 18, 27, or 36 in. (457, 686, or 914 mm) lengths, as ordered, and shall not vary more than +0, -1/2 in. (-13 mm) from the length ordered.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of wire 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 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure 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 composition (3.1) and tolerance (3.5) requirements are classified as acceptance or routine control tests.

4.2.2 Qualification Tests: Tests to determine conformance to weldability (3.3.1), cast (3.3.2.1), helix (3.3.2.2), and tensile property (3.3.3) requirements are classified as qualification or periodic control tests.

Ø 4.3 Sampling: Shall be in accordance with AMS 2370 and the following:

- 4.3.1 Specimens for Tensile Property Testing: A single vee-groove, butt-joint weld shall be made between two pieces of AMS 6435 plate 0.250 in. (6.35 mm) thick, which are chamfered full depth to a 60 deg (1.05 rad) included angle. The weld metal shall be finished flush with the parent metal on both faces. The weld area in the location of the tensile specimen or specimens shall be free from conditions detrimental to the tensile properties of the weld as revealed by radiographic inspection in accordance with AMS 2635. After heat treating the welded blank to tensile strength not lower than 260,000 psi (1793 MPa) in the parent metal, a standard sheet-type rectangular tensile test specimen shall be prepared in accordance with ASTM A370 with the weld in the approximate center of the gage length and perpendicular to the longitudinal axis of the specimen.

4.4 Reports:

- 4.4.1 The vendor of wire shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment and a statement that the wire conforms to the other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number and its revision letter, nominal size, and quantity from each heat.
- 4.4.2 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, material specification number and its revision letter, part or assembly number, and quantity.

- Ø 4.5 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. The outside end of the spooled wire shall be so treated that it may be readily located.
- 5.2 Heat: Wire on each spool shall be of one continuous length from the same heat of material. No package of cut lengths shall contain wire from more than one heat of material.
- 5.3 Identification: Wire shall be identified in accordance with AMS 2815. Tab marking of cut lengths is permissible.

5.4 Packaging and Marking:

- Ø 5.4.1 Wire shall be packaged and the packages marked in accordance with AMS 2814.
- 5.4.2 Packages of wire shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Wire not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

- 8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.