

AEROSPACE
MATERIAL
SPECIFICATION

AMS 6459
(Draft 64DM)

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Revised

STEEL WELDING WIRE
1.0Cr - 1.0Mo - 0.12V (0.18 - 0.23C)
Vacuum Induction Melted

1. SCOPE:

- 1.1 Form: This specification covers a vacuum-melted, low-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 critical weldments of low-alloy steels where the joint is capable of being heat treated to a strength approximating 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 SAE, 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

AMS 2816 - Identification, Welding Wire, Color 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

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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

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	0.18	0.23
Manganese	0.40	0.60
Silicon	0.60	0.90
Phosphorus	--	0.015
Sulfur	--	0.008
Chromium	0.80	1.20
Molybdenum	0.80	1.20
Vanadium	0.08	0.15
Copper	--	0.50
Oxygen	--	0.0025 (25 ppm)
Nitrogen	--	0.005 (50 ppm)
Hydrogen	--	0.0010 (10 ppm)

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259. No variation is permitted for oxygen, nitrogen, and hydrogen.

3.2 Condition: Cold finished, in a temper which will provide proper feeding of the wire in machine welding equipment.

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

3.2.2 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.

3.2.3 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 in 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, determined by a procedure agreed upon by purchaser and vendor.
- 3.3.2 Spooled Wire: Shall conform to 3.3.2.1 and 3.3.2.2, unless otherwise agreed upon by purchaser and vendor.
- 3.3.2.1 Cast: Wire wound on the standard 12 in. (300 mm) spool shall have imparted to it a curvature such that a specimen sufficient in length (4 - 8 ft (1.2 - 2.4 m)) to form one loop, when cut from the spool and laid on a flat surface, shall form a circle not less than 15 in. (375 mm) and not greater than 30 in. (750 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 vacuum induction melted.
- 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: Unless otherwise specified, 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	minus
Cut Lengths	0.030, 0.045, 0.062, 0.078	0.002	0.002
Cut Lengths	0.094, 0.125, 0.156, 0.180	0.003	0.003
Spools	0.062, 0.078, 0.093	0.002	0.002
Spools	0.030, 0.035, 0.045	0.001	0.002
Spools	0.007, 0.010, 0.015, 0.020	0.0005	0.0005

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, 3.10, 4.00, 4.75	0.08	0.08
Spools	1.55, 2.00, 2.35	0.05	0.05
Spools	0.75, 0.90, 1.15	0.03	0.05
Spools	0.20, 0.25, 0.40, 0.50	0.015	0.015

- 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. (-12 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 4.4. 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 to determine conformance to requirements for composition (3.1) and tolerances (3.5) are classified as acceptance tests and shall be performed on each heat or lot as applicable.
- 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.

- 4.3 Sampling: Shall be in accordance with AMS 2370 and as specified herein.

4.4 Reports:

- 4.4.1 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 6459, 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, AMS 6459, part or assembly number, and quantity.

- 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. An additional 8-in. (200-mm) length shall be made accessible for alloy verification at both ends of each spool.