



# AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

## AMS 6461E

Superseding AMS 6461D

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STEEL WIRE, WELDING  
0.95Cr - 0.20V (0.28 - 0.33C) (SAE 6130)  
Vacuum Melted

### 1. SCOPE:

1.1 Form: This specification covers a low-alloy steel in the form of welding wire.

1.2 Application: Primarily for use as filler metal for inert gas arc welding of critical weldments of low-alloy steels where the joint is capable of being heat treated to 180,000 psi (1241 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., Two Pennsylvania Plaza, New York, New York 10001.

#### 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

AMS 2635 - Radiographic Inspection

AMS 2814 - Packaging, Welding Wire, Premium Quality

AMS 2815 - Identification, Welding Wire, Line Code System

AMS 6350 - Steel Sheet, Strip, and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)

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:

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	min	max
Carbon	0.28	0.33
Manganese	0.60	0.90
Silicon	0.20	0.35
Phosphorus	--	0.008
Sulfur	--	0.008
Phosphorus + Sulfur	--	0.012
Chromium	0.80	1.10
Vanadium	0.15	0.25
Nickel	--	0.25
Molybdenum	--	0.06
Oxygen	--	0.0025 (25 ppm)
Nitrogen	--	0.005 (50 ppm)
Hydrogen	--	0.0025 (25 ppm)
Copper	--	0.35

- 3.1.1 **Check Analysis:** Composition variations shall meet the requirements of AMS 2259, paragraph titled "Low Alloy Steels" except that the limit for phosphorus plus sulfur includes the check analysis tolerance.
- 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 or 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 in vacuum or 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 standard sheet-type rectangular tensile test specimen conforming to ASTM A370, prepared as in 4.3.1, shall be capable of meeting the following requirements:

Tensile Strength Through Weld Zone,	
% of Parent Metal	90 min
Elongation, % in 2 in. (50.8 mm)	5 min

3.4 Quality: Steel shall be vacuum induction melted. 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 furnished 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 Millimeters	Tolerance, Millimeter 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. (-12.7 mm) from the length ordered.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product 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 product 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 properties (3.3.3) requirements are classified as qualification or periodic control tests.

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 6350 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 defects detrimental to the tensile properties of the weld as revealed by radiographic inspection in accordance with AMS 2635. After heat treating the parent metal to tensile strength not lower than 180,000 psi (1241 MPa), a standard sheet-type rectangular tensile test specimen shall be prepared and tested 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.