

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS 5821D

Submitted for recognition as an American National Standard

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Superseding AMS 5821C

STEEL, CORROSION RESISTANT, WELDING WIRE
12Cr (SAE 51410 Modified)
Ferrite Control Grade

UNS S41081

1. SCOPE:

1.1 Form:

This specification covers a corrosion-resistant steel in the form of welding wire.

1.2 Application:

Primarily for use as filler metal for gas-tungsten-arc or gas-metal-arc welding of corrosion-resistant steels of similar composition where the weld area is required to have strength and corrosion resistance comparable to those of the parent metal and where control of ferrite is necessary.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

- AMS 2248 Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
- AMS 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
- AMS 2813 Packaging of Welding Wire, Standard Method
- AMS 2814 Packaging of Welding Wire, Premium Quality
- AMS 2815 Identification, Welding Wire, Line Code System
- AMS 2816 Identification, Welding Wire, Color Code System
- AMS 5505 Steel Sheet, Strip, and Plate, Corrosion and Moderate Heat Resistant, 12Cr (SAE 51410 Modified), Ferrite Controlled, Annealed
- ARP1876 Weldability Test for Weld Filler Metal Wire

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

- ASTM E 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

(R)

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	0.11	0.15
Manganese	--	0.60
Silicon	--	0.50
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	11.50	12.50
Nickel	--	0.75
Molybdenum	--	0.20
Aluminum	--	0.05
Copper	--	0.50
Tin	--	0.05
Nitrogen	--	0.08

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

3.2 Condition:

(R)

Cold worked, annealed, descaled, and bright finished in a temper and with a surface finish which will provide proper feeding of the wire in machine welding equipment.

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

3.2.2 Drawing compounds, oxides, dirt, oil, and other surface contamination 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.

3.2.2.1 If pickling is necessary to remove surface contamination or scaling, only a light pickle shall be used and pickling shall be followed by vacuum degassing.

3.3 Properties:

Wire shall conform to the following requirements:

- 3.3.1 Weldability: Melted wire shall flow smoothly and evenly during welding (R) and shall produce acceptable welds. ARP1876 may be used to resolve disputes.
- 3.3.2 Response to Heat Treatment: Weld metal deposits, approximately 1/4 inch (6.4 mm) thick, on AMS 5505 steel sheet shall have hardness of 39 - 44 HRC, or equivalent, determined in accordance with ASTM E 18, after being heated to $1700\text{ }^{\circ}\text{F} \pm 10$ ($927\text{ }^{\circ}\text{C} \pm 6$), held at heat for 60 minutes ± 6 , and cooled in still air and double tempered by heating to $600\text{ }^{\circ}\text{F} \pm 10$ ($316\text{ }^{\circ}\text{C} \pm 6$), holding at heat for 2 hours ± 0.25 , cooling in still air, reheating to $600\text{ }^{\circ}\text{F} \pm 10$ ($316\text{ }^{\circ}\text{C} \pm 6$), holding at heat for 2 hours ± 0.25 , and cooling in still air.
- 3.3.3 Spooled Wire: Shall conform to 3.3.3.1 and 3.3.3.2.
- 3.3.3.1 Cast: Wire, wound on standard 12-inch (305 mm) diameter spools shall (R) have imparted to it a curvature such that a specimen sufficient in length, 4 - 14 feet (1.2 - 4.3 m) to form one loop, when cut from the spool and laid on a flat surface, shall form a circle 15 - 50 inches (381 - 1270 mm) in diameter.
- 3.3.3.2 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).

3.4 Quality:

Wire, as received by 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.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

- (R) The vendor of wire shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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 for composition (3.1), response to heat treatment (R) (3.3.2), sizes and tolerances (5.1), and alloy verification (5.3.1) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests for weldability (3.3.1), cast (3.3.3.1), and helix (3.3.3.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

(R)

Shall be in accordance with AMS 2371 and as specified herein.

4.4 Reports:

The vendor of wire shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and stating that the wire conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 5821D, nominal size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

5.1 Sizes and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in Table 2 and 5.1.1.

TABLE 2A - Diameter, Inch Pound Units

Form	Nominal Diameter Inch	Tolerance	
		Inch plus	Inch minus
Cut Lengths	0.030, 0.045, 0.062, 0.078	0.002	0.002
Cut Lengths	0.094, 0.125, 0.156, 0.188	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, 0.094	0.002	0.002