

UNS S41000

**STEEL WELDING WIRE, CORROSION AND MODERATE HEAT RESISTANT
12.5Cr (SAE 51410)**

1. SCOPE:

- 1.1 Form: This specification covers a corrosion and moderate heat resistant 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 steels of similar composition requiring joints with strength and corrosion resistance comparable to those of the basis 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 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
- AMS 2350 - Standards and Test Methods
- AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock
- AMS 2813 - Packaging of Welding Wire, Standard Method
- AMS 2815 - Identification, Welding Wire, Line Code System
- AMS 2816 - Identification, Welding Wire, Color Code System
- AMS 5504 - Steel Sheet, Strip, and Plate, Corrosion and Moderate Heat Resistant, 12.5Cr (SAE 51410)

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

- ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and other Similar Chromium-Nickel-Iron Alloys

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 E353, 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	--	0.15
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.025
Sulfur	--	0.015
Phosphorus + Sulfur	--	0.030
Chromium	11.50	13.50
Nickel	--	0.75
Molybdenum	--	0.50
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: Cold finished, bright finish, in a temper 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 In-process annealing between cold rolling or drawing operations shall be performed in a suitable protective atmosphere.

- 3.2.3 Oxides, dirt, and drawing compounds 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.

- 3.3 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 Response to Heat Treatment: Weld metal deposits, approximately 1/4 in. (6.5 mm) in thickness, deposited on AMS 5504 steel shall attain hardness of 35 - 45 HRC or equivalent, determined in accordance with ASTM E18, after being heated to 1750°F ± 10 (955°C ± 5), held at heat for 30 min. ± 3, and cooled in still air.

- 3.3.3 Spooled Wire: Shall conform to 3.3.3.1 and 3.3.3.2, unless otherwise agreed upon by purchaser and vendor.

- 3.3.3.1 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. (375 mm) and not greater than 30 in. (750 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 in. (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 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	minus
Cut Lengths	0.030, 0.045, 0.062, 0.078	0.002	0.002
Cut Lengths	0.093, 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, 0.093	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, 4.75	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, -1/2 in. (-13 mm) from the length ordered.

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the 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), response to heat treatment (3.3.2), cast (3.3.3.1), and helix (3.3.3.2) 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 2371.

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 5776B, 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 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 5776B, part or assembly number, and quantity.

Ø 4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.

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 steel. No package of cut lengths shall contain wire from more than one heat of steel.

Ø 5.3 Identification: Wire shall be identified in accordance with AMS 2815 unless identification in accordance with AMS 2816 is specified by purchaser. Tab marking of cut lengths is permissible.

5.4 Packaging and Marking: Wire shall be packaged and the packages marked in accordance with AMS 2813.

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 modifications authorized by purchaser 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.

8.2 For direct U.S. Military procurement, purchase documents should specify not less than the following:

Title, number, and date of this specification
Size and form (spools or cut lengths) of wire desired
Length of cut lengths or weight of spools desired
Quantity of wire desired
Applicable level of packaging (See AMS 2813).