

# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

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Superseding AMS 5696A

STEEL, CORROSION AND HEAT RESISTANT, WELDING WIRE  
19Cr - 12.5Ni - 2.5Mo  
High Ferrite Grade

UNS S31683

## 1. SCOPE:

### 1.1 Form:

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

### 1.2 Application:

This wire has been used typically as bare wire filler metal for gas-tungsten-arc or gas-metal-arc welding of corrosion and heat resistant steels and alloys, but usage is not limited to such applications.

- 1.2.1 The relatively high ferrite content promotes weldability by combating microfissuring and minimizing cracking in heavy sections but limits use of the wire to applications not operating in the sigma-forming temperature range.

## 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.

### 2.1 SAE Publications:

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

- AMS 2248 Chemical Check Analysis Limits, 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 and Marking of Packages of Welding Wire, Standard Method  
AMS 2814 Packaging and Marking of Packages of Welding Wire, Premium Quality

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## 2.1 (Continued):

- AMS 2816 Identification, Welding Wire, Tab Marking Method  
 AMS 2819 Identification, Welding Wire, Direct Color Code System
- ARP1876 Weldability Test for Weld Filler Metal Wire  
 ARP4926 Alloy Verification and Chemical Composition Inspection of Welding Wire

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

- ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

## 2.3 AWS Publications:

Available from American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.

AWS Handbook, Volume 4, 7th Edition - Metals and Their Weldability

## 3. TECHNICAL REQUIREMENTS:

## 3.1 Wire 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	--	0.03
Manganese	1.00	2.50
Silicon	0.30	0.65
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	18.00	20.00
Nickel	11.00	14.00
Molybdenum	2.00	3.00
Copper	--	0.50
Nitrogen	--	0.006 (60 ppm)

- 3.1.1 (R) Chemical analysis of initial ingot, bar, or rod stock before drawing is acceptable provided the processes used for drawing or rolling, annealing, and cleaning are controlled to ensure continued conformance to composition requirements.

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

3.1.3 Ferrite Control: Ferrite number of the wire shall be not less than 4.0, based on the calculated ferrite content from the DeLong diagram. (See AWS Handbook, Volume 4, 7th Edition, Page 106).

3.2 Condition:

(R)

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

3.3 Fabrication:

3.3.1 In-process annealing between cold rolling or drawing operations shall be performed in a protective atmosphere to avoid surface oxidation and adsorption of other extraneous elements.

(R)

3.3.2 Butt welding is permissible provided both ends to be joined are alloy verified using a method or methods capable of distinguishing the alloy from all other alloys processed within the facility, or the repair is made at the wire processing station. The butt weld shall not interfere with uniform, uninterrupted feeding of the wire in machine welding equipment.

(R)

3.3.3 Drawing compounds, oxides, dirt, oil, and other foreign materials 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.

(R)

3.4 Properties:

Wire shall conform to the following requirements:

3.4.1 Weldability: Melted wire shall flow smoothly and evenly during welding and shall produce acceptable welds. ARP1876 may be used to resolve disputes.

(R)

3.4.2 Spooled Wire: Shall conform to 3.4.2.1 and 3.4.2.2.

3.4.2.1 Cast: Wire, wound on standard 12-inch (305-mm) diameter spools, shall have imparted to it a curvature such that a specimen sufficient in length to form one loop with a one-inch (25-mm) overlap, when cut from the spool and laid on a flat surface, shall form a circle 15 to 50 inches (381 to 1270 mm) in diameter.

(R)

3.4.2.2 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 inch (25 mm).

3.5 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.

## 3.6 Sizes and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in 3.6.1 and 3.6.2.

## 3.6.1 Diameter: Shall be as shown in Table 2.

(R)

TABLE 2A - Sizes and Tolerances, Inch/Pound Units

Form	Nominal Diameter inch	Tolerance	Tolerance
		Inch plus	Inch minus
Cut Lengths	0.030, 0.035, 0.045, 0.062	0.002	0.002
Cut Lengths	0.094, 0.125	0.003	0.003
Spools	0.007, 0.010, 0.015, 0.002	0.0005	0.0005
Spools	0.030, 0.035, 0.045	0.001	0.002
Spools	0.062, 0.094	0.002	0.002

TABLE 2B - Sizes and Tolerances, SI Units

Form	Nominal Diameter Millimeters	Tolerance	Tolerance
		Millimeters plus	Millimeters minus
Cut Lengths	0.76, 0.89, 1.14, 1.57	0.05	0.05
Cut Lengths	2.39, 3.18	0.08	0.08
Spools	0.18, 0.25, 0.38, 0.51	0.013	0.013
Spools	0.76, 0.89, 1.14	0.025	0.05
Spools	1.57, 2.39	0.05	0.05

3.6.2 Length: Cut lengths shall be furnished in 18, 27, or 36 inch (457, 686, or 914 mm) lengths, as ordered, and shall not vary more than +0, -0.5 inch (-13 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to specified requirements.

## 4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), ferrite number (3.1.3), sizes and tolerances (3.6), and alloy verification (5.2) are acceptance tests and shall be performed on each heat or lot as applicable.