

Steel, Corrosion and Heat-Resistant, Welding Wire  
16.4Cr - 4.8Ni - 0.22Cb - 3.6Cu  
Vacuum Melted

(Composition similar to UNS S17480)

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 filler metal for gas-tungsten-arc or gas-metal-arc welding of steels of similar composition requiring joints with strength and corrosion resistance comparable to those of the base metal, but usage is not limited to such application.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or [www.sae.org](http://www.sae.org).

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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**SAE WEB ADDRESS:**

## 2.1 (Continued):

AMS 2816	Identification, Welding Wire, Tab Marking Method
AMS 2819	Identification, Welding Wire, Direct Color Code System
AMS 5643	Steel, Corrosion Resistant, Bars, Forgings, Tubing, and Rings
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 or [www.astm.org](http://www.astm.org).

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 Wire Composition:

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	--	0.05
Manganese	0.25	0.75
Silicon	--	0.50
Phosphorus	--	0.015
Sulfur	--	0.008
Chromium	16.00	16.75
Nickel	4.50	5.00
Columbium	0.15	0.30
Copper	3.25	4.00
Molybdenum	--	0.75
Aluminum	--	0.05
Boron (3.1.2)	--	0.0010 ( 10 ppm)
Tin (3.1.2)	--	0.0050 ( 50 ppm)
Lead (3.1.2)	--	0.0010 ( 10 ppm)
Oxygen (3.1.2)	--	0.0050 ( 50 ppm)
Nitrogen (3.1.2)	--	0.0150 (150 ppm)
Hydrogen (3.1.2)	--	0.0005 ( 5 ppm)

- 3.1.1 Chemical analysis of initial 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 applicable requirements of AMS 2248. No variation over maximum is permitted for boron, tin, lead, oxygen, nitrogen, and hydrogen.
- 3.2 Melting Practice:
- Steel shall be multiple melted using consumable electrode practice in the remelt cycle or shall be vacuum induction melted.
- 3.3 Condition:
- Cold worked, bright finish, in a temper and with a surface finish which will provide proper feeding of the wire in machine welding equipment.
- 3.3.1 All wire shall have a smooth finish that is free from slivers, depressions, scratches, scale, seams, laps, and foreign matter that would adversely affect welding characteristics, operation of the welding equipment, or properties of the weld metal.
- 3.4 Fabrication:
- 3.4.1 Wire shall be formed from rod or bar descaled by a process which does not affect the composition of the wire. Surface irregularities inherent with a forming process that does not tear the wire surfaces are acceptable provided the wire conforms to the tolerances of 3.7.
- 3.4.2 Butt welding is permissible provided both ends to be joined are alloy verified using a method capable of distinguishing the alloy from all other alloys processed in 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.
- 3.4.3 In-process annealing, if required, between cold rolling or drawing operations, shall be performed in vacuum or protective atmospheres to ensure freedom from surface oxidation and absorption of other extraneous elements.
- 3.4.4 Residual elements, drawing compounds, oxides, dirt, oil, dissolved gasses and other foreign materials picked up during wire processing that can adversely affect the welding characteristics, the operation of the equipment, or the properties of the weld metal, shall be removed by cleaning processes that will neither result in pitting nor cause gas absorption by the wire or deposition of substances harmful to welding operations.

### 3.5 Properties:

Wire shall conform to the following requirements:

- 3.5.1 Weldability: Melted wire shall flow smoothly and evenly during welding and shall produce acceptable welds. ARP1876 may be used to resolve disputes.
- 3.5.2 Response to Heat Treatment: When specified, weld metal, approximately ¼-inch (6.4-mm) in thickness, deposited on AMS 5643 steel, shall attain hardness not lower than 38 HRC, or equivalent (See 8.2), determined in accordance with ASTM E 18, after being solution heat treated by heating to 1900 °F ± 25 (1038 °C ± 14), holding at heat for not less than 30 minutes, and cooling to below 60 °F (16 °C), and precipitation heat treated by heating to 900 °F ± 10 (482 °C ± 6), holding at heat for 60 minutes ± 5, and cooling at a rate equivalent to cooling in air.
- 3.5.3 Spooled Wire: Shall conform to 3.5.3.1 and 3.5.3.2.
- 3.5.3.1 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 1-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.
- 3.5.3.2 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).

### 3.6 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.

### 3.7 Sizes and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in 3.7.1 and 3.7.2.

- 3.7.1 Diameter: Shall be as shown in Table 2.

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

Form	Nominal Diameter Inch	Tolerance
		Inch Plus and Minus
Cut Lengths	0.030, 0.035, 0.045	0.001
Cut Lengths	0.062, 0.078, 0.094, 0.125, 0.156, 0.187	0.002
Spools	0.007, 0.010, 0.015	0.0005
Spools	0.020, 0.030, 0.035, 0.045	0.001
Spools	0.062, 0.078, 0.094	0.002

TABLE 2B - Sizes and Diameter Tolerances, SI Units

Form	Nominal Diameter Millimeters	Tolerance
		Millimeter Plus and Minus
Cut Lengths	0.76, 0.89, 1.14	0.025
Cut Lengths	1.57, 1.98, 2.39, 3.18, 3.96, 4.75	0.05
Spools	0.18, 0.25, 0.38	0.013
Spools	0.51, 0.76, 0.89, 1.14	0.025
Spools	1.57, 1.98, 2.39	0.05

3.7.2 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  $\pm 0$ , -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), response to heat treatment when specified (3.5.2), sizes and tolerances (3.7), and alloy verification (5.2) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Weldability (3.5.1), cast (3.5.3.1) and helix (3.5.3.2) 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:

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