

AEROSPACE MATERIAL SPECIFICATION

Issued 1978-04
Revised 2003-10
Reaffirmed 2008-04

Superseding AMS 6468C

Steel, Welding Wire
1.0Cr - 10Ni - 3.8Co - 0.45Mo - 0.08V (0.14 - 0.17C)
Vacuum Melted, Environment Controlled Packaging
(Composition Similar to UNS K91461)

1. SCOPE:

1.1 Form:

This specification covers an alloy steel in the form of welding wire.

1.2 Application:

This wire has been used typically as filler metal for gas-tungsten-arc and gas-metal-arc welding of low-alloy steels having similar composition and requiring a combination of high strength and high notch toughness without the need for post-weld heat treatment, but usage is not limited to such applications.

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.

AMS 2259	Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2300	Steel Cleanliness, Premium Aircraft-Quality, Magnetic Particle Inspection Procedure
AMS 2370	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel 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

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2008 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER:

Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

2.1 (Continued):

AMS 2816	Identification, Welding Wire, Tab Marking Method
AMS 2819	Identification, Welding Wire, Direct Color Code System
AMS 6523	Steel, Sheet, Strip, and Plate, 0.75Cr - 9.0Ni - 4.5Co - 1.0Mo - 0.09V (0.17 - 0.23C), Vacuum Consumable Electrode Melted, Annealed
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.

ASTM D 2650	Chemical Composition of Gases by Mass Spectrometry
ASTM E 350	Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron
ASTM E 1742	Radiographic Examination
ASTM E 1820	Measurement of Fracture Toughness

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 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon (3.1.1.1)	0.14	0.17
Manganese	0.40	0.55
Silicon	0.15	0.25
Phosphorus	--	0.006
Sulfur	--	0.005
Chromium	0.90	1.05
Nickel	9.75	10.25
Cobalt	3.50	4.00
Molybdenum	0.40	0.50
Vanadium	0.06	0.10
Copper	--	0.10
Oxygen (3.1.1.1)	--	0.0025 (25 ppm)
Nitrogen (3.1.1.1)	--	0.0050 (50 ppm)
Hydrogen (3.1.1.1)	--	0.0005 (5 ppm)

- 3.1.1 Chemical analysis of initial ingot, bar, or rod stock before drawing, other than those analyses required to be done on the finished wire, is acceptable provided the processes used for drawing or rolling, annealing, and cleaning are controlled to ensure continued conformance to requirements.
- 3.1.1.1 Carbon, oxygen, nitrogen, and hydrogen shall also be determined periodically on finished wire (See 4.2.2).
- 3.1.1.2 The hydrogen content of the wire shall be determined at final diameter in accordance with ASTM D 2650.
- 3.1.2 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.
- 3.2 Melting Practice:
- Steel shall be vacuum induction melted; it may be re-melted using consumable electrode vacuum practice in the remelt cycle, but remelting is not required.
- 3.2.1 Steel shall be premium aircraft-quality conforming to AMS 2300.
- 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.
- 3.4 Fabrication:
- 3.4.1 In-process annealing, if required between cold rolling or drawing operations, shall be performed in vacuum or protective atmosphere to avoid surface oxidation and adsorption of other extraneous elements.
- 3.4.2 Butt welding is permissible provided both ends to be joined are either alloy verified using a method or methods 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 equipment.
- 3.4.3 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.
- 3.4.4 Residual elements and dissolved gasses picked up during wire processing that can adversely affect the welding characteristics, the operation of the equipment, or the properties of weld metal shall be removed.

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 Spooled Wire: Shall conform to 3.5.2.1 and 3.5.2.2.

3.5.2.1 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 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.

3.5.2.2 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).

3.5.3 Fracture Toughness: When specified by purchaser, test specimens prepared as in 4.3.1 shall be fracture toughness tested in accordance with ASTM E 1820. Standards for acceptance for fracture toughness, when specified, shall be as agreed upon by purchaser and vendor.

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, 0.094, 0.125	0.002
Spools	0.020, 0.025	0.0005
Spools	0.030, 0.035, 0.045	0.001
Spools	0.062, 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, 0.089, 1.14	0.025
Cut Lengths	1.57, 2.39, 3.18	0.05
Spools	0.51, 0.64	0.013
Spools	0.76, 0.89, 1.14	0.025
Spools	1.57, 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 +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 (3.1.1), alloy verification (5.2), sizes and tolerances (3.7) and, when specified, fracture toughness (3.5.3) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Determination of carbon, oxygen, nitrogen, and hydrogen on finished wire (3.1.1.1), weldability (3.5.1), cast (3.5.2.1), and helix (3.5.2.2) 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 2370.