

NOTICE OF
ADOPTION

ADOPTION NOTICE
15 August 1990 for
AMS 6465B
1 January 1990
SUPERSEDING
AMS 6465A
10 August 1984

AMS 6465B was adopted on 15 August 1990 and is approved for use by the Department of Defense (DOD). Copies of this document are stocked at the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120 for issue to DOD activities only. Other Government Agencies, contractors, private concerns, or other requestors must obtain the document from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

Title of Document: Wire, Steel Welding
2.0Cr - 10Ni - 8.0Co - 1.0Mo - 0.02Al - 0.06V (0.10 - 0.14C)
Vacuum Melted, Environment Controlled Packaging

Date of Specific Issue Adopted: 1 January 1990

Releasing Non-Government Standards Body: SAE

Custodians:

Air Force - 11
Army - MR
Navy - AS

Military Coordinating Activity
Air Force - 11

(Project No: 3439-0763)

FSC 3439

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

SAE The Engineering Society
For Advancing Mobility
Land Sea Air and Space®
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

AMS 6465B

Issued 9-15-75
Revised 1-1-90

Superseding AMS 6465A

Submitted for recognition as an American National Standard

WIRE, STEEL WELDING

2.0Cr - 10Ni - 8.0Co - 1.0Mo - 0.02Al - 0.06V (0.10 - 0.14C)
Vacuum Melted, Environment Controlled Packaging

UNS K91971

1. SCOPE:

1.1 Form: This specification covers a low-alloy steel in the form of welding wire.

1.2 Application: Primarily for use as filler metal for gas-tungsten-arc and gas-metal-arc welding of steels of similar composition which may be heat treated after welding.

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 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 Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
- AMS 2350 - Standards and Test Methods
- AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock
- AMS 2635 - Radiographic Inspection
- 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 6543 - Steel Bars and Forgings, Maraging, 2.0Cr - 10Ni - 8.0Co - 1.0Mo (0.10 - 0.14C), Double Vacuum Melted, Solution Heat Treated
- AMS 6544 - Steel Plate, Maraging, 2.0Cr - 10Ni - 8.0Co - 1.0Mo (0.10 - 0.14C) Vacuum Melted, Solution Heat Treated

SAE Technical 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."

AMS documents are protected under United States and international copyright laws. Reproduction of these documents by any means is strictly prohibited without the written consent of the publisher.

2.1.2 Aerospace Recommended Practices:

ARP1876 - Weldability Test for Weld Filler Metal Wire

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM E 8 - Tension Testing of Metallic Materials
 ASTM E 8M - Tension Testing of Metallic Materials, Metric
 ASTM E 23 - Notched Bar Impact Testing of Metallic Materials
 ASTM E 353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 ANSI Publications: Available from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

ANSI B46.1 - Surface Texture

3. TECHNICAL REQUIREMENTS:3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	0.10	0.14
Manganese	0.07	0.17
Silicon	0.15	0.25
Phosphorus	--	0.006
Sulfur	--	0.006
Chromium	1.80	2.20
Nickel	9.50	10.50
Cobalt	7.50	8.50
Molybdenum	0.90	1.10
Aluminum	0.01	0.03
Vanadium	0.04	0.09
Titanium	--	0.02
Oxygen	--	0.0025 (25 ppm)
Nitrogen	--	0.005 (50 ppm)
Hydrogen	--	0.0003 (3 ppm)

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2248. No variation is permitted for oxygen, nitrogen, and hydrogen.3.2 Condition: Cold drawn, bright finish, and stress-relieved 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 and in cut lengths for manual welding, as ordered.

3.2.2 Surface texture of spooled wire shall be as agreed upon by purchaser and vendor.

3.2.3 Drawing compounds, oxides, dirt, and oil 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.

3.2.4 Residual elements and dissolved gasses deposited on, or absorbed by, the welding wire as a result of cleaning or drawing operations shall be removed by vacuum degassing.

3.2.5 Annealing, if required, shall be performed in vacuum or inert gas atmosphere.

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. The referee method of ARP1876 may be used to resolve weldability disputes.

3.3.2 Spooled Wire: Shall conform to 3.3.2.1 and 3.3.2.2.

3.3.2.1 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, 4 - 8 feet (1219 - 2438 mm), to form one loop, when cut from the spool and laid on a flat surface, shall form a circle 15 - 30 inches (381 - 762 mm) in diameter.

3.3.2.2 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).

3.3.3 Tensile Properties: Specimens, prepared in accordance with 4.3.2 and tested in accordance with ASTM E 8 or ASTM E 8M, shall have tensile and yield strengths not lower than 90% of the average of the control specimens of 4.3.2; elongation of the welded specimens shall be not less than 15% in 2.0 inches (50.8 mm).

3.3.3.1 Welds, properly deposited using the gas-tungsten-arc process with heat input controls, shall provide not less than 180,000 psi (1241 MPa) tensile yield strength in the as-deposited condition. Aging shall not be required to achieve this strength; however, properties can be improved by heating to $950^{\circ}\text{F} \pm 10$ ($510^{\circ}\text{C} \pm 6$), holding at heat for not less than 5 hours for sections 2.0 inches (51 mm) and under in nominal thickness and for 10 hours +0.5, -0, for thicker sections, and cooling in air.

3.3.4 Impact Properties: Charpy V-Notch specimens, prepared in accordance with 4.3.3 and tested at 0°F (-18°C) in accordance with ASTM E 23, shall have average impact strength not lower than 60 foot-pounds (81 J).

3.4 Quality:

3.4.1 Steel shall be produced by vacuum induction melting; it may be remelted using consumable electrode vacuum process but remelting is not required.

3.4.2 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.

3.5 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	0.094, 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

TABLE I (SI)

Form	Nominal Diameter Millimetres	Tolerance, Millimetre	
		plus	minus
Cut Lengths	0.76, 1.14, 1.57, 1.98	0.05	0.05
Cut Lengths	2.39, 3.18, 3.96, 4.78	0.08	0.08
Spools	0.18, 0.25, 0.38, 0.51	0.013	0.013
Spools	0.76, 0.89, 1.14	0.03	0.05
Spools	1.57, 1.98, 2.39	0.05	0.05

3.5.2 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, -1/2 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 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 for composition (3.1) and sizes and tolerances (3.5) 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 (3.3.2.1), helix (3.3.2.2), tensile properties (3.3.3), and impact properties (3.3.4) 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 and the following; the number of specimens to be sampled shall be the minimum number of specimens tested. When steel is consumable electrode vacuum remelted, a heat shall be the consumable electrode remelted ingots produced from steel originally melted as a single furnace charge:

4.3.1 Samples for composition (3.1) shall be taken from a vacuum induction melted ingot.

4.3.2 Specimens for tensile testing shall be obtained from a single-vee-groove, butt-joint weld made between two pieces of AMS 6543 bar or AMS 6544 plate, nominally 0.500 inch (12.70 mm) thick, chamfered full depth to a 40 degree included angle; the weld shall be perpendicular to the longitudinal grain direction of the test pieces. The test pieces shall be of sufficient size to permit cutting six transverse weld tensile specimens to the configuration of Figure 1. The specimens, prior to welding, shall be aged by heating to $950^{\circ}\text{F} \pm 10$ ($510^{\circ}\text{C} \pm 6$), holding at heat for not less than 5 hours, and cooling in air. The specimens shall be machined on both faces to $0.375 \text{ inch} \pm 0.010$ ($9.52 \text{ mm} \pm 0.25$) thick, centered on the original thickness. The weld area in the location of the tensile specimens shall be free from defects detrimental to tensile properties of the weld, determined by radiographic inspection in accordance with AMS 2635. Three control tensile specimens shall be machined to the configuration of Figure 1 from 0.500 inch (12.70 mm) thick bar or plate of the same heat as that used for the welded specimens and aged with the weld specimens. All weld specimens shall be tested in the as-welded condition.

4.3.3 Five Charpy V-Notch specimens shall be taken transverse to the weld joint from panels prepared as in 4.3.2. Preparation and testing shall be in accordance with ASTM E 23. The specimens shall be located approximately 0.125 inch (3.18 mm) from the top surface of the weld. The V-notch shall be centered in the weld metal with the line of the notch root perpendicular to the plane of the surface of the panel. Either three (the lowest and highest values may be disregarded) or five tests shall be used to determine the average.

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 of this specification. This report shall include the purchase order number, heat number, AMS 6465B, nominal size, and quantity.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2370.

5. PREPARATION FOR DELIVERY:

5.1 Heat: Wire on each spool shall be of one continuous length from the same heat of steel. Butt welding is permissible provided both ends to be joined are verified and the weld will not interfere with uniform, uninterrupted feeding of the wire in machine welding equipment. Verification shall consist of either repairing the broken ends at the draw bench or qualitative chemical analysis of the two ends to be joined.

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

5.2.1 An 8 inch (203 mm) length of wire shall be made accessible at both ends of each spool for alloy verification. Alloy verification shall be performed by a method agreed upon by purchaser and vendor.

5.3 Packaging and Marking: Shall be in accordance with AMS 2814.

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 (ϕ) symbol is used to indicate technical changes from the previous issue of this specification.

8.2 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.3 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
Method of test and acceptance standards for weldability (See 3.3.1)
Method for alloy verification (5.2.1)
Applicable level of packaging (See AMS 2814).

8.4 Wire meeting the requirements of this specification has been classified under Federal Supply Classification (FSC) 3439.

8.5 This specification is under the jurisdiction of AMS Committee "E".

SAENORM.COM : Click to view the full PDF of ams6465b