Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4953A
Superseding AMS 4953
Issued 3-1-58
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TITANIUM ALLOY WIRE, WELDING
5Al - 2.5Sn

1. SCOPE:

1.1 Form: This specification covers a titanium alloy in the form of welding wire.

1.2 Application: Primarily for gas-metal-arc and gas-tungsten arc welding.

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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2249 - Chemical Check Analysis Limits, Titanium and Titanium Alloys
AMS 2350 - Standards and Test Methods
AMS 2813 - Packaging of Welding Wire, Standard Method
AMS 2815 - Identification, Welding Wire, Line Code System
AMS 2816 - Identification, Welding Wire, Color Code System

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

ASTM E120 - Chemical Analysis of Titanium and Titanium-Base Alloys

2.3 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

2.3.2 Military Specifications:

MIL-W-10430 - Welding Rods and Electrodes, Preparation for Delivery of

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E120, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Aluminum	4.50	5.75
Tin	2.00	3.00
Iron	--	0.50
Oxygen (3.1.1)	--	0.175
Carbon	--	0.08
Nitrogen	--	0.05
Hydrogen	--	0.015 (150 ppm)
Yttrium	--	0.005 (50 ppm)
Residual Elements, each (3.1.1)	--	0.10
Residual Elements, total (3.1.1)	--	0.40
Titanium	remainder	

3.1.1 Determination not required for routine acceptance.

3.1.2 Check Analysis: Composition variations shall meet the requirements of AMS 2249.

3.2 Condition: Cold drawn, bright finish, in a temper which will provide proper feeding of the wire in machine welding equipment. Wire shall be furnished on disposable spools for machine welding or in ø cut lengths for manual or other welding operations, as ordered.

3.2.1 In-process annealing between cold rolling or drawing operations shall be performed in a suitable ø protective atmosphere.

3.2.2 Oxides, dirt, and drawing compounds shall be removed by processes which will neither result in ø 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 Spooled Wire: Shall conform to the following, unless otherwise agreed upon by purchaser and vendor:

3.3.2.1 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 ø less than 15 in. or 380 mm and not greater than 30 in. or 760 mm in diameter.

3.3.2.2 Helix: The specimen on which cast was determined, when laid on a flat surface and measured ø between adjacent turns, shall show a vertical separation not greater than 1 in. or 25 mm.

3.4 Quality:

3.4.1 Alloy shall be produced by multiple melting using consumable electrode practice unless otherwise permitted; at least one of the melting cycles shall be under vacuum.

3.4.2 Wire, as received by the purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to welding operations, operations 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:

ø

TABLE I

Form	Nominal Diameter Inch	Tolerance, Inch plus and minus
Cut Lengths	0.030, 0.045, 0.062, 0.093, 0.125	0.003
Spools	0.030, 0.035, 0.045, 0.062, 0.093	0.002

TABLE I (SI)

Form	Nominal Diameter Millimetres	Tolerance, Millimetre plus and minus
Cut Lengths	0.76, 1.14, 1.57, 2.36, 3.18	0.08
Spools	0.76, 0.89, 1.14, 1.58, 2.36	0.05

3.5.2 Length: Cut lengths shall be furnished in 12, 18, 27, or 36 in. (305, 457, 686, or 914 mm) lengths, ø 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 wire shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as ø required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems 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 composition (3.1) and tolerance (3.5) ø requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests to determine conformance to weldability (3.3.1), cast (3.3.2.1) and helix (3.3.2.2) requirements are classified as periodic tests.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this ø specification are classified as preproduction tests.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction ø test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows; a lot shall be all wire of the same nominal size from the same heat ø processed at the same time:

4.3.1 Acceptance Tests:

4.3.1.1 Composition: One sample from each heat except that for hydrogen determinations one sample from ø each lot, obtained after thermal and chemical processing is completed.

Ø 4.3.1.2 Other Requirements: As agreed upon by purchaser and vendor.

Ø 4.3.2 Periodic Tests and Preproduction Tests: As agreed upon by purchaser and vendor.

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 for the hydrogen content of each lot, and stating Ø that the wire conforms to the other technical requirements of this specification. This report shall include the purchase order number, heat number, lot number, material specification number and its revision letter, 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 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, material specification number and its revision letter, part or assembly number, and quantity.

4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the wire may be based on the results of testing three additional specimens Ø for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the wire represented and no additional testing shall be permitted. Results of all tests shall be reported.

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, Ø 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 material. No Ø package of cut lengths shall contain wire from more than one heat of material.

5.3 Identification: Spooled wire shall be identified in accordance with AMS 2816; cut lengths shall be Ø identified in accordance with AMS 2815. Tab marking of cut lengths is permissible.

5.4 Packaging and Marking:

Ø 5.4.1 Wire shall be packaged and the packages marked in accordance with AMS 2813.

5.4.2 Packages of wire shall be prepared for shipment in accordance with commercial practice to ensure carrier acceptance and safe transportation to the point of delivery. Packaging shall Ø conform to carrier rules and regulations applicable to the mode of transportation.

5.4.3 For direct U.S. Military procurement, packaging shall be in accordance with MIL-W-10430, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.4.2 will be acceptable if it meets the requirements of Level C.

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 authorized modifications will be subject to rejection.