

TITANIUM ALLOY SHEET AND STRIP
4Al - 3Mo - 1V
Solution Heat Treated

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 10-7-75. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the "A" revision of the subject specification.

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REAFFIRMED

10/91

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AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 1000

AMS 4912A

Superseding AMS 4912

Issued	1-15-61
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TITANIUM ALLOY SHEET AND STRIP 4Al - 3Mo - 1V Solution Heat Treated

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. **APPLICATION:** Primarily for parts to be formed in the solution heat treated condition and subsequently precipitation hardened. Material may be characterized by poor crack propagation resistance in the precipitation treated condition.
3. **COMPOSITION:**

	min	max	
Aluminum	3.75	- 4.75	
Molybdenum	2.50	- 3.50	
Vanadium	0.75	- 1.25	
Iron	--	0.35	
Oxygen		0.20	
Carbon	--	0.08	
Nitrogen	--	0.05	(500 ppm)
Hydrogen	--	0.015	(150 ppm)
Other Elements, each (1)	--	0.10	
Other Elements, total (1)	--	0.40	
Titanium			remainder

(1) Determination not required for routine acceptance.

- 3.1 **Check Analysis:** Composition variations shall meet the requirements of the latest issue of AMS 2249.
4. **CONDITION:** Unless otherwise specified, hot rolled with or without subsequent cold reduction, solution heat treated, descaled, and leveled, having a surface appearance comparable to a commercial corrosion resistant steel No. 2D finish.
5. **TECHNICAL REQUIREMENTS:**
 - 5.1 **Solution Heat Treatment:** Unless otherwise specified, material shall be solution heat treated by heating to 1640 F + 15 (893.3 C + 8.3), holding at heat for a time commensurate with the thickness and the heating equipment and procedure used, but not longer than 30 min., and then quenching in oil or water at room temperature.
 - 5.2 **Tensile Properties:** These properties apply when the rate of strain is maintained at 0.003 - 0.007 in. per in. per min. through the yield strength and then is increased so as to produce failure in approximately one additional minute. When a dispute occurs between purchaser and vendor over the yield strength values, a referee test shall be performed on a machine having a strain rate pacer, using a rate of 0.005 in. per in. per min. through the yield strength and a minimum cross head speed of 0.10 in. per min. above the yield strength; for such referee tests, yield strength shall be determined by the offset method.

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Tensile Strength, psi	(1)
Yield Strength at 0.2% Offset or at 0.0226 in. in 2 in. Extension Under Load (E = 14,500,000), psi	135,000 max
Elongation, % in 2 in.	
Nominal Thickness, Inch	
Up to 0.031, incl	8 min
Over 0.031 to 0.069, incl	10 min
Over 0.069	12 min

(1) Tensile strength shall be not less than 15,000 psi higher than yield strength.

5.2.1 For widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

5.3 Bending: Material shall withstand, without cracking, bending at room temperature through an angle of 105 deg around a diameter equal to the bend factor times the nominal thickness of the material, using either V-block, U-channel, or free bend procedure. Unless otherwise specified, the axis of bend shall be parallel to the direction of rolling. For V-block and U-channel bend tests, specimen width shall be not less than 10 times the nominal thickness but not less than 1 inch. For free bend tests, minimum specimen width shall, when possible, be not less than 10 times the nominal thickness; maximum width need not be greater than 1 inch. Only one of these tests will be required in routine inspection. In case of dispute, results of bend tests using the V-block procedure shall govern.

Nominal Thickness	
Inch	Bend Factor
Up to 0.070, incl	7
Over 0.070 to 0.1875, excl	8

5.4 Properties After Precipitation Heat Treatment: Material shall be capable of meeting the following requirements after heating to 925 F ± 15, (496.1 C ± 8.3), holding at heat for 10 - 14 hr, and cooling in air.

5.4.1 Tensile Properties: These properties apply when the rate of strain is maintained at 0.003 - 0.007 in. per in. per min. through the yield strength and then is increased so as to produce failure in approximately one additional minute. When a dispute occurs between purchaser and vendor over the yield strength values, a referee test shall be performed on a machine having a strain rate pacer, using a rate of 0.005 in. per in. per min. through the yield strength and a minimum cross head speed of 0.10 in. per min. above the yield strength; for such referee tests, yield strength shall be determined by the off-set method.

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 16,400,000)		Elongation % in 2 in. or 4D, min
		psi, min	Extension Under Load in. in 2 in.	
Up to 0.033, excl	170,000	155,000	0.0229	3
0.033 to 0.050, excl	180,000	155,000	0.0229	4
0.050 to 0.1875, excl	180,000	155,000	0.0229	5

5.4.1.2 For widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

6. QUALITY: Unless otherwise specified, material shall be produced by multiple melting using consumable electrode practice; at least one of the melting cycles shall be under vacuum. The product shall be uniform in quality and condition, clean, sound, and free from "oil cans" of depth in excess of the flatness tolerance, ripples, and foreign materials, and from internal and external imperfections detrimental to fabrication or to performance of parts.

Note. An "oil can" is defined as an excess of material in a localized area of a sheet which causes the sheet to buckle in that area. When the sheet is placed on a flat surface and hand pressure applied to the buckle, the buckle will spring through to the opposite surface or spring up in another area of the sheet.

7. TOLERANCES: Unless otherwise specified, tolerances shall conform to the following:

7.1 Thickness, Width, Length, and Straightness: The latest issue of AMS 2242.

7.2 Flatness: Flatness tolerance for material 36 in. and under in width and over 0.070 to 0.1875 in., excl, in thickness shall be 3% and for material 0.070 in. and under shall be 5%. Flatness tolerance for material over 36 in. wide shall be as agreed upon by purchaser and vendor.

7.2.1 Flatness shall be determined from the expression $100H/L$ where "L" is the distance between contact points of a straight edge laid in any direction on the material and "H" is the distance from the straight edge to the material at the point of greatest separation.

7.2.2 Flatness tolerances do not apply to coiled products.

8. REPORTS:

8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment and the results of tests on each lot to determine conformance to the hydrogen, tensile, and bending requirements of this specification. A lot is defined as all material of the same nominal thickness from the same heat processed at the same time. This report shall include the purchase order number, heat number, material specification number and its revision letter, thickness, size, and quantity from each heat.

8.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

9. IDENTIFICATION: Unless otherwise specified, each sheet and strip shall be marked on one face, in the respective location indicated below, with AMS 4912A, heat number, manufacturer's identification, and nominal thickness in inches. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid whose residue shall contain not more than traces of halogen-bearing compounds, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

9.1 Flat Strip 6 In. and Under in Width: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 feet.

9.2 Flat Sheet and Flat Strip Over 6 In. in Width: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft, the rows being spaced not more than 6 in. apart and alternately staggered.