Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 4906

Issued 11-1-69
Revised

TITANIUM ALLOY SHEET AND STRIP
6Al - 4V
Continuously Rolled, Annealed

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for parts requiring strength up to 750 F (399 C)

3. COMPOSITION:

	min	max
Aluminum	5.50	6.75
Vanadium	3.50	4.50
Iron	--	0.30
Oxygen	--	0.20
Carbon	--	0.08
Nitrogen	--	0.05 (500 ppm)
Hydrogen	--	0.0125 (125 ppm)
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 ordered, the product shall be supplied hot rolled, with subsequent cold reduction, annealed, descaled, and flattened, having a surface appearance comparable to a corrosion resistant steel No. 2D finish.

5. TECHNICAL REQUIREMENTS:

5.1 Annealing: Unless otherwise specified, material shall be line annealed by a procedure agreed upon by purchaser and vendor which will result in material meeting all requirements of this specification.

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 test machine having a strain rate pacer, using a rate of 0.005 in. per in. per min. through the yield strength and a minimum crosshead speed of 0.10 in. per min. above the yield strength; for such referee tests, yield strength shall be determined by the offset method.

REAFFIRMED
10-91

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Nominal Thickness Inch	Tensile Strength psi	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 0.008, incl	140,000	126,000	0.0194	--
Over 0.008 to 0.025, incl	140,000	126,000	0.0194	8
Over 0.025 to 0.060, incl	140,000	126,000	0.0194	10

5.2.1 Tensile property requirements for material over 0.060 in. thick shall be as agreed upon by purchaser and vendor.

5.2.2 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.

5.3 Bending: Material shall withstand, without evidence of cracking when examined at 20X magnification, 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, with axis of bend either parallel or perpendicular 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	
	Axis Parallel to Rolling Direction	Axis Perpendicular to Rolling Direction
Up to 0.025, incl	9	11
Over 0.025 to 0.070, excl	10	12
Over 0.070 to 0.1875, excl	As agreed upon by purchaser and vendor	

5.4 Microstructure: Shall be essentially that resulting from alpha-beta processing. Microstructure shall not be cause for rejection unless standards have been agreed upon by purchaser and vendor.

5.5 Surface Contamination: Material shall be free of any oxygen-rich layer, such as alpha case, or other surface contamination.

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.

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7.1.1 When material is ordered to "close tolerances", the following thickness tolerances shall apply, unless otherwise specified. These tolerances apply to material 36 in. and under in width; tolerances for material over 36 in. wide shall be as agreed upon by purchaser and vendor.

Nominal Thickness Inch	Thickness Tolerances, Inch plus and minus
0.012 to 0.016, incl	0.001
Over 0.016 to 0.026, incl	0.0015
Over 0.026 to 0.040, incl	0.002
Over 0.040 to 0.058, incl	0.0025
Over 0.058 to 0.072, incl	0.003
Over 0.072 to 0.083, incl	0.0035
Over 0.083 to 0.098, incl	0.004
Over 0.098 to 0.114, incl	0.0045
Over 0.114 to 0.130, incl	0.005
Over 0.130 to 0.145, incl	0.006
Over 0.145 to 0.1875, excl	0.007

7.2 Flatness: Flatness tolerance for material 36 in. and under in width and 0.025 - 0.1875 in., excl, in thickness shall be 3%. Flatness tolerance for material 36 in. and under in width and under 0.025 in. thick shall be 5%. Flatness tolerance for material over 36 in. wide in all thicknesses 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, thickness, size, specific annealing treatment used, 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, 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, strip, and plate shall be marked on one face, in the respective location indicated below, with AMS 4906, 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.

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