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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4932A

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Superseding AMS 4932

Titanium Alloy Sheet
6Al - 4V
Driver Sheet

(Composition similar to UNS R56400)

1. SCOPE:

1.1 Form:

This specification covers a titanium alloy in the form of sheet.

1.2 Application:

This material has been used typically for driver sheet used as a consumable manufacturing aid in superplastic forming of titanium alloy sheet or plate components at 1600 to 1700 °F (871 to 927 °C), 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 canceled 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 2249 Chemical Check Analysis Limits, Titanium and Titanium Alloys

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 120	Chemical Analysis of Titanium Alloys
ASTM E 1409	Determination of Oxygen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique
ASTM E 1447	Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1; oxygen shall be determined in accordance with ASTM E 1409, hydrogen in accordance with ASTM E 1447, and other elements determined by wet chemical methods in accordance with ASTM E 120, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	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 (3.1.2)	--	0.02 (200 ppm)
Residual Elements, total (3.1.1)	--	0.40
Titanium	remainder	

3.1.1 Determination not required for routine acceptance.

3.1.2 Sample size when using ASTM E 1447 for hydrogen determination may be as large as 0.35 gram.

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

3.2 Melting Practice:

Alloy shall be multiple melted; melting cycle(s) prior to the final melting cycle shall be made using consumable electrode, nonconsumable electrode, electron beam, or plasma arc melting practice(s). The final melting cycle shall be made under vacuum using consumable electrode practice with no alloy additions permitted.

3.2.1 The atmosphere for nonconsumable electrode melting shall be vacuum or shall be inert gas at a pressure not higher than 1000 mm of mercury.

3.2.2 The electrode tip for nonconsumable electrode melting shall be water-cooled copper.

3.3 Condition:

Hot rolled, flattened, descaled, and, if required, pickled. Sheet may be supplied annealed or as-rolled, at vendor's option.

3.4 Properties:

Shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M with the rate of strain maintained at 0.003 to 0.007 inch/inch/minute (0.003 to 0.007 mm/mm/minute) through the yield strength and then increased so as to produce failure in approximately one additional minute:

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	134 ksi (924 MPa)
Yield Strength at 0.2% Offset	126 ksi (869 MPa)
Elongation in 2 Inches (50.8 mm)	5%

3.4.1.1 Tensile properties shall be determined in the transverse direction.

3.4.1.2 Sheet shall not be rejected on the basis of tensile properties if all other technical requirements are met.

3.4.2 Microstructure: Shall be the structure resulting from processing within the alpha-beta phase field. Microstructure shall conform to 3.4.2.1 or 3.4.2.2.

3.4.2.1 Equiaxed and/or elongated primary alpha in a transformed beta matrix with no continuous network of alpha at prior beta grain boundaries.

3.4.2.2 Essentially complete field of equiaxed and/or elongated alpha with or without intergranular beta and no continuous network of alpha at prior grain boundaries.

3.4.3 Surface Contamination: Sheet shall be free of any oxygen-rich layer, such as alpha case, or other surface contamination, determined by microscopic examination at 400X or other method acceptable to purchaser.

3.5 Quality:

Sheet, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.6 Tolerances:

Shall conform to the following:

3.6.1 Length and Width: -0, +1/4 inch (-0, +6.4 mm).

3.6.2 Thickness: -0, +0.013 inch (-0, +0.33 mm).

3.6.3 Flatness: Shall not deviate more than 3% for sheet 36 inches (914 mm) and under in width, and not more than 5% for sheet over 36 inches (914 mm) in width.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of sheet 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 sheet conforms to the specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), surface contamination (3.4.3), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tensile properties (3.4.1) and microstructure (3.4.2) 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 the following; a lot shall be all sheet from the same heat processed at the same time; a heat shall be the consumable electrode remelted ingots produced from alloy originally melted as a single furnace charge.