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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-4932

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Submitted for recognition as an American National Standard

TITANIUM ALLOY SHEET
6Al - 4V
Driver Sheet

UNS R56400

1. SCOPE:

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

1.2 Application: Primarily 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).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent indicated herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS-2249 - Chemical Check Analysis Limits, Titanium and Titanium Alloys

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8 - Tension Testing of Metallic Materials
ASTM E 8M - Tension Testing of Metallic Materials (Metric)
ASTM E 120 - Chemical Analysis of Titanium and Titanium Alloys

2.3 U.S. Government Publications: Available from Naval Publications and Forms Center, Attn: NPODS, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

2.3.1 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Chemical Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 120, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

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

3.1.1 Determination not required for routine acceptance.

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

3.2 Condition: Hot rolled, flattened, descaled, and, if required, pickled. Sheet may be supplied annealed or as-rolled, at vendors option.

3.3 Properties: Shall conform to the following requirements:

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

Tensile Strength, minimum	134,000 psi (924 MPa)
Yield Strength at 0.2% Offset, minimum	126,000 psi (869 MPa)
Elongation in 2 Inches (50.8 mm), minimum	5%

3.3.1.1 Tensile properties shall be determined in the transverse direction.

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

3.3.2 Microstructure: Shall be that structure resulting from alpha-beta processing. Microstructure shall conform to 3.3.2.1, 3.3.2.2, or 3.3.2.3.

3.3.2.1 Equiaxed alpha in a transformed beta matrix.

3.3.2.2 Equiaxed alpha and elongated alpha in a transformed beta matrix.

3.3.2.3 Partially broken and distorted grain boundary alpha with plate-like alpha.

3.3.2.4 A microstructure showing a continuous network of alpha in prior beta grain boundaries is not acceptable.

3.3.3 Surface Contamination: Sheet shall be free of any oxygen-rich layer, such as alpha case, or other surface contamination, determined by microscopic examination at 100X or other method acceptable to purchaser.

3.4 Quality:

3.4.1 Alloy shall be multiple melted; at least one of the melting cycles shall be under vacuum. The first melt shall be made by consumable electrode, nonconsumable electrode, electron beam, or plasma arc melting practice. The subsequent melt or melts shall be made using consumable electrode practice.

3.4.1.1 The atmosphere for nonconsumable electrode melting shall be vacuum or shall be inert gas at a pressure not higher than 250 mm of mercury.

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

3.4.2 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.

3.5 Tolerances: Shall conform to the following:

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

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

3.5.3 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 performing 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 requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), surface contamination (3.3.3), 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 tensile properties (3.3.1) and microstructure (3.3.2) 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.

4.3.1 For Acceptance Tests:

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

4.3.1.2 Surface Contamination and Tolerances: One sample from each lot.

4.3.2 For Periodic Tests: One sample.

4.4 Reports: The vendor of sheet shall furnish with each shipment a report showing the results of tests for composition of each heat and for hydrogen content, tensile properties when determined, and surface contamination of each lot, and stating that the sheet conforms to the other technical requirements. The report shall include the purchase order number, lot number, AMS-4932, size, and quantity.

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

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each sheet shall be marked on one face in lengthwise rows of characters recurring at intervals not greater than 3 feet (914 mm), the rows being spaced not more than 6 inches (152 mm) apart and alternately staggered, with DRIVER SHEET, AMS-4932, heat number, lot number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be legible, shall be applied using a suitable marking fluid whose residue shall contain no more than traces of halogen-bearing compounds, and shall be removable in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the sheet or its performance and shall be sufficiently stable to withstand normal handling.