AEROSPACE MATERIAL SPECIFICATION

AMS4932™	REV. E

Issued 1990-04
Reaffirmed 2015-03
Revised 2019-12
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Superseding AMS4932D

Titanium Alloy Sheet 6Al - 4V Driver Sheet (Composition similar to UNS R56400)

RATIONALE

AMS4932E has been declared “STABILIZED” by SAE AMS Committee G Titanium and Refractory Metals. This document will no longer be updated and may no longer represent standard industry practice. This document contains mature technology that is not expected to change and thus no further revisions are anticipated.

NOTE: Previously, this document was Revised. The last technical update of this document occurred in December 2019. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to the specification; including exceptions listed on the certification. In many cases, the purchaser may represent a sub tier supplier and not the cognizant engineering organization.

STABILIZED NOTICE

AMS4932E has been declared “STABILIZED” by SAE AMS Committee G Titanium and Refractory Metals and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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For more information on this standard, visit
https://www.sae.org/standards/content/AMS4932E/

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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2249	Chemical Check Analysis Limits, Titanium and Titanium Alloys
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications
AS1814	Terminology for Titanium Microstructures
AS6279	Standard Practice for Production, Distribution, and Procurement of Metal Stock

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E539 Analysis of Titanium Alloys by X-Ray Fluorescence Spectrometry

ASTM E1409 Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by Inert Gas Fusion

ASTM E1447 Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity/Infrared Detection Method

ASTM E1941 Determination of Carbon in Refractory and Reactive Metals and Their Alloys by Combustion Analysis

ASTM E2371 Analysis of Titanium and Titanium Alloys by Direct Current Plasma and Inductively Coupled Atomic Emission Spectrometry

ASTM E2994 Analysis of Titanium and Titanium Alloys by Spark Atomic Emission Spectrometry and Glow Discharge Atomic Emission Spectrometry

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1; carbon shall be determined in accordance with ASTM E1941, hydrogen in accordance with ASTM E1447, oxygen and nitrogen in accordance with ASTM E1409, and other elements in accordance with ASTM E539, ASTM E2371, or ASTM E2994. Other analytical methods may be used if acceptable to the 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	--	0.02 (200 ppm)
Other 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 applicable requirements of AMS2249.

3.2 Melting Practice

Alloy shall be multiple melted. Melting cycle(s) prior to the final melting cycle shall be made using vacuum consumable electrode, nonconsumable electrode, electron beam cold hearth, or plasma arc cold heath melting practice(s). The final melting cycle shall be made using vacuum arc remelting (VAR) 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 producer'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 E8/E8M with the rate of strain set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through the 0.2% offset yield strain.

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 (see 8.2), 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.

3.7 Production, distribution, and procurement of metal stock shall comply with AS6279. This requirement becomes effective July 1, 2021.

3.8 Exceptions

Any exceptions shall be authorized by purchaser and reported as in 4.4.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of sheet shall supply all samples for producer'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 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 producer 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 vacuum arc remelted ingots produced from alloy originally melted as a single furnace charge.

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.