Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4908C
Superseding AMS 4908B
Issued 11-1-52
Revised 6-15-75

TITANIUM ALLOY SHEET AND STRIP
8Mn
Annealed

1. SCOPE:

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

1.2 Application: Primarily for parts requiring good formability and strength up to 600° F (316° C). Certain processing procedures and service conditions may cause this material to be subject to stress-corrosion cracking; ARP 982 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) and Aerospace Recommended Practices (ARP) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

2.1.1 Aerospace Material Specifications:

AMS 2242 - Tolerances, Corrosion and Heat Resistant Steel and Iron Base Alloy Sheet, Strip, and Plate and Titanium and Titanium Alloy Sheet, Strip, and Plate
AMS 2249 - Chemical Check Analysis Limits, Titanium and Titanium Alloys
AMS 2350 - Standards and Test Methods

2.1.2 Aerospace Recommended Practices:

ARP 982 - Minimizing Stress-Corrosion in Wrought Titanium Alloy Products

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM E8 - Tension Testing of Metallic Materials
ASTM E120 - Chemical Analysis of Titanium and Titanium-Base Alloys
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E120, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Manganese	6.5	9.0
Iron	--	0.50
Oxygen	--	0.20
Carbon	--	0.08
Nitrogen	--	0.05 (500 ppm)
Hydrogen	--	0.015 (150 ppm)
Other Elements, Each (3.1.1)	--	0.10
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 requirements of AMS 2249.

3.2 Condition: Hot rolled, with or without subsequent cold reduction, annealed, descaled, and leveled, having a surface appearance comparable to a commercial corrosion resistant steel No. 2D finish.

3.3 Annealing: The product shall be annealed by heating to 1275°F ± 25 (690.6°C ± 14), holding at heat for not less than 60 min., cooling to 1050°F (566°C) or lower at a rate not greater than 300 F (149 C) deg per hr, and cooling in air to room temperature.

3.4 Properties: The product shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8 with the rate of strain maintained at 0.003 - 0.007 in. per in. per min. (0.003 - 0.007 mm/mm/min.) through the yield strength and then 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. (0.005 mm/mm/min.) through the yield strength and a minimum cross head speed of 0.010 in. per min. (2.5 mm/min.) above the yield strength.

Tensile Strength, min	125,000 psi (862 MPa)
Yield Strength at 0.2% Offset, min	110,000 psi (758 MPa)
Elongation in 2 in. (50.8 mm), min	10%

3.4.1.1 Yield strength, determined with axis of specimen parallel to direction of rolling, shall be not higher than 140,000 psi (965 MPa).

3.4.2 Bending: The product shall withstand, without evidence of cracking when examined at 20X magnification, bending in accordance with ASTM E290 at room temperature through an angle of 105 deg (1.83 rad) around a diameter equal to the bend factor times the nominal thickness of the product, using either V-block, U-channel, or free bend procedure, with axis of bend parallel to direction of rolling. 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		Bend
Inch	(Millimetres)	Factor
Up to 0.070, incl	(Up to 1.78, incl)	6
Over 0.070 to 0.1875, excl	(Over 1.78 to 4.762, excl)	7

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

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

3.5 Quality:

3.5.1 Material shall be produced by multiple melting using consumable electrode practice, unless otherwise permitted; at least one of the melting cycles shall be under vacuum.

3.5.2 The product shall be uniform in quality and condition, clean, sound, and free from "oil cans" (See 8.2) 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.

3.6 Tolerances: Unless otherwise specified, tolerances shall conform to the following:

3.6.1 Thickness, Width, Length, and Straightness: All applicable requirements of AMS 2242.

3.6.2 Flatness: Flatness tolerance for material 36 in. (914 mm) and under in width shall be 5% if nominal thickness is less than 0.025 in. (0.64 mm) and 3% if nominal thickness is 0.025 to 0.1875 in. (0.64 to 4.762 mm), exclusive. Flatness tolerance for material under 0.1875 in. (4.762 mm) thick and over 36 in. (914 mm) wide shall be as agreed upon by purchaser and vendor.

3.6.2.1 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 product and "H" is the distance from the straight edge to the product at the point of greatest separation.

3.6.2.2 Flatness tolerances do not apply to coiled products.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

4.3 Sampling: Shall be in accordance with the following: a lot shall be all product of the same nominal size from the same heat processed at the same time.

4.3.1 Composition: One sample from each heat except that for hydrogen determinations one sample from each lot.

4.3.2 Tensile Property, Bending, Microstructure, and Surface Contamination Requirements: One sample from each lot.

4.3.2.1 Tensile test specimens from widths 9 in. (229 mm) and over shall be taken with the axis of the specimen perpendicular to the direction of rolling; for widths less than 9 in. (229 mm), specimens shall be taken with the axis parallel to the direction of rolling.

4.3.2.2 For V-block or U-channel bend tests, specimen width shall be not less than 10 times the nominal thickness but not less than 1 in. (25 mm). 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 in. (25 mm).

4.4 Reports:

4.4.1 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, the results of tests on each lot to determine conformance to the hydrogen, tensile, bending, and surface contamination requirements, and a statement that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat.

4.4.2 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.

4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product 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 product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each sheet and strip shall be marked on one face, in the respective location indicated below, with AMS 4908C, heat number, manufacturer's identification, and nominal thickness. 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.

5.1.1 Flat Strip 6 In. (152 mm) and Under in Width: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm).

5.1.2 Flat Sheet and Flat Strip Over 6 In. (152 mm) in Width: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm), the rows being spaced not more than 6 in. (152 mm) apart and alternately staggered.

5.2 Packaging: The product shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.