LAND SEA AIR SPACE

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

AEROSPACE MATERIAL SPECIFICATION

AMS 2249B
Superseding AMS 2249A
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CHEMICAL CHECK ANALYSIS LIMITS
Titanium and Titanium Alloys

1. SCOPE: This specification covers standard chemical check analysis limits as established by AMS usage. The chemical check analysis limits shown herein shall apply when this specification is referenced in material specifications for titanium and titanium alloys. Check analysis limits for elements or for ranges of elements not listed herein shall be as agreed upon by purchaser and vendor.

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) 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 2350 - Standards and Test Methods

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

ASTM E59 - Sampling Steel, Cast Iron, Open-Hearth Iron, and Wrought Iron for Determination of Chemical Composition
ASTM E120 - Chemical Analysis of Titanium and Titanium-Base Alloys

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 Analytical Procedures: Referee methods of analysis shall be by wet chemical methods in accordance with ASTM E120, by spectrographic methods in accordance with Federal Test Method Standard No. 151, or by methods approved by the National Bureau of Standards. Procedures for elements not covered by above test procedures shall be as agreed upon by purchaser and vendor.

3.2 Definitions:

3.2.1 Check Analysis: An analysis made by purchaser or vendor of the metal after it has been worked into semi-finished or finished forms or fabricated into parts, and is either for the purpose of verifying the composition of a heat or lot or to determine variations in the composition within the heat. Acceptance or rejection of a heat or lot of material or batch of parts may be made by the purchaser on the basis of this check analysis. In the analysis of finished parts, these values do not apply to elements whose percentage can be varied by fabricating techniques employed (for example oxygen, nitrogen, hydrogen) unless the sample is taken in such a manner as to exclude such changes.

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3.2.2 Variation Limit, Under Min or Over Max: Given in 3.3 is the amount an individual determination for a specified element may vary under or over the specified composition limit. In no case shall the several determinations of any element in a heat, using the same analytical procedure, vary both above and below the specified range. These variations are not permitted for ingot analyses made by the producer.

3.2.3 Remainder: Shows the basis element from which the alloy is made and is assumed to be present in an amount approximately equal to the difference between 100% and the sum percentage of the alloying elements and listed impurities. Analysis for this element need not be made nor need a percentage figure be reported.

3.2.4 Other Impurities (Elements), Each, Max: The maximum amount of an individual element not mentioned specifically in the tabulated composition that may be present. Producer normally will analyze only for impurities which are possible to be present because of raw materials or manufacturing processes and which may affect the product significantly. Others will analyze for impurities as they deem necessary.

3.2.5 Other Impurities (Elements), Total, Max: The sum percentage of the impurities (elements) (See 3.2.4) found. It is not inferred by this statement that an analysis need be made for each element of the periodic table not mentioned specifically in the tabulated composition.

3.2.6 Heat: All metal which, during the final melting operation, is melted in the same furnace crucible and solidified in the same ingot mold.

3.2.7 Lot: All material of the same size processed at the same time from the same heat.

3.3 Check Analysis Limits: Shall be as follows:

Element	Limit or Maximum of Specified Range, %	Variation Under Min or Over Max
Carbon	Up to 0.20, incl	0.02
	Over 0.20 to 0.50, incl	0.04
	Over 0.50	0.06
Manganese	Up to 0.30, incl	0.10
	Over 0.30 to 6.00, incl	0.20
	Over 6.00 to 9.00, incl	0.25
Chromium	Up to 1.00, incl	0.05
	Over 1.00 to 4.00, incl	0.20
	Over 4.00	0.25
Molybdenum	Up to 1.00, incl	0.04
	Over 1.00 to 5.00, incl	0.20
	Over 5.00	0.25
Aluminum	Up to 1.00, incl	0.12
	Over 1.00 to 10.00, incl	0.40
Hydrogen	Up to 0.020 (200 ppm), incl	0.0020 (20 ppm)
	Over 0.020 to 0.050 (200 to 500 ppm), incl	0.005 (50 ppm)
	Over 0.050 (500 ppm)	0.010 (100 ppm)
Nitrogen	Up to 0.10 (1000 ppm), incl	0.02 (200 ppm)
Oxygen	Up to 0.20 (2000 ppm), incl	0.02 (200 ppm)
	Over 0.20 (2000 ppm), incl	0.03 (300 ppm)
Iron	Up to 0.25, incl	0.10
	Over 0.25 to 0.50, incl	0.15
	Over 0.50 to 5.00, incl	0.20
	Over 5.00	0.25