AEROSPACE MATERIAL SPECIFICATION

AMS2249™	REV. K

Issued 1961-01
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Revised 2024-12

Superseding AMS2249J

Chemical Check Analysis Limits, Titanium and Titanium Alloys

RATIONALE

AMS2249K results from a Five-Year Review and update of this specification with changes to align heat lot and material lot definitions with AS7766 (see 2.3 and 4.1), expand coverage in Table 1 for Cb and add coverage for Mg (see Table 1), update Applicable Documents (see Section 2), and relocate Definitions (see 2.3).

1. SCOPE

1.1 Form

This specification defines limits of variation for determining acceptability of the composition of cast or wrought titanium and titanium alloy parts and material acquired from a producer.

1.2 Application

1.2.1 When specifically referenced in the material specification, the purchaser may apply check analysis limits to determine the acceptability of parts and materials at the purchaser's final acceptance or verification testing operation.

1.2.2 Check analysis limits are not for the producer's use at the producer's acceptance testing. Composition of parts and materials must conform to the limits of the material specification. Check limits are not permitted for ladle or ingot analysis.

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.

AS7766 Terms Used in Aerospace Metals Specifications

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS2249K/

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 E539 Analysis of Titanium Alloys by Wavelength Dispersive 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 Reactive Metals and Reactive Metal Alloys by Inert Gas Fusion with Detection by Thermal Conductivity or Infrared Spectrometry

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 Plasma Atomic Emission Spectrometry (Performance-Based Test Methodology)

ASTM E2994 Analysis of Titanium and Titanium Alloys by Spark Atomic Emission Spectrometry and Glow Discharge Atomic Emission Spectrometry (Performance-Based Method)

2.3 Definitions

Terms used in AMS are defined in AS7766 and as follows:

2.3.1 CHECK ANALYSIS

An analysis made by the purchaser or producer of the metal after it has been worked into semifinished or finished forms or fabricated into parts and is either for the purpose of verifying the composition of a heat lot or material lot or to determine variations in the composition within the heat lot. Acceptance or rejection of a heat lot or material 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 sufficiently large to produce a reliable result.

2.3.2 VARIATION LIMIT, UNDER MINIMUM OR OVER MAXIMUM

Given in Table 1 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 lot, 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.

2.3.3 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.

2.3.4 OTHER ELEMENTS, EACH, MAXIMUM

The maximum amount of an individual element not mentioned specifically in the tabulated composition that may be present. The 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.

2.3.5 OTHER ELEMENTS, TOTAL, MAXIMUM

The sum percentage of the other (residual) elements (see 2.3.4) 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. TECHNICAL REQUIREMENTS

3.1 Analytical Procedures

Referee methods of analysis shall be ASTM E1409 for oxygen and nitrogen, ASTM E1447 for hydrogen, and ASTM E1941 for carbon. Other elements shall be determined by ASTM E2371, ASTM E539, or ASTM E2994.

3.2 Check (Product) Analysis Limits

Shall be as shown in Table 1. Check analysis limits for elements or for ranges of elements not listed herein shall be as specified in the applicable material specification or as agreed upon by the purchaser and producer.

Table 1 - Check analysis limits

Element	Limits 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 0.50, incl	0.04
	Over 0.50 to 1.00, incl	0.10
	Over 1.00 to 10.00, incl	0.20
	Over 10.00 to 30.00, incl	0.25
Aluminum	Up to 1.00, incl	0.12
	Over 1.00 to 10.00, incl	0.40
	Over 10.00 to 30.00, incl	0.50
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)	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
Vanadium	Up to 0.50, incl	0.05
	Over 0.50 to 5.00, incl	0.15
	Over 5.00 to 6.00, incl	0.20
	Over 6.00 to 10.00, incl	0.30
	Over 10.00 to 20.00, incl	0.40
Tin	Up to 3.00, incl	0.15
	Over 3.00 to 6.00, incl	0.25
	Over 6.00 to 12.00, incl	0.40
Copper	Up to 1.00, incl	0.05
	Over 1.00 to 3.00, incl	0.10
Zirconium	Up to 4.00, incl	0.10
	Over 4.00 to 6.00, incl	0.20
	Over 6.00 to 10.00, incl	0.30
	Over 10.00	0.40
Columbium	Up to 1.00, incl	0.10
	Over 1.00 to 5.00, incl	0.15