



AEROSPACE MATERIAL SPECIFICATION

AMS2249**REV. G**

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Reaffirmed 2013-10

Superseding AMS2249F

Chemical Check Analysis Limits
Titanium and Titanium Alloys

RATIONALE

AMS2249G has been reaffirmed to comply with the SAE five-year review policy.

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 purchaser final acceptance or verification testing operation.

1.2.2 Check analysis limits are not for producers use at 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 ASTM Publications

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

ASTM E 539	X-Ray Emission Spectrometric Analysis of 6Al-4V Titanium Alloy
ASTM E 1409	Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique
ASTM E 1447	Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity/Infrared Detection Method
ASTM E 1941	Determination of Carbon in Refractory and Reactive Metals and Their Alloys
ASTM E 2371	Analysis of Titanium and Titanium Alloys by Atomic Emission Plasma Spectrometry

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3. TECHNICAL REQUIREMENTS

3.1 Analytical Procedures

Referee methods of analysis shall be ASTM E 1409 for oxygen and nitrogen, ASTM E 1447 for hydrogen, and ASTM E 1941 for carbon. Other elements shall be determined by ASTM E 2371, or ASTM E 539 for 6Al-4V.

3.2 Check (Product) Analysis Limits

Shall be 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 purchaser and vendor.

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

TABLE 1 - CHECK ANALYSIS LIMITS (CONTINUED)

Element	Limits or Maximum of Specified Range, %			Variation Under Min or Over Max
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
	Over	5.00	to 7.00, incl	0.20
	Over	7.00	to 10.00, incl	0.25
	Over	10.00	to 15.00, incl	0.30
	Over	15.00	to 20.00, incl	0.35
	Over	20.00	to 30.00, incl	0.40
Tantalum	Up	to	0.50, incl	0.10
	Over	0.50	to 2.00, incl	0.15
Silicon	Up	to	0.10, incl	0.02
	Over	0.10	to 0.50, incl	0.05
Bismuth	Up	to	0.50, incl	0.05
Yttrium	Up	to	0.005, incl	0.0006
	Over	0.005	to 0.020, incl	0.001
Boron	Up	to	0.005, incl	0.0006
Palladium	Up	to	0.250, incl	0.02
Nickel	Up	to	1.00, incl	0.03
Tungsten	Up	to	1.00, incl	0.04
	Over	1.00	to 3.00, incl	0.10
	Over	3.00	to 5.00, incl	0.15
	Over	5.00	to 10.00, incl	0.20

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and Testing

For the purpose of determining conformance to the material specification composition requirement, each heat or lot, whichever is applicable, in the shipment shall be considered separately. All samples shall be taken from material in the condition in which it is received, except that all protective surface treatments shall be removed before sampling finished parts. Drillings, chips, and other samples shall be taken without the application of water, oil, or other lubricants and shall be free from scale, grease, dirt, and other foreign materials. Samples shall be taken to prevent alteration of the chemical composition of the sample.

5. PREPARATION FOR DELIVERY

Not applicable.

6. ACKNOWLEDGMENT

Not applicable.

7. REJECTIONS

Not applicable.