



AEROSPACE MATERIAL SPECIFICATION

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

AMS 2248B

Superseding 2248A

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CHEMICAL CHECK ANALYSIS LIMITS Wrought Heat and Corrosion Resistant Steels and Alloys

1. SCOPE: This specification covers standard chemical check (product or verification) analysis limits as established by AMS or AISI usage. The chemical check analysis limits shown herein shall apply when this specification is referenced in the material specification. 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.
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 E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and
Other Similar Chromium-Nickel-Iron 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 in accordance with ASTM E353, 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 shall be as agreed upon by purchaser and vendor.
 - 3.2 Definitions:

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 3.2.1 Check (Product or Verification) Analysis: An analysis made by the purchaser after the steel or alloy 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 a 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, carbon in steel) unless the sample is taken in such a manner as to exclude such changes.
- 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 ladle or ingot analyses made by the producer.
- 3.2.3 Remainder: Shows the basic 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.

3.3 Check Analysis Limits: Shall be as follows:

Element	Upper Limit or Maximum of Specified Range, %	Variation	
		Under Min	Over Max
Carbon	Up to 0.010, incl	0.002	0.002
	Over 0.010 to 0.030, incl	0.005	0.005
	Over 0.03 to 0.20, incl	0.01	0.01
	Over 0.20 to 0.60, incl	0.02	0.02
	Over 0.60 to 1.20, incl	0.03	0.03
Manganese	Up to 1.00, incl	0.03	0.03
	Over 1.00 to 3.00, incl	0.04	0.04
	Over 3.00 to 6.00, incl	0.05	0.05
	Over 6.00 to 10.00, incl	0.06	0.06
	Over 10.00 to 15.00, incl	0.10	0.10
	Over 15.00 to 20.00, incl	0.15	0.15
Silicon	Up to 1.00, incl	0.05	0.05
	Over 1.00 to 3.00, incl	0.10	0.10

3.3 Check Analysis Limits: (Continued)

Element	Upper Limit or Max of Specified Range, %	Variation	
		Under Min	Over Max
Phosphorus	Up to 0.040, incl	0.005	0.005
	Over 0.040 to 0.20, incl	0.010	0.010
Sulfur	Up to 0.040, incl	0.005	0.005
	Over 0.040 to 0.20, incl	0.010	0.010
	Over 0.20 to 0.50, incl	0.020	0.020
Chromium Ø	Over 4.00 to 10.00, incl	0.10	0.10
	Over 10.00 to 15.00, incl	0.15	0.15
	Over 15.00 to 20.00, incl	0.20	0.20
	Over 20.00 to 30.00, incl	0.25	0.25
Nickel	Up to 1.00, incl	0.03	0.03
	Over 1.00 to 5.00, incl	0.07	0.07
	Over 5.00 to 10.00, incl	0.10	0.10
	Over 10.00 to 20.00, incl	0.15	0.15
	Over 20.00 to 30.00, incl	0.20	0.20
	Over 30.00 to 40.00, incl	0.25	0.25
	Over 40.00	0.30	0.30
Cobalt Ø	Over 0.05 to 0.50, incl	0.01	0.01
	Over 0.50 to 2.00, incl	0.02	0.02
	Over 2.00 to 5.00, incl	0.05	0.05
	Over 5.00 to 10.00, incl	0.10	0.10
	Over 10.00 to 15.00, incl	0.15	0.15
	Over 15.00 to 22.00, incl	0.20	0.20
	Over 22.00 to 30.00, incl	0.25	0.25
Molybdenum	Over 0.20 to 0.60, incl	0.03	0.03
	Over 0.60 to 2.00, incl	0.05	0.05
	Over 2.00 to 7.00, incl	0.10	0.10
	Over 7.00 to 15.00, incl	0.15	0.15
	Over 15.00 to 30.00, incl	0.20	0.20
Tungsten	Up to 1.00, incl	0.03	0.03
	Over 1.00 to 2.00, incl	0.05	0.05
	Over 2.00 to 5.00, incl	0.07	0.07
	Over 5.00 to 10.00, incl	0.10	0.10
	Over 10.00 to 20.00, incl	0.15	0.15
Columbium + Tantalum	Up to 1.50, incl	0.05	0.05
	Over 1.50 to 5.00, incl	0.10	0.10
	Over 5.00	0.15	0.15
Titanium	Up to 1.00, incl	0.05	0.05
	Over 1.00 to 3.00, incl	0.07	0.07
	Over 3.00	0.10	0.10
Tantalum	Up to 0.10, incl	0.02	0.02

3.3 Check Analysis Limits: (Continued)

Element	Upper Limit or Max Of Specified Range, %		
Aluminum	Up to 0.15, incl	0.005	0.01
	Over 0.15 to 0.50, incl	0.05	0.05
	Over 0.50 to 2.00, incl	0.10	0.10
	Over 2.00 to 5.00, incl	0.20	0.20
	Over 5.00 to 10.00, incl	0.35	0.35
Nitrogen Ø	Up to 0.02, incl	0.005	0.005
	Over 0.02 to 0.19, incl	0.01	0.01
	Over 0.19 to 0.25, incl	0.02	0.02
	Over 0.25 to 0.35, incl	0.03	0.03
	Over 0.35 to 0.45, incl	0.04	0.04
Boron	0.001 to 0.010, incl	0.0004	0.001
	Over 0.01 to 0.12, incl	0.005	0.01
Selenium	All	0.03	0.03
Iron	Up to 1.00, incl	0.03	0.03
	Over 1.00 to 2.50, incl	0.05	0.05
	Over 2.50 to 5.00, incl	0.07	0.07
	Over 5.00 to 10.00, incl	0.10	0.10
	Over 10.00 to 15.00, incl	0.15	0.15
	Over 15.00 to 30.00, incl	0.25	0.25
Copper	Up to 0.50, incl	0.03	0.03
	Over 0.50 to 1.00, incl	0.05	0.05
	Over 1.00 to 3.00, incl	0.10	0.10
	Over 3.00 to 5.00, incl	0.15	0.15
	Over 5.00 to 10.00, incl	0.20	0.20
Vanadium	Up to 0.50, incl	0.03	0.03
	Over 0.50 to 1.50, incl	0.05	0.05
Zirconium	Up to 0.10, incl	0.000	0.02
	Over 0.10	0.05	0.05
Tin	Up to 0.05, incl	0.005	0.01

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Sampling: For the purpose of determining conformance to the material specification composition requirement, each heat in a 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 or chips shall be taken without the application of water, oil, or other lubricants, shall be free from scale, grease, dirt, and other foreign materials, and shall be taken in such a manner as to prevent alteration of the chemical composition of the sample. If finished parts are too hard for machining, they may be tempered in a protective atmosphere prior to sampling. Sampling shall be in accordance with ASTM E59, insofar as practicable.