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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2248C
Superseding AMS 2248B

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CHEMICAL CHECK ANALYSIS LIMITS
Wrought Corrosion and Heat Resistant, Steels and Alloys, Maraging, and Other Highly-Alloyed Steels, and Iron Alloys

1. SCOPE: This specification covers chemical check (product or verification) analysis limits for corrosion and heat resistant steels and alloys, maraging and other highly-alloyed steels, and iron alloys 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 ranges of elements not listed herein shall be as specified in the 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 SAE, 400 Commonwealth Drive, Warrendale, PA 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, PA 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, PA 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:

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 a 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	Variation 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
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	Up to 0.90, incl	0.03	0.03
	Over 0.90 to 2.10, incl	0.05	0.05
ø	Over 2.10 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

Element	Upper Limit or Maximum of Specified Range, %	Variation Under Min	Variation Over Max
Cobalt	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
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	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

Element	Upper Limit or Maximum of Specified Range, %	Variation, Under Min	Variation, Over Max
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.