

**AEROSPACE
MATERIAL
SPECIFICATION**

Submitted for recognition as an American National Standard

AMS 5881A

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Superseding AMS 5881

ALLOY FORGINGS, CORROSION AND HEAT RESISTANT
59.5Ni - 12Cr - 10Co - 3.0Mo - 6.0W - 3.0Ti - 1.5Ta - 4.5Al - 0.015B - 0.10Zr
(0.30 - 0.35C), Solution, Stabilized, and Precipitation Heat Treated
UNS N07012

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 16 October 1986. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the "A" revision of the subject specification.

"Noncurrent" refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, SAE, does not recommend these as standard materials for future use in new designs. Each of these "Noncurrent" specifications is available on request from SAE.

This specification is under the jurisdiction of AMS Committee "F".

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ALLOY FORGINGS, CORROSION AND HEAT RESISTANT
59.5Ni - 12Cr - 10Co - 3.0Mo - 6.0W - 3.0Ti - 1.5Ta - 4.5Al - 0.015B - 0.10Zr (0.30 - 0.35C)
Solution, Stabilized, and Precipitation Heat Treated

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel alloy powder-metallurgy product in the form of forgings.

1.2 Application: Primarily for parts requiring high strength up to 1500°F (815°C) and corrosion and oxidation resistance up to 1700°F (925°C).

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.

AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys

AMS 2350 - Standards and Test Methods

AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Forgings and Forging Stock

AMS 2375 - Control of Forgings Requiring First Article Approval

AMS 2808 - Identification, Forgings

AMS 5856 - Alloy Billets and Preforms, Corrosion and Heat Resistant, 59.5Ni - 12Cr - 10Co - 3.0Mo - 6.0W - 3.0Ti - 1.5Ta - 4.5Al - 0.015B - 0.10Zr - (0.30 - 0.35C), Powder-Metallurgy Product

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

ASTM E8 - Tension Testing of Metallic Materials

ASTM E10 - Brinell Hardness of Metallic Materials

ASTM E21 - Elevated Temperature Tension Tests of Metallic Materials

ASTM E112 - Estimating the Average Grain Size of Metals

ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

ASTM E292 - Conducting Time-for-Rupture Notch Tension Tests of Materials

ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. 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

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

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3. TECHNICAL REQUIREMENTS:

- 3.1 Material: Forgings shall be produced from AMS 5856 billets or preforms, forged by a process or processes which will produce the required shape and which will meet the requirements of 3.2, 3.5, and 3.6.
- 3.2 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, except that oxygen and nitrogen shall be determined by Leco Gas Analyzer, or by other analytical methods approved by purchaser:

	min	max
Carbon	0.30	0.35
Manganese	--	0.10
Silicon	--	0.10
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	11.50	12.50
Cobalt	9.50	10.50
Molybdenum	2.50	3.50
Tungsten	5.50	6.50
Titanium	2.75	3.25
Tantalum	1.00	2.00
Aluminum	4.20	4.80
Boron	0.01	0.02
Zirconium	0.05	0.15
Oxygen	--	0.010 (100 ppm)
Nitrogen	--	0.005 (50 ppm)
Iron	--	1.00
Lead	--	0.0002 (2 ppm)
Bismuth	--	0.00005 (0.5 ppm)
Nickel	remainder	

- 3.2.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

- 3.3 Condition: Solution, stabilization, and precipitation heat treated.

- 3.4 Heat Treatment: Shall be as follows:

- 3.4.1 Solution Heat Treatment: Heat to a temperature within the range 2175° - 2225°F (1190° - 1220°C), hold at the selected temperature within $\pm 15^\circ\text{F}$ ($\pm 8^\circ\text{C}$) for 2 hr $\pm$ 0.3, and quench in oil.
- 3.4.2 Stabilization Heat Treatment: Heat to 2050°F $\pm$ 15 (1120°C $\pm$ 8), hold at heat for 2 hr $\pm$ 0.3, and cool in air to below 700°F (370°C).
- 3.4.3 Precipitation Heat Treatment: Heat to 1300°F $\pm$ 15 (705°C $\pm$ 8), hold at heat for 12 hr $\pm$ 0.5, cool in air to below 700°F (370°C), reheat to 1500°F $\pm$ 15 (815°C $\pm$ 8), hold at heat for 8 hr $\pm$ 0.5, and cool in air.

- 3.5 Properties: Forgings shall conform to the following requirements:

- 3.5.1 Grain Size: Shall be predominantly recrystallized grains of 1 or finer with no segregation of coarse or fine grain areas, determined by comparison of a polished and etched specimen with the chart in ASTM E112.