



400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 5856B

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Superseding AMS 5856A

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

UNS N07012

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1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant nickel alloy powder-metallurgy product in the form of billets and preforms the 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 SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2261 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
AMS 2269 Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
AMS 2350 Standards and Test Methods
AMS 2375 Control of Forgings Requiring First Article Approval
AMS 2630 Ultrasonic Inspection
AMS 5855 Alloy Powder, 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)

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 8 Tension Testing of Metallic Materials
ASTM E 10 Brinell Hardness of Metallic Materials
ASTM E 21 Elevated Temperature Tension Tests of Metallic Materials
ASTM E 112 Estimating the Average Grain Size of Metals
ASTM E 139 Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E 292 Conducting Time-for-Rupture Notch Tension Tests of Materials
ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

FED-STD-151 Metals: Test Methods

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

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Billets and preforms shall be produced by consolidation of AMS 5855 powder by a process which will produce a product meeting 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 E 354, by spectrographic methods in accordance with FED-STD-151, Method 112, except that oxygen and nitrogen shall be determined by Leco Gas Analyzer, or by other analytical methods approved by purchaser:

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

3.3 Condition:

As ordered by the forging manufacturer.

3.4 Heat Treatment:

When specified, the product shall be heat treated 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).

	min	max
Carbon	0.30	0.35
Manganese	-	0.10
Silicon	-	0.10
Phosphorous	-	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
Iron	-	1.00
Lead	-	0.0002 (2 ppm)
Bismuth	-	0.00005 (0.5 ppm)
Oxygen	-	0.010 (100 ppm)
Nitrogen	-	0.005 (50 ppm)
Nickel	remainder	

3.4.3 Precipitation Heat Treatment: Heat to 1300 °F ± 15 (705 °C ± 8), hold at heat for 12 hr ± 0.5, cool in air to below 700 °F (370 °C), reheat to 1500 °F ± 15 (815 °C ± 8), hold at heat for 8 hr ± 0.5, and cool in air.

3.5 Properties:

When specified, a sample billet or preform shall be forged to a test coupon and heat treated as in 3.4; specimens taken from the heat treated coupon shall conform to the requirements of 3.5.1 through 3.5.5. If specimens taken from billets or preforms after heat treatment as in 3.4 conform to the requirements of 3.5.1 through 3.5.5, the tests shall be accepted as equivalent to tests of a forged coupon.

3.5.1 Grain Size: Shall be predominantly recrystallized grains of 1 or finer with no segregation of coarse or fine areas, determined by comparison of a polished and etched specimen with the chart in ASTM E 112.