

ALLOY BARS AND FORGINGS, CORROSION RESISTANT

66.5Ni - 3.0Al - 0.62Ti - 28Cu

As Quenched, Precipitation Hardenable

UNS N05500

1. SCOPE:

1.1 Form: This specification covers a corrosion-resistant nickel-copper alloy in the form of bars, forgings, and forging stock.

1.2 Application: Primarily for parts requiring moderate strength, resistance to corrosion, and low magnetic permeability.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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 2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock

MAM 2261 - Tolerances, Metric, 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 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings and Forging Stock

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

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2.1.1 Aerospace Material Specifications (cont'd.):

AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and
Extrusions, Carbon and Alloy Steels and Corrosion and Heat
Resistant Steels and Alloys

AMS 2808 - Identification, Forgings

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 E76 - Chemical Analysis of Nickel-Copper 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 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight,
Ø determined by wet chemical methods in accordance with ASTM E76 or by
spectrographic or other analytical methods approved by purchaser:

	min	max
Nickel + Cobalt	63.00	70.00
Aluminum	2.00	4.00
Titanium	0.25	1.00
Iron	--	2.00
Manganese	--	1.50
Silicon	--	1.00
Cobalt (3.1.1)	--	1.00
Carbon	--	0.25
Zinc (3.1.1)	--	0.02
Phosphorus (3.1.1)	--	0.02
Sulfur	--	0.010
Tin (3.1.1)	--	0.006
Lead (3.1.1)	--	0.006
Copper	remainder	

3.1.1 Determination not required for routine acceptance.

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

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Bars and Forgings: Hot finished and quenched into water from not lower than 1450°F (790°C).

3.2.1.1 Surface finish of bars shall be as ordered.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties: The product shall conform to the following requirements:

3.3.1 Bars and Forgings:

3.3.1.1 As Solution Heat Treated:

3.3.1.1.1 Hardness: Shall be not higher than 248 HB, or equivalent, determined in accordance with ASTM E10.

3.3.1.2 After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1100° - 1125°F (595° - 605°C), holding at heat for 16 hr + 0.5, and furnace cooling at a rate of 15 - 25 F (10 - 15 C) deg per hr to 900°F (480°C). Cooling from 900°F (480°C) may be accomplished without regard to cooling rate. As an alternate method, cooling may be done in steps of 100 F (55 C) deg, holding the product 4 - 6 hr at each step.

3.3.1.2.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

Tensile Strength, min	140,000 psi (965 MPa)
Yield Strength at 0.2% Offset, min	100,000 psi (690 MPa)
Elongation in 2 in. (50 mm) or 4D, min	20% (3.3.1.2.1.1)

3.3.1.2.1.1 Round bars over 4.25 in. (105 mm) in diameter and over 12 ft (3.5 m) in length may have elongation as low as 17%.

3.3.1.2.2 Hardness: Should be not lower than 262 HB, or equivalent, determined in accordance with ASTM E10, but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.2 Forging Stock: When a sample of stock is forged to a test coupon, quenched into water from not lower than 1450°F (790°C), and heat treated as in 3.3.1.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.3.1.2.1 and 3.3.1.2.2. If specimens taken from the stock quenched into water from not lower than 1450°F (790°C) and heat treated as in 3.3.1.2 conform to the requirements of 3.3.1.2.1 and 3.3.1.2.2, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4 Quality: The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.4.1 Forgings shall have substantially uniform macrostructure. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4.2 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings, showing no evidence of re-entrant flow.

3.5 Tolerances: Bars and forging stock shall conform to all applicable requirements of AMS 2261 or MAM 2261.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Hardness (3.3.1.1.1) of each lot of bars and forgings as quenched.

4.2.1.3 Tensile properties (3.3.1.2.1) and hardness (3.3.1.2.2) of each lot of bars and forgings after precipitation heat treatment.

4.2.1.4 Tolerances (3.5) of bars and forging stock.

4.2.2 Periodic Tests: Tests of forging stock (3.4.2) to demonstrate ability to develop required properties are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a forging to a purchaser, when a change in material, processing, or both requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.