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

AEROSPACE MATERIAL SPECIFICATION

AMS 4676A

Issued 1-31-64
Revised 6-15-75

UNS N05500

ALLOY BARS AND FORGINGS, CORROSION RESISTANT
66.5Ni - 3.0Al - 0.62Ti - 28Cu

1. SCOPE:

1.1 Form: This specification covers a precipitation-heat-treatable, 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 (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 2261 - Tolerances, Nickel, Nickel Base, and Cobalt Base Alloy Bars and Forging Stock
AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel and Nickel Base Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings
AMS 2375 - Approval and Control of Critical Forgings
AMS 2808 - Identification, Forgings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 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 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 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E76, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	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 (788°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:

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 (593.3° - 607.2°C), holding at heat for 16 hr ± 0.5, and furnace cooling at a rate of 15 - 25 F (8.3 - 14 C) deg per hr to 900°F (482.2°C). Cooling from 900°F (482.2°C) may be accomplished without regard to cooling rate. As an alternate method, cooling may be done in steps of 100 F (55.6 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. (50.8 mm) or 4D, min	20% (3.3.1.2.1.1)

3.3.1.2.1.1 Round bars over 4.25 in. (108 mm) in diameter and over 12 ft (3.6 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, Ø 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 a temperature not lower than 1450°F (788°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 Ø the stock quenched into water from a temperature not lower than 1450°F (788°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 shall be uniform in quality and condition, clean, sound, and free from foreign mate- Ø rials and from internal and external imperfections detrimental to fabrication or to performance of parts. Forgings shall have substantially uniform macrostructure and grain flow.

3.5 Tolerances: Tolerances for bars and forging stock shall conform to all applicable requirements of AMS 2261.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible Ø 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 perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification Ø are classified as acceptance or routine control tests.

Ø 4.3 Sampling: Shall be in accordance with the following:

Ø 4.3.1 Bars: AMS 2371.

Ø 4.3.2 Forgings and Forging Stock: As agreed upon by purchaser and vendor.

Ø 4.4 Approval: When specified, approval and control of critical forgings shall be in accordance with AMS 2375.

4.5 Reports:

4.5.1 The vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment and the results of tests on each size from each Ø heat to determine conformance to the tensile property requirements of this specification. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of a laboratory reports showing the results of tests to determine conformance.