

Nickel-Copper Alloy, Corrosion-Resistant, Bars and Forgings

66.5Ni - 3.0Al - 0.62Ti - 28Cu

Hot-Finished, Precipitation Hardenable

(Composition similar to 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:

These products have been used typically for parts requiring a combination of moderate strength, resistance to corrosion, and low magnetic permeability, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
AMS 2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2374	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings

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SAE WEB ADDRESS:

2.1 (Continued):

- AMS 2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys
- AMS 2808 Identification, Forgings

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

- ASTM E 8 Tension Testing of Metallic Materials
- ASTM E 8M Tension Testing of Metallic Materials (Metric)
- ASTM E 10 Brinell Hardness of Metallic Materials
- ASTM E 76 Chemical Analysis of Nickel-Copper Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 76, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.25
Manganese	--	1.50
Silicon	--	1.00
Phosphorus (3.1.1)	--	0.02
Sulfur	--	0.010
Copper	27.00	33.00
Aluminum	2.00	4.00
Titanium	0.25	1.00
Iron	--	2.00
Zinc (3.1.1)	--	0.02
Tin (3.1.1)	--	0.006
Lead (3.1.1)	--	0.006
Nickel	remainder	

3.1.1 Determination not required for routine acceptance.

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

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Bars and Forgings: Hot finished.

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 Hot-Finished:

3.3.1.1.1 Hardness: Shall be not higher than 248 HB, or equivalent (See 8.2), determined in accordance with ASTM E 10.

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 to 1125 °F (593 to 607 °C), holding at heat for 8 to 16 hours, and furnace cooling at a rate of 15 to 25 °F (8 to 14 °C) degrees per hour to 900 °F (482 °C). Cooling from 900 °F (482 °C) may be accomplished without regard to cooling rate. As an alternate method, the precipitation heat treatment may be done by heating to 1100 °F (607 °C), holding at heat up to 16 hours, and furnace cooling in steps of 100 °F (56 °C) degrees to 1000 °F (538 °C), holding at heat for approximately 6 hours, furnace cooling to 900 °F (482 °C), holding at heat for approximately 8 hours, and cooling to room temperature at a rate equivalent to air cooling.

3.3.1.2.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	140 ksi (965 MPa)
Yield Strength at 0.2% Offset	100 ksi (689 MPa)
Elongation in 4D	20% (3.3.1.2.1.1)

3.3.1.2.1.1 Round bars over 4.25 inches (108 mm) in diameter and over 12 feet (3.7 m) in length may have elongation as low as 17%.

3.3.1.2.2 Hardness: Shall be not lower than 262 HB, or equivalent (See 8.2), determined in accordance with ASTM E 10. Product shall not be rejected on the basis of hardness if the tensile property requirements are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.3.2 Forging Stock: When a sample of stock is forged to a test coupon, 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 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 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 reentrant grain flow.

3.5 Tolerances:

3.5.1 Bars: Shall conform to all applicable requirements of AMS 2261.

3.5.2 Forging Stock: Shall be as agreed upon by purchaser and vendor.

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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following requirements are 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 hot finished.

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.