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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-5667

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Issued 1947-12-01
Revised 1990-04-01

Superseding AMS-5667H

Submitted for recognition as an American National Standard

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
72Ni - 15.5Cr - 0.95(Cb + Ta) - 2.5Ti - 0.70Al - 7.0Fe
Equalized, Precipitation Hardenable

UNS N07750

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel alloy in the form of bars, forgings, flash welded rings, and stock for forging, flash welded rings, or heading.

1.2 Application: Primarily for parts, such as bolts and turbine rotors, requiring high strength in the range of 800° - 1100°F (427° - 593°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.

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2.1.1 Aerospace Material Specifications:

- AMS-2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods and Wire
- MAM-2261 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
- AMS-2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
- AMS-2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and 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-2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys
- AMS-2808 - Identification, Forgings
- AMS-7490 - Rings, Flash Welded, Corrosion and Heat Resistant Austenitic Steels and Austenitic-Type Alloys

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

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

2.3 U.S. Government Publications: Available from Naval Publications and Forms Center, Attn: NPODS, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

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, determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	--	0.08
Manganese	--	1.00
Silicon	--	0.50
Sulfur	--	0.01
Chromium	14.00 -	17.00
Nickel + Cobalt	70.00	--
Columbium + Tantalum	0.70 -	1.20
Titanium	2.25 -	2.75
Aluminum	0.40 -	1.00
Iron	5.00 -	9.00
Cobalt (3.1.1)	--	1.00
Copper	--	0.50

- 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: Hot finished and equalized.

- 3.2.1.1 Round bars shall be ground or turned except that bars under 0.50 inch (12.7 mm) in nominal diameter, when so ordered, shall be cold drawn.

- 3.2.2 Forgings and Flash Welded Rings: Equalized.

- 3.2.2.1 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS-7490.

- 3.2.3 Stock for Forging, Flash Welded Rings, or Heading: As ordered by the forging, flash welded ring, or heading manufacturer.

- 3.3 Heat Treatment: Bars, forgings, and flash welded rings shall be equalized by heating to $1625^{\circ}\text{F} \pm 25$ ($885^{\circ}\text{C} \pm 14$), holding at heat for 24 hours ± 0.5 , and cooling in air.

- 3.4 Properties: The product shall conform to the following requirements:

- 3.4.1 Bars, Forgings, and Flash Welded Rings:

- 3.4.1.1 Hardness After Equalization Heat Treatment: Shall be not higher than 302 HB, or equivalent, determined in accordance with ASTM E 10.

3.4.1.2 After Precipitation Heat Treatment: The product shall have the following properties after being precipitation heat treated by heating to $1300^{\circ}\text{F} \pm 25$ ($704^{\circ}\text{C} \pm 14$), holding at heat for 20 hours ± 1 , and cooling in air to room temperature.

3.4.1.2.1 Tensile Properties: Shall be as specified in Table I for product $\emptyset$ 10.0 inches (254 mm) and under in nominal diameter or least distance between parallel sides, determined in accordance with ASTM E 8 or ASTM E 8M. Requirements apply in both the longitudinal and transverse directions but tests in the transverse direction need be made only on product from which a specimen not less than 2.50 inches (63.5 mm) in length can be obtained. Tests in the longitudinal direction are not required on product tested in the transverse direction. Tensile property requirements for product over 10.0 inches (254 mm) in nominal diameter or least distance between parallel sides shall be as agreed upon by purchaser and vendor.

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min	Reduction of Area %, min
Up to 4.0, excl	165,000	105,000	20	25
4.0 and over	160,000	100,000	15	17

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min	Reduction of Area %, min
Up to 102, excl	1138	724	20	25
102 and over	1103	689	15	17

3.4.1.2.1.1 When tensile specimens are machined from the center area of disc and hub forgings and this area lies within a 4-inch (102-mm) radius or 25% of the forging radius, whichever is the smaller dimension, elongation may be as low as 10% and reduction of area as low as 12%.

3.4.1.2.2 Hardness: Should be 302 – 363 HB, or equivalent, determined in accordance with ASTM E 10, but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.4.2 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 3.3 and 3.4.1.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2. If specimens taken from the stock after heat treatment as in 3.3 and 3.4.1.2, conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2, the tests shall be accepted as equivalent to tests of a forged coupon.

- 3.4.3 Stock for Flash Welded Rings or Heading: Specimens taken from the stock
 0 after heat treatment as in 3.3 and 3.4.1.2 shall conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2.

3.5 Quality:

- 3.5.1 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.

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

- 3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars will be acceptable in mill lengths of 6 - 24 feet (1.8 - 7.3 m) but not more than 25% of any shipment shall be supplied in lengths of 6 - 9 feet (1.8 - 2.7 m) except that for bars weighing over 25 pounds per foot (37 kg/m), short lengths down to 2 feet (610 mm) may be supplied.

- 3.7 Tolerances: Bars 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
 0 samples for vendor's tests and shall be responsible for performing all required tests. 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 for the following requirements are acceptance
 0 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 (3.4.1.1) of each lot of bars, forgings, and flash welded rings as equalization heat treated.

- 4.2.1.3 Tensile properties (3.4.1.2.1) and hardness (3.4.1.2.2) of each lot of bars, forgings, and flash welded rings after precipitation heat treatment.

- 4.2.1.4 Tolerances of bars (3.7).

- 4.2.2 Periodic Tests: Tests of forging stock (3.4.2) and stock for flash welded rings and heading (3.4.3) to demonstrate ability to develop required properties are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.