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AEROSPACE MATERIAL SPECIFICATION

AMS 5667G
Superseding AMS 5667F
Issued 12-1-47
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ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
Nickel Base - 15.5Cr - 7.0Fe - 2.5Ti - 1.0(Cb+Ta) - 0.70Al

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1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel-base 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 at 800 - 1100 F (426.7 - 593.3 C).

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 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
AMS 7490 - Rings, Flash Welded, Corrosion and Heat Resistant, Austenitic Steels and Austenitic-Type Alloys

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 E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt-Base 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 E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods.

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

3.1.1 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.

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 they 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 F ± 25 (885 C ± 14), holding at heat for approximately 24 hr, and cooling in air.

3.4 Properties:

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 E10.

3.4.1.2 Properties After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1300 F ± 25 (704.4 C ± 14), holding at heat for 20 hr ± 1, and cooling in air to room temperature.

3.4.1.2.1 Tensile Properties: Shall be as specified in Table I, determined in accordance with ASTM E8:

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 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

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TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimeters	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min	Reduction of Area %, min
Up to 102, excl	1138	724	20	25
102 and over	1103	690	15	17

3.4.1.2.1.1 Large Disc Forgings: When tensile test specimens are machined from the bore and punchout areas of disc and hub forgings and these areas lie within a 4 in. (102 mm) radius of the disc center, the elongation may be as low as 10% and the 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 E10, but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.4.2 Stock for Forging, Flash Welded Rings, or Heading: When a sample of stock is forged to a test coupon and heat treated as in 3.3, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.1 and 3.4.1.2. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1 and 3.4.1.2, the tests shall be accepted as equivalent to tests of the forged coupon.

3.5 Quality: The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

3.6 Tolerances: Unless otherwise specified, 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 shall supply all samples 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 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 are classified as acceptance or routine control tests.

4.3 Sampling: Bars, flash welded rings, and stock for flash welded rings or heading shall be sampled in accordance with AMS 2371. Forgings and forging stock shall be sampled as agreed upon by purchaser and vendor.

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 heat to determine conformance to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, heat number, 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.

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