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AEROSPACE MATERIAL SPECIFICATION

AMS 5757B

Issued 6-30-82
Revised 1-1-84

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
54Ni - 19Cr - 10Co - 10Mo - 2.6Ti - 1.0Al - 0.006B
Vacuum Melted, Solution and Precipitation Heat Treated UNS N07252

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 4-1-83. It is recommended, therefore, that this specification not be specified for new designs.

This cover sheet should be attached to the "B" revision of the subject specification.

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

AEROSPACE MATERIAL SPECIFICATION

AMS 5757B
Superseding AMS 5757A

Issued 6-30-60
Revised 7-15-77

UNS N07252

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
54Ni - 19Cr - 10Co - 10Mo - 2.6Ti - 1.0Al - 0.006B
Vacuum Melted, Solution and Precipitation Treated

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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 and assemblies, such as turbine rotors, shafts, blades, and bolts, requiring high strength up to 1500°F (815°C) and oxidation resistance up to 1800°F (980°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 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 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 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
AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Forgings and Forging Stock
AMS 2375 - Approval and Control of Critical Forgings
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion 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 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 E112 - Estimating the Average Grain Size of Metals
ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E292 - Conducting Time-for-Rupture Notch Tension Tests of 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, PA 19120.

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2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 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 E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	0.10	0.20
Manganese	--	0.75
Silicon	--	0.75
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	18.00	20.00
Cobalt	9.00	11.00
Molybdenum	9.00	11.00
Titanium	2.25	3.00
Aluminum	0.75	1.30
Boron	0.003	0.010
Iron	--	5.00
Nickel	remainder	

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, Forgings, and Flash Welded Rings: Solution and precipitation heat treated. Forgings shall be descaled.

3.2.1.1 Bars 2.750 in. (69.85 mm) and under in nominal diameter or distance between parallel sides shall be cold finished.

3.2.1.2 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.

3.2.2 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 solution heat treated by heating to 1950°F ± 25 (1066°C ± 15), holding at heat for 4 hr ± 0.5, and quenching in oil, water, or air and precipitation heat treated by heating to 1400°F ± 25 (760°C ± 15), holding at heat for 15 hr ± 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:

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3.4.1.1 Grain Size: Shall be predominantly 3 or finer with occasional grains as large as 1 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

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

Tensile Strength, min	165,000 psi (1138 MPa)
Yield Strength at 0.2% Offset, min	110,000 psi (758 MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	15%
Reduction of Area, min	18%

3.4.1.2.1 When tensile test specimens are machined tangentially from the bore and punch-out areas of disc and hub forgings and these areas lie within a 4-in. (102-mm) radius or 25% of total radius, whichever is smaller, of the disc center, the elongation may be as low as 12% and the reduction of area as low as 15%.

3.4.1.3 Hardness: Should be 321 - 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.

3.4.1.4 Stress-Rupture Properties at 1500°F (816°C): Shall be as follows; testing of notched specimens and of combination smooth-and-notched specimens shall be performed in accordance with ASTM E292 and of smooth specimens in accordance with ASTM E139:

3.4.1.4.1 A combination smooth-and-notched test specimen machined to the dimensions shown in Fig. 1 and Table I, maintained at 1500°F ± 3 (816°C ± 2) while a load sufficient to produce an initial axial stress of 40,000 psi (276 MPa) is applied continuously, shall not rupture in less than 25 hours. The test shall be continued to rupture without change of load. Rupture shall occur in the smooth section; if rupture occurs in the notched section, the product is not acceptable.

3.4.1.4.2 As an alternate procedure, separate smooth and notched test specimens, machined from adjacent sections of the same piece, with gage sections conforming to the respective dimensions of Table I, may be tested individually under the conditions of 3.4.1.4.1. The smooth specimens shall not rupture in less than 25 hours. The notched specimen shall not rupture in less time than the companion smooth specimen but need not be tested to rupture.

3.4.1.4.3 The tests of 3.4.1.4.1 and 3.4.1.4.2 may be conducted using a load higher than required to produce an initial axial stress of 40,000 psi (276 MPa) but load shall not be changed while test is in progress. Time to rupture and rupture location requirements shall be as specified in 3.4.1.4.1.

3.4.1.4.4 When permitted by purchaser, the tests of 3.4.1.4.1 and 3.4.1.4.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 40,000 psi (276 MPa) shall be used to rupture or for 25 hr, whichever occurs first. After the 25 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 2,000 psi (13.8 MPa). Time to rupture and rupture location requirements shall be as specified in 3.4.1.4.1.

3.4.2 Forging Stock: 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, 3.4.1.2, 3.4.1.3, and 3.4.1.4. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1, 3.1.1.2, 3.1.1.3, and 3.4.1.4, 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 after heat treatment as in 3.3 shall conform to the requirements of 3.4.1.1, 3.4.1.2, 3.4.1.3, and 3.4.1.4.

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3.5 Quality:

3.5.1 Alloy shall be produced by vacuum induction melting or by double vacuum melting.

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

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.7 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 of the product 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 ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

Ø 4.2.1 Acceptance Tests: The following are classified as acceptance tests:

Ø 4.2.1.1 Tests of the product to determine conformance to composition (3.1) requirements.

4.2.1.2 Tests of bars, forgings, and flash welded rings to determine conformance to grain size (3.4.1.1), Ø tensile property (3.4.1.2), hardness (3.4.1.3), and stress-rupture (3.4.1.4) requirements.

Ø 4.2.1.3 Tests of bars and forging stock to determine conformance to tolerance (3.7) requirements.

4.2.2 Periodic Tests: Tests of forging stock (3.4.2) and of stock for flash welded rings or heading (3.4.3) Ø to demonstrate ability to develop required properties are classified as periodic tests.

4.2.3 Preproduction Tests: Tests of forgings to determine conformance to all technical requirements of Ø this specification are classified as preproduction tests.

4.2.3.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, Ø preproduction forgings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars, Flash Welded Rings, and Stock for Flash Welded Rings, or Heading: AMS 2371 and the Ø following:

4.3.1.1 Specimens for tensile and stress-rupture testing of flash welded rings shall be cut from parent metal not including the weld-heat-affected zone.

Ø 4.3.2 Forgings and Forging Stock: AMS 2374.

4.3.3 Frequency of sampling for periodic tests and extent of sampling for both periodic tests and preproØ duction tests shall be as agreed upon by purchaser and vendor.

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4.4 Approval: When specified, approval and control of 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 showing the results of tests for chemical composition of each heat and the results of tests on each size from each heat to determine conformance to the other acceptance test requirements and stating that the product conforms to the other technical 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 laboratory reports showing the results of test to determine conformance.

4.6 Resampling and Retesting: Shall be in accordance with the following:

4.6.1 Bars, Flash Welded Rings, and Stock for Flash Welded Rings or Heading: AMS 2371.

4.6.2 Forgings and Forging Stock: AMS 2374.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

ø 5.1.1 Bars: In accordance with AMS 2806.

5.1.2 Forgings: In accordance with AMS 2808.

5.1.3 Flash Welded Rings and Stock for Forging, Flash Welded Rings, or Heading: As agreed upon by purchaser and vendor.

5.2 Packaging:

5.2.1 ø The product shall be prepared for shipment in accordance with commercial practice to ensure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.2.2 ø For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-163, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi symbol is used to indicate technical changes from the previous issue of this specification.

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8.2 For direct U.S. Military procurement, purchase documents should specify the following:

Title, number, and date of this specification
Form and size or part number of product desired
Quantity of product desired
Applicable level of packaging (See 5.2.2).

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