



# AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
TWO PENNSYLVANIA PLAZA, NEW YORK, N. Y. 10001

## AMS 5666A

Superseding AMS 5666

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ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT  
Nickel Base - 21.5Cr - 9.0Mo - 3.65 (Cb+Ta)

### 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, extrusions, and stock for forging or flash welded rings.
- 1.2 Application: Primarily for parts and assemblies requiring both corrosion and oxidation resistance at temperatures up to approximately 2000° F (1093° C) and where such parts may require welding during fabrication.

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., Two Pennsylvania Plaza, New York, New York 10001.

- 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

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 E18 - Rockwell Hardness and Rockwell Superficial Hardness  
of Metallic Materials

ASTM E112 - Estimating Average Grain Size of Metals

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

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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
Manganese	---	0.50
Silicon	--	0.50
Phosphorous	--	0.015
Sulfur	--	0.015
Chromium	20.00 -	23.00
Molybdenum	8.00 -	10.00
Columbium + Tantalum	3.15 -	4.15
Iron	--	5.00
Cobalt (3.1.1)	--	1.00
Titanium	Present but not exceeding	0.40
Aluminum	Present but not exceeding	0.40
Nickel		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: Hot finished and annealed; round bars shall be ground or turned.

- 3.2.2 Forgings, Extrusions, and Flash Welded Rings: Annealed.

- 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 or Flash Welded Rings: As ordered by the forging or welded ring manufacturer.

- 3.3 Properties:

- 3.3.1 Bars, Forgings, and Flash Welded Rings:

- 3.3.1.1 Tensile Properties: Product up to 4 in. (102 mm) in least cross-sectional dimension shall conform to the following requirements, determined in accordance with ASTM E8:

Tensile Strength, min	120,000 psi (827 MPa)
Yield Strength at 0.2% Offset, min	60,000 psi (418 MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	30%

- 3.3.1.1.1 Tensile properties of product 4 in. (102 mm) and over in least cross-sectional dimension shall be as agreed upon by purchaser and vendor.

- 3.3.1.2 Hardness: Should be not higher than 287 HB or equivalent but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

- 3.3.1.3 Grain Size: Predominantly 5 or finer, determined in accordance with ASTM E112, for product with a least cross-section dimension less than 2-1/2 in. (63.5 mm). For product with a least cross-section dimension 2-1/2 in. (63.5 mm) and over, grain size shall be as agreed upon by purchaser and vendor.

3.3.2 Extrusions and Stock for Forging and Flash Welded Rings: Shall have properties as agreed upon by purchaser and vendor.

3.4 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.

3.5 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 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, extrusions, flash welded rings, and stock for flash welded rings 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, 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 tests to determine conformance.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars: