



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

# AEROSPACE MATERIAL SPECIFICATION

## AMS 5755C

Superseding AMS 5755B

Issued 1-15-57

Revised 4-1-81

UNS N1004

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT

64Ni - 5.0Cr - 24.5Mo - 5.5Fe

Solution Heat Treated

### 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 or flash welded rings.

1.2 Application: Primarily for parts and assemblies, such as turbine shrouds and seals, requiring oxidation resistance up to 1600°F (870°C), good strength up to 1200°F (650°C), and low coefficient of expansion.

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 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 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 E10 - Brinell Hardness of Metallic Materials

ASTM E21 - Elevated Temperature Tension Tests of Metallic Materials

ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

#### 2.3.1 Federal Standards:

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

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade or their use by governmental agencies is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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 analytical methods approved by purchaser:

	min	max
Carbon	--	0.12
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.050
Sulfur	--	0.050
Chromium	4.00 -	6.00
Molybdenum	23.00 -	26.00
Iron	4.00 -	7.00
Vanadium	--	0.60
Cobalt (3.1.1)	--	2.50
Nickel + Cobalt	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 rolled, solution heat treated, and descaled. Rounds 0.75 in. (19.0 mm) and over in nominal diameter shall be ground.

3.2.2 Forgings: Solution heat treated and descaled.

3.2.3 Flash Welded Rings: Solution heat treated.

3.2.3.1 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.

3.2.4 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.

3.3 Heat Treatment: Bars, forgings, and flash welded rings shall be solution heat treated by heating to  $2150^{\circ}\text{F} \pm 25$  ( $1175^{\circ}\text{C} \pm 15$ ), holding at heat for a time commensurate with section thickness but not less than the following times, and cooling at a rate equivalent to a rapid air cool or faster.

Nominal Diameter or Maximum Cross Section		Time at Heat Minutes
Inches	(Millimetres)	
Up to 0.500, incl	(Up to 12.70, incl)	30
Over 0.500 to 1.000, incl	(Over 12.70 to 25.40, incl)	45
Over 1.000 to 2.000, incl	(Over 25.40 to 50.80, incl)	60
Over 2.000	(Over 50.80)	75

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

3.4.1 Bars, Forgings, and Flash Welded Rings:

3.4.1.1 Tensile Properties at 1500°F (815°C): Shall be as follows, determined in accordance with ASTM E21 on specimens heated to 1500°F ± 5 (815°C ± 3), held at heat for 20 - 30 min. before testing, and tested at 1500°F ± 5 (815°C ± 3):

Tensile Strength, min	55,000 psi (379 MPa)
Elongation in 4D, min	10%

3.4.1.2 Hardness: Should be 170 - 241 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 or Flash Welded Rings: As agreed upon by purchaser and vendor.

3.5 Quality: The product, as received by 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 - 24 ft (1.8 - 7.3 m) but not more than 25% of any shipment shall be supplied in lengths of 6 - 9 ft (1.8 - 2.7 m) except that for bars weighing over 25 lb per ft (37 kg/m), short lengths down to 2 ft (600 mm) may be supplied.

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 for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and 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: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1 Composition (3.1) of each heat.

4.2.2 Elevated temperature tensile properties (3.4.1.1) and hardness (3.4.1.2) of each lot of bars, forgings, and flash welded rings.

4.2.3 Tolerances (3.7) of bars and forging stock.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars, Flash Welded Rings, and Stock for Flash Welded Rings: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374.

4.4 Reports:

4.4.1 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 for tensile properties and hardness of each lot. This report shall include the purchase order number, heat number, AMS 5755C, 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.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 5755C, 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.

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

Ø 4.5.1 Bars, Flash Welded Rings, and Stock for Flash Welded Rings: AMS 2371.

Ø 4.5.2 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 or Flash Welded Rings: As agreed upon by purchaser and vendor.

5.2 Packaging:

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

5.2.2 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 modifications authorized by purchaser will be subject to rejection.

8. NOTES:

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