

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5754J

Issued 5-1-54
Revised 1-1-90

Superseding AMS 5754H

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe
Solution Heat Treated

UNS N06002

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 turbine rotors, shafts, flanges, blades, and bolts, requiring oxidation resistance up to 2200°F (1204°C) and relatively high strength above 1500°F (816°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 as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE Technical Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

AMS documents are protected under United States and international copyright laws. Reproduction of these documents by any means is strictly prohibited without the written consent of the publisher.

2.1.1 Aerospace Material Specifications:

- AMS 2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars
- MAM 2261 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Bars
- 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 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.

- ASTM E 10 - Brinell Hardness of Metallic Materials
- ASTM E 139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests 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 Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

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	0.05	0.15
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	20.50	23.00
Cobalt	0.50	2.50
Molybdenum	8.00	10.00
Tungsten	0.20	1.00
Iron	17.00	20.00
Boron	--	0.010 (See 3.1.1)
Aluminum	--	0.50 (See 3.1.1)
Titanium	--	0.15
Copper	--	0.50
Nickel	remainder	

3.1.1 Shall be present but not in excess of value specified.

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, Forgings, and Flash Welded Rings: Solution heat treated.

3.2.1.1 Bars under 0.750 inch (19.05 mm) in nominal diameter or distance between parallel sides shall be descaled.

3.2.1.2 Round bars 0.750 inch (19.05 mm) and over in nominal diameter shall be ground.

3.2.1.3 Bars, other than round, 0.750 inch (19.05 mm) and over in distance between parallel sides shall be descaled.

3.2.1.4 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.

3.2.2 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 $2150^{\circ}\text{F} \pm 25$ ($1177^{\circ}\text{C} \pm 14$), holding at heat for a time commensurate with section thickness but not less than 20 minutes, and cooling at a rate equivalent to an air cool or faster.
- 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: Shall be as follows, determined in accordance with ASTM E 10:
- 3.4.1.1.1 Bars and Forgings: Not higher than 241 HB, or equivalent. Hardness of bars shall be determined at approximately mid-radius of rounds and at approximately T/4 of other shapes.
- 3.4.1.1.2 Flash Welded Rings: Not higher than 277 HB, or equivalent, after sizing.
- 3.4.1.2 Stress-Rupture Properties at 1500°F (816°C): A tensile specimen, maintained at $1500^{\circ}\text{F} \pm 3$ ($816^{\circ}\text{C} \pm 2$) while a load sufficient to produce an initial axial stress of 15,000 psi (103 MPa) is applied continuously, shall not rupture in less than 24 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 10% in 4D. Test shall be conducted in accordance with ASTM E 139.
- 3.4.1.2.1 The test of 3.4.1.2 may be conducted using a load higher than required to produce an initial axial stress of 15,000 psi (103 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.1.2.
- 3.4.1.2.2 When permitted by purchaser, the test of 3.4.1.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 15,000 psi (103 MPa) shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 - 16 hours, preferably 8 - 10 hours, thereafter, the stress shall be increased in increments of 5,000 psi (34.5 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.1.2.
- 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 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 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 and 3.4.1.2.

3.5 Quality: 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.

3.5.1 Grain flow of die forgings, except in areas which contain flash-line end 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 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 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 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) and stress-rupture properties (3.4.1.2) of each lot of bars, forgings, and flash welded rings.

4.2.1.3 Tolerances (3.7) of bars.

4.2.2 Periodic Tests: Tests of forging stock (3.4.2) and of stock for flash welded rings or 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.