

AEROSPACE
MATERIAL
SPECIFICATION

AMS 5754H
Superseding AMS 5754G

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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 (1205°C) and relatively high strength above 1500°F (815°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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

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2.1.1 Aerospace Material Specifications:

- AMS 2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
- MAM 2261 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt 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 2375 - Control of Forgings Requiring First Article Approval
- 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 E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture 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

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:

ϕ	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 in. (18.75 mm) in nominal diameter or distance between parallel sides shall be descaled.

3.2.1.2 Round bars 0.750 in. (18.75 mm) and over in nominal diameter shall be ground.

3.2.1.3 Bars, other than round, 0.750 in. (18.75 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, 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 rings, or heading manufacturer.

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- 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 20 min., and cooling at a rate equivalent to 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 E10:
- 3.4.1.1.1 Bars and Forgings: Not higher than 241 HB or equivalent. Hardness of \emptyset bars shall be determined at approximately midradius 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 (815°C): A tensile specimen, maintained at $1500^{\circ}\text{F} \pm 3$ ($815^{\circ}\text{C} \pm 2$) while a load sufficient to produce an initial axial stress of 15,000 psi (105 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 E139.
- 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 (105 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 (105 MPa) shall be used to rupture or for 24 hr, whichever occurs first. After the 24 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 5,000 psi (35 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 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 (2 - 7 m) but not more than 25% of any shipment shall be supplied in lengths of 6 - 9 ft (2 - 3 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 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 4.5. 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 to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1.1 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 and forging stock.

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 classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a forging to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.