

# AEROSPACE MATERIAL SPECIFICATION



AMS 5887B

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Superseding AMS 5887A

Nickel Alloy, Corrosion and Heat Resistant, Bars, Forgings, and Rings

54Ni - 22Cr - 12.5Co - 9.0Mo - 1.2Al

Consumable Electrode or Vacuum Induction Melted

Annealed

(Composition similar to UNS N06617)

## 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:

These products have been used typically for parts requiring high strength and resistance to oxidation and corrosion up to 2200 °F (1204 °C) and where such parts may require welding during fabrication, but usage is not limited to such applications.

## 2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

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## 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
MAM 2261	Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
AMS 2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2374	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steel and Alloy Forgings
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, Austenitic-Type Iron, Nickel, or Cobalt Alloys, or Precipitation-Hardenable Alloys

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 21	Elevated Temperature Tension Tests 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

## 3. TECHNICAL REQUIREMENTS:

### 3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	0.05	0.15
Manganese	--	0.50
Silicon	--	0.50
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	20.00	24.00
Cobalt	10.00	15.00
Molybdenum	8.00	10.00
Aluminum	0.80	1.50
Titanium	--	0.60
Boron	--	0.006
Iron	--	3.00
Copper	--	0.50
Nickel	remainder	

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2269.

### 3.2 Melting Practice:

Alloy shall be multiple melted using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used for remelting.

### 3.3 Condition:

The product shall be supplied in the following condition:

3.3.1 Bars: Hot finished and annealed; round bars shall be ground or turned.

3.3.2 Forgings and Flash Welded Rings: Annealed and descaled.

3.3.2.1 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.

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

3.3.4 Heat Treatment: Bars, forgings, and flash welded rings shall be annealed by heating within the range 2075 to 2200 °F (1135 to 1204 °C), holding at the selected temperature within  $\pm 25$  °F ( $\pm 14$  °C) for a time commensurate with cross-sectional thickness, 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 Tensile Properties: Shall be as follows for product under 4 inches (102 mm) in least cross-sectional dimension, determined in accordance with ASTM E 8 or ASTM E 8M:

3.4.1.1.1 At Room Temperature: Shall be as shown in Table 2.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	95 ksi (655 MPa)
Yield Strength at 0.2% Offset	35.0 ksi (241 MPa)
Elongation in 4D	35%

3.4.1.1.2 At 1000 °F (538 °C): Shall be as shown in Table 3, determined in accordance with ASTM E 21 on specimens heated to 1000 °F  $\pm 5$  (538 °C  $\pm 3$ ), held at heat for not less than 20 minutes before testing, and tested at 1000 °F  $\pm 5$  (538 °C  $\pm 3$ ).

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	66 ksi (455 MPa)
Yield Strength at 0.2% Offset	23.0 ksi (159 MPa)
Elongation in 4D	45%

3.4.1.2 Stress-Rupture Properties at 1600 °F (871 °C): A tensile specimen, maintained at 1600 °F  $\pm 3$  (871 °C  $\pm 2$ ) while a load sufficient to produce an initial axial stress of 13.0 ksi (90 MPa) or higher is applied continuously, shall not rupture in less than 23 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. Testing 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 incremental loading. In such case, the load required to produce an initial axial stress of 13.0 ksi (90 MPa) or higher shall be used to rupture or for 23 hours. After the 23 hours and at intervals of 8 to 16 hours, preferably 8 to 10 hours, thereafter, the stress shall be increased in increments of 2.0 ksi (13.8 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.1.2.

3.4.2 Stock for Forging or Flash Welded Rings: Shall be 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 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 reentrant grain flow.

### 3.6 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

### 4.2 Classification of Tests:

4.2.1 Acceptance Tests: 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 Tensile properties (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 (3.6) of bars.

4.2.2 Periodic Tests: Grain flow of die forgings (3.5.1) is a periodic test and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.