# AEROSPACE MATERIAL SPECIFICATION

| AMS5886 | REV. C |
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Issued 1986-07
Reaffirmed 2008-05
Revised 2014-06

Superseding AMS5886B

Alloy, Corrosion and Heat-Resistant, Bars, Forgings, and Rings
50Ni - 20Cr - 20Co - 5.8Mo - 2.2Ti - 0.45Al
Consumable Electrode or Vacuum Induction Melted
2100 °F (1149 °C) Solution Heat Treated
(Composition similar to UNS N07263)



RATIONALE

AMS5886C revises Scope (1.1.1), Condition (3.3.1.2), Reports (4.4), and is a Five Year Review and update of this specification.

## 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.

1.1.1 This specification covers product 3.25 inches (82.6 mm) and under in nominal diameter or least distance between parallel sides, and forging stock of any size (See 8.4).

### 1.2 Application

These products have been used typically for parts requiring high strength up to 1500 °F (816 °C) and oxidation resistance up to 2000 °F (1093 °C), particularly those parts which are formed or welded and then heat treated to develop required properties, 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 supplied 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2261 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire



**TO PLACE A DOCUMENT ORDER:** **Tel: 877-606-7323 (inside USA and Canada)**
**Tel: +1 724-776-4970 (outside USA)**
**Fax: 724-776-0790**
**Email: CustomerService@sae.org**
**SAE WEB ADDRESS:** **http://www.sae.org**

**SAE values your input. To provide feedback on this Technical Report, please visit**
**http://www.sae.org/technical/standards/AMS5886C**

AMS2269 Chemical Check Analysis Limits, Nickel, Nickel Alloys and Cobalt Alloys

AMS2371 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS2374 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings

AMS2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys

AMS2808 Identification, Forgings

AMS7490 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 International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 10 Brinell Hardness of Metallic Materials

ASTM E 21 Elevated Temperature 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 | 0.04 | 0.08 |
| Manganese | -- | 0.60 |
| Silicon | -- | 0.40 |
| Phosphorus | -- | 0.015 |
| Sulfur | -- | 0.007 |
| Chromium | 19.00 | 21.00 |
| Cobalt | 19.00 | 21.00 |
| Molybdenum | 5.60 | 6.10 |
| Titanium | 1.90 | 2.40 |
| Aluminum | 0.30 | 0.60 |
| Titanium + Aluminum | 2.40 | 2.80 |
| Boron | -- | 0.005 |
| Iron | -- | 0.70 |
| Copper | -- | 0.20 |
| Nickel | Remainder | |

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Melting Practice

The alloy shall be produced by multiple melting using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum.

3.3 Condition

The product shall be supplied in the following condition:

3.3.1 Bars

Solution heat treated and descaled.

3.3.1.1 Bars shall be hot rolled or extruded; round bars shall be ground or turned.

3.3.1.2 Bars shall not be cut from plate (Also see 4.4.2)

3.3.2 Forgings and Flash Welded Rings

Solution heat treated.

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 AMS7490.

3.3.3 Stock for Forging or Flash Welded Rings

As ordered by the forging or flash welded ring manufacturer.

3.4 Heat Treatment

Bars, forgings, and flash welded rings shall be solution heat treated by heating to a temperature within the range 1900 to 2125 °F (1038 to 1163 °C) holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with cross-sectional thickness, and cooling at a rate equivalent to an air cool or faster.

3.5 Properties

The product shall conform to the following requirements:

3.5.1 Bars, Forgings, and Flash Welded Rings

3.5.1.1 As Solution Heat Treated

3.5.1.1.1 Hardness

Shall be not higher than 248 HB, or equivalent (See 8.2), determined in accordance with ASTM E 10.

3.5.1.2 After Precipitation Heat Treatment

Product 3.25 inches (82.6 mm) and under in nominal diameter or least distance between parallel sides shall have the following properties after being precipitation heat treated by heating to 1475 °F ± 15 (802 °C ± 8), holding at heat for 8 hours ± 0.5, and cooling in air; product over 3.25 inches (82.6 mm) in nominal diameter or least distance between parallel sides shall have properties as agreed upon by purchaser and vendor:

3.5.1.2.1 Tensile Properties at 1435 °F (779 °C)

Shall be as shown in Table 2, determined in accordance with ASTM E 21 on specimens heated to 1435 °F ± 10 (779 °C ± 6) held at heat for 20 to 30 minutes before testing, and tested at 1435 °F ± 10 (779 °C ± 6).

TABLE 2 - MINIMUM TENSILE PROPERTIES

| Property | Value |
|---|---|
| Tensile Strength | 78.5 ksi (541 MPa) |
| Yield Strength at 0.2% Offset | 58.5 ksi (403 MPa) |
| Elongation in 4D | 12% |

3.5.1.2.2 Creep Properties at 1435 °F (779 °C)

A tensile specimen, maintained at 1435 °F ± 3 (779 °C ± 2) while a load sufficient to produce an initial axial stress 17.4 ksi (120 MPa) is applied continuously, shall not exceed 0.1% total plastic strain in 50 hours. Test shall be conducted in accordance with ASTM E 139.

3.5.2 Forging Stock

When a sample of stock is forged to a test coupon and heat treated as in 3.4 and 3.5.1.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.5.1.2.1 and 3.5.1.2.2. If specimens taken from stock after heat treatment as in 3.4 and 3.5.1.2 conform to the requirements of 3.5.1.2.1 and 3.5.1.2.2, the tests shall be accepted as equivalent to tests of a forged coupon.

3.5.3 Stock for Flash Welded Rings

Specimens taken from the stock after heat treatment as in 3.4 and 3.5.1.2 shall conform to the requirements of 3.5.1.2.1 and 3.5.1.2.2.

3.6 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.

3.6.1 Grain flow, except in areas of die forgings which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of re-entrant grain flow.

3.7 Tolerances

Bars shall conform to all applicable requirements of AMS2261.

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 Hardness (3.5.1.1.1) of each lot of bars, forgings, and flash welded rings as solution heat treated.

4.2.1.3 Tensile properties (3.5.1.2.1) and creep properties (3.5.1.2.2) of each lot of bars, forgings, and flash welded rings after precipitation heat treatment.

4.2.1.4 Tolerances of bars (3.7).