AEROSPACE MATERIAL SPECIFICATION

AMS5714™	REV. E

Issued 1969-01
Revised 2018-02
Reaffirmed 2022-11

Superseding AMS5714D

Alloy Bars, Forgings, and Rings, Corrosion- and Heat-Resistant 73Ni - 15.5Cr - 2.5Ti - 0.70Al - 7.0Fe Precipitation Hardenable

(Composition similar to UNS N07722)

RATIONALE

AMS5714E revises properties (3.3.1.2.4), reports (4.5), and identification (5.2.1.1), and results from a Five-Year Review and update of this specification.

AMS5714E has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant nickel alloy in the form of bars, forgings, and flash welded rings up to 4.000 inch (101.6 mm), inclusive, in nominal thickness or distance between parallel sides, and stock of any size for forging or flash welded rings (see 8.6).

1.2 Application

These products have been used typically for parts, such as flanges, cases, and turbine rotors, requiring high strength at temperatures in the range 800 to 1200 °F (427 to 649 °C), particularly where welding is involved, 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 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 +1 724-776-4970 (outside USA), www.sae.org.

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

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

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**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5714E/

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

AMS2375 Control of Forgings Requiring First Article Approval

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

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

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 E8/E8M Tension Testing of Metallic Materials

ASTM E10 Brinell Hardness of Metallic Materials

ASTM E18 Rockwell Hardness of Metallic Materials

ASTM E112 Determining Average Grain Size

ASTM E140 Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

ASTM E354 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 E354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	--	0.08
Manganese	--	1.00
Silicon	--	0.70
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel	70.00	--
Titanium	2.20	2.75
Aluminum	0.50	0.90
Iron	5.00	9.00
Cobalt (3.1.1)	--	1.00
Copper	--	0.50

3.1.1 Determination not required for routine acceptance.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Bars

Hot finished, annealed, and descaled; round bars shall be ground or turned.

3.2.2 Forgings and Flash Welded Rings

Solution heat treated and descaled.

3.2.2.1 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. During manufacture of flash welded rings, the stock shall not be heated higher than 1825 °F (996 °C).

3.2.3 Stock for Forging or Flash Welded Rings

As ordered by the forging or flash welded ring manufacturer.

3.3 Properties

The product shall conform to the following requirements:

3.3.1 Bars, Forgings, and Flash Welded Rings

3.3.1.1 As Received

3.3.1.1.1 Hardness

Shall be as follows, determined in accordance with ASTM E10:

3.3.1.1.1.1 Bars

Not higher than 277 HB, or equivalent (see 8.2).

3.3.1.1.1.2 Forgings and Flash Welded Rings

Not higher than 229 HB, or equivalent (see 8.2).

3.3.1.2 Response to Heat Treatment

The product shall have the following properties after being solution heat treated by heating to 1800 °F ± 25 °F (982 °C ± 14 °C), holding at heat for 60 minutes ± 5 minutes, and cooling at a rate equivalent to air cool or faster, and precipitation heat treated by heating to 1325 °F ± 15 °F (718 °C ± 8 °C), holding at heat for 8 hours ± 0.25 hour, cooling at a rate not faster than 25 °F (15 °C) degrees per hour to 1150 °F ± 15 °F (621 °C ± 8 °C), and cooling in air. Instead of the 25 °F (15 °C) degrees per hour cooling rate to 1150 °F ± 15 °F (621 °C ± 8 °C), the furnace cooling may be at any rate provided the time at 1150 °F ± 15 °F (621 °C ± 8 °C) is adjusted to give a total precipitation heat treatment time of 16 hours.

3.3.1.2.1 Tensile Properties

Shall be as specified in Table 2, determined in accordance with ASTM E8/E8M; requirements apply in both the longitudinal and transverse direction but tests in the transverse direction need be made only on product from which a specimen not less than 2.50 inches (63.5 mm) in length can be taken. Tests in the longitudinal direction are not required on product tested in the transverse direction.

Table 2

Table 2A - Minimum tensile properties, inch/pound units

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %	Reduction of Area %
Up to 2.50, excl	145	95	18	20
2.50 to 4.00, excl	145	95	15	15

Table 2B - Minimum tensile properties, SI units

Nominal Diameter or Distance Between Parallel Sides Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %	Reduction of Area %
Up to 63.5, excl	1000	655	18	20
63.5 to 101.6, excl	1000	655	15	15

3.3.1.2.2 Hardness

Shall be not lower than 23 HRC, or equivalent (see 8.2), determined in accordance with ASTM E18. Product shall not be rejected on the basis of hardness if the tensile property requirements of 3.3.1.2.1 are acceptable. Tensile properties shall be determined on material taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.3.1.2.3 Average Grain Size

Bars 4.00 inches (101.6 mm) and under in nominal diameter or least distance between parallel sides, flash welded rings 4.00 inches (101.6 mm) and under in radial thickness, and forgings shall have an average grain size of ASTM No. 4 or finer determined in accordance with ASTM E112.

3.3.1.2.4 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between producer and purchaser.

3.3.2 Forging Stock

When a sample of stock is forged to a test coupon and heat treated as in 3.3.1.2, specimens taken from the heat-treated coupon shall conform to the requirements of 3.3.1.2.1, 3.3.1.2.2, and 3.3.1.2.3. If specimens taken from the stock after heat treatment as in 3.3.1.2 conform to the requirements of 3.3.1.2.1, 3.3.1.2.2, and 3.3.1.2.3, the tests shall be accepted as equivalent to tests of a forged coupon.

3.3.3 Stock for Flash Welded Rings

Specimens taken from the stock after heat treatment as in 3.3.1.2 shall conform to the requirements of 3.3.1.2.1, 3.3.1.2.2, and 3.3.1.2.3.

3.4 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.

3.4.1 Forgings shall have substantially uniform macrostructure. Standards for acceptance shall be as agreed upon by purchaser and producer.

3.4.2 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.

3.5 Tolerances

Bars and forging stock shall conform to all applicable requirements of AMS2261.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer'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, except for cobalt (see 3.1.1).

4.2.1.2 Hardness (3.3.1.1.1) of each lot of bars, forgings, and flash welded rings as received.

4.2.1.3 Tensile properties (3.3.1.2.1), hardness (3.3.1.2.2), and average grain size (3.3.1.2.3) of each lot of bars, forgings, and flash welded rings after heat treatment.

4.2.1.4 Tolerances (3.5) of bars and forging stock.

4.2.2 Periodic Tests

Tests of forging stock (3.3.2) and of stock for flash welded rings (3.3.3) to demonstrate ability to develop required properties and grain flow of die forgings (3.4.2) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Bars, Flash Welded Rings, and Stock for Forgings or Flash Welded Rings

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.