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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5714C

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Superseding AMS 5714B

Submitted for recognition as an American National Standard

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

UNS N07722

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, 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 form 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.

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 2375	Control of Forgings Requiring First Article Approval

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

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 10 Brinell Hardness of Metallic Materials
ASTM E 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112 Determining the Average Grain Size
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	--	0.08
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 requirements of AMS 2269.

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Bars: Hot finished, mill 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 AMS 7490. 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 E 10:

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.

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 (982 °C ± 14), holding at heat for 60 minutes ± 5, and cooling at a rate equivalent to air cool or faster, and precipitation heat treated by heating to 1325 °F ± 15 (718 °C ± 8), holding at heat for 8 hours ± 0.25, cooling at a rate not faster than 25 F (15 C) degrees per hour to 1150 °F ± 15 (621 °C ± 8), and cooling in air. Instead of the 25 F (15 C) degrees per hour cooling rate to 1150 °F ± 15 (621 °C ± 8), the furnace cooling may be at any rate provided the time at 1150 °F ± 15 (621 °C ± 8) 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 E 8 or ASTM E 8M; 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 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 E 18. Product shall not be rejected on the basis of hardness if the tensile property requirements of 3.2.1.2.1 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 4 or finer determined in accordance with ASTM E 112 (See 8.4).

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 vendor.

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 re-entrant grain flow.

3.5 Tolerances:

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 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 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 (3.6) 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 vendor 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 AMS 2371.

4.3.2 Forgings: In accordance with AMS 2374.