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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5854A

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Superseding AMS 5854

Nickel Alloy, Corrosion and Heat-Resistant, Bars, Wire, Forgings, and Rings
61Ni - 20.5Cr - 8.5Mo - 3.4Cb - 1.3Ti - 5.0Fe
Consumable Electrode or Vacuum Induction Melted
Solution Heat Treated

(Composition similar to UNS N07716)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat-resistant nickel alloy in the form of bars, wire, forgings, flash welded rings, extrusions, and stock for forging or flash welded rings.

1.2 Application:

These products have been used typically for parts requiring both corrosion and oxidation resistance up to 1000 °F (538 °C), and where such parts may require welding during fabrication and are then precipitation 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 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

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 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 10	Brinell Hardness of Metallic Materials
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112	Determining 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	--	0.03
Manganese	--	0.20
Silicon	--	0.20
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	19.00	22.00
Nickel	59.00	63.00
Molybdenum	7.50	9.50
Columbium	2.75	4.00
Titanium	1.00	1.60
Cobalt	--	1.00
Aluminum	--	0.35
Iron	remainder	

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

3.2 Melting Practice:

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: Hot finished and solution heat treated; round bars shall be ground or turned.

3.3.2 Wire: Cold drawn and solution heat treated.

3.3.3 Forgings, Extrusions, and Flash Welded Rings: Solution heat treated.

3.3.3.1 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.

3.3.4 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 1850to1950°F (1010 to 1066 °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 air cooling. Pyrometry shall be in accordance with AMS 2750.

3.5 Properties:

The product shall conform to the following requirements:

3.5.1 Bars, Wire, Forgings, and Flash Welded Rings:

3.5.1.1 As Solution Heat Treated:

3.5.1.1.1 Hardness of Bars, Forgings, and Flash Welded Rings: Shall be not higher than 287 HB, or equivalent (See 8.2).

3.5.1.1.2 Tensile Strength of Wire: Shall be not higher than 135 ksi (931 MPa), determined in accordance with ASTM E 8 or ASTM E 8M

3.5.1.1.3 Average Grain Size: ASTM No. 3 or finer, determined in accordance with ASTM E 112, for product with a least cross-section dimension under 2-1/2 inches (63.5 mm).

3.5.1.2 After Precipitation Heat Treatment: Product, 4-inches (102-mm) and under in nominal diameter or least distance between parallel sides, shall meet the requirements of 3.5.1.2.1 after being precipitation heat treated by heating to a temperature within the range 1325 to 1375 °F (718 to 746 °C), holding at the selected temperature within ±15 °F (±8 °C) for not less than 8 hours, cooling at a rate of 100 F ± 15 (55 C ± 8) degrees per hour to 1150 °F ± 15 (621 °C ± 8), holding at 1150 °F ± 15 (621 °C ± 8) for not less than 8 hours, and cooling at a rate equivalent to air cooling. Instead of the 100 F (55 C) degrees per hour cooling rate to 1150 °F ± 15 (621 °C ± 8), product may be furnace cooled at any rate provided the time at 1150 °F ± 15 (621 °C ± 8) is adjusted to give a total precipitation heat treatment time of not less than 18 hours.

3.5.1.2.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M on specimens taken from product under 4-inches (102-mm) in least cross-sectional dimension.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	150 ksi (1034 MPa)
Yield Strength at 0.2% Offset	115 ksi (793 MPa)
Elongation in 4D	25%
Reduction in Area	40%

3.5.1.2.2 Hardness: Shall be not lower than 30 HRC, or equivalent (See 8.2), but the product shall not be rejected on basis of hardness if the tensile properties of 3.5.1.2.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

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

3.5.3 Extrusions and Stock for Forging and Flash Welded Rings: Shall be as agreed upon by purchaser and vendor.

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

3.7 Tolerances:

Shall conform to all applicable requirements of AMS 2261 or MAM 2261 for bars and wire.

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 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), wire tensile properties (3.5.1.1.2), and average grain size (3.5.1.1.3) of each lot solution heat treated.

4.2.1.3 Tensile properties (3.5.1.2.1), and hardness (3.5.1.2.2) of each lot after precipitation heat treatment.

4.2.1.4 Tolerances (3.7) of each lot.

4.2.2 Periodic Tests: Grain flow of die forgings (3.6.1) is a periodic test 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, Wire, Flash Welded Rings, Extrusions, and Stock for Forgings and Flash Welded Rings: In accordance with AMS 2371.

4.3.2 Forgings: In accordance with AMS 2374.