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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIALS SPECIFICATION

SAE® AMS 5962

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Submitted for recognition as an American National Standard

NICKEL ALLOY, CORROSION AND HEAT RESISTANT, BARS AND WIRE
52.5Ni - 19Cr - 3.0Mo - 5.1Cb - 0.90Ti - 0.50Al - 19Fe
Consumable Electrode or Vacuum Induction Melted
1775 °F (968 °C) Solution Treated and Cold Worked
Precipitation Hardenable

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant work strengthened nickel alloy in the form of bars and wire.

1.2 Application:

These products have been used typically for parts, such as fasteners, requiring a room temperature minimum tensile strength of 220 ksi (1517 MPa) after precipitation heat treatment for use up to 900 °F (482 °C) and having oxidation resistance up to 1800 °F (982 °C), but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect of the date of the purchase order.

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 2750	Pyrometry

QUESTIONS REGARDING THIS DOCUMENT: (412)772-7154 FAX:(412)776-0243
TO PLACE A DOCUMENT ORDER: (412)776-4970 FAX:(412)776-0790

2.1 (Continued):

AMS 2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

ARP1313 Determination of Trace Elements in High Temperature 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 103 Rapid Indentation Hardness Testing 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, by the methods of ARP1313 for lead, bismuth, and selenium, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	17.00	21.00
Nickel	50.00	55.00
Molybdenum	2.80	3.30
Columbium	4.75	5.50
Titanium	0.65	1.15
Aluminum	0.20	0.80
Cobalt	--	1.00
Tantalum (3.1.1)	--	0.05
Boron	--	0.006
Copper	--	0.30
Lead	--	0.0005 (5 ppm)
Bismuth	--	0.00003 (0.3 ppm)
Selenium	--	0.0003 (3 ppm)
Iron	remainder	

3.1.1 Determination not required for routine analysis.

3.1.2 Check Analysis: Composition variations shall meet the 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:

Solution heat treated and suitably work-strengthened.

3.3.1 Bars shall be cold finished; straight, round bars shall be ground or turned.

3.3.2 Coiled bars and wire shall be cold-drawn.

3.4 Heat Treatment:

Before cold working, bar and wire stock shall be solution heat treated by heating to a temperature within the range 1700 to 1850 °F (927 to 1010 °C), holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with cross-section thickness, and quenching at a rate equivalent to an air cool or faster. The stock shall be work strengthened as required to meet the requirements of 3.5. Pyrometry shall be in accordance with AMS 2750.

3.5 Properties:

The product shall conform to the following requirements:

3.5.1 As Solution Treated and Work-Strengthened:

3.5.1.1 Average Grain Size: Shall be as follows, determined by the comparative method of ASTM E 112. In case of disagreement, the intercept (Heyn) procedure shall be used.

3.5.1.1.1 Product under 9 square inches (58 cm^2) in cross-sectional area shall exhibit an average grain size of ASTM No. 5 or finer. Up to 20% of the cross section of the product may have a grain size of ASTM No. 3 to 5, determined by the intercept method of ASTM E 112, due to the presence of nonrecrystallized grains.

3.5.1.1.2 Product 9 to 50 square inches (58 to 323 cm^2), inclusive, in cross-sectional area shall exhibit an average grain size of ASTM No. 4 or finer. Up to 20% of the cross section of the product may have a grain size of ASTM No. 2 to 4, determined by the intercept method of ASTM E 112, due to the presence of nonrecrystallized grains.

3.5.2 Response to Heat Treatment: The product shall meet the requirements of 3.5.2.1 and 3.5.2.2 after being precipitation heat treated by heating to 1325 °F ± 15 (718 °C ± 8), holding at heat for not less than 8 hours, cooling at a rate of 100 F ± 15 (56 C ± 8) degrees per hour, holding at 1150 °F ± 15 (621 °C ± 8), for not less than 8 hours, and cooling in air. Instead of the 100 F (56 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.

3.5.2.1 Tensile Properties: Specimens from the center of product 1.500 inches (38.10 mm) and under in nominal diameter shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M (See 4.3 and 8.1).

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	220 ksi (1517 MPa)
Yield Strength at 0.2% Offset	200 ksi (1379 MPa)
Elongation in 4D	8%
Reduction in Area	15%

3.5.2.2 Hardness: Shall be not lower than 363 HB or equivalent (See 8.2), determined in accordance with ASTM E 10 or ASTM E 103. Product shall not be rejected on the basis of hardness if the tensile property requirements of 3.5.2.1, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness, are acceptable.

3.6 Quality:

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.

3.7 Tolerances:

The product shall conform to all applicable requirements of AMS 2261 or MAM 2261.