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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE MAM 5536A

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Superseding MAM 5536

Submitted for recognition as an American National Standard

NICKEL ALLOY, CORROSION AND HEAT RESISTANT, SHEET, STRIP, AND PLATE
47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe
Solution Heat Treated

UNS N06002

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant nickel alloy in the form of sheet, strip, and plate procured in SI (metric) units.

1.1.1 AMS 5536 is the inch/pound version of this MAM.

1.2 Application:

These products have been used typically for parts requiring oxidation resistance up to 1205 °C and relatively high strength up to 815 °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 on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

MAM 2262 Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate
AMS 2269 Chemical Check Analysis Limits, Wrought 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 2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8M Tension Testing of Metallic Materials (Metric)
ASTM E 112 Determining the Average Grain Size
ASTM E 139 Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E 290 Semi-Guided Bend Test for Ductility of Metallic Materials
ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition:
(R)

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	0.05	0.15
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	20.50	23.00
Cobalt	0.50	2.50
Molybdenum	8.00	10.00
Tungsten	0.20	1.00
Iron	17.00	20.00
Aluminum	--	0.50
Titanium	--	0.15
Boron	--	0.010
Copper	--	0.50
Nickel	remainder	

3.1.1 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 Sheet and Strip: Hot or cold rolled, solution heat treated, and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled having a surface appearance comparable to the following commercial corrosion-resistant steel finishes as applicable (See 8.2):

3.2.1.1 Sheet: No. 2D finish.

3.2.1.2 Strip: No. 1 strip finish.

3.2.2 Plate: Hot rolled, solution heat treated, and descaled.

3.3 Heat Treatment:

(R) The product shall be solution heat treated by heating in a suitable atmosphere within the range 1150 to 1175 °C, holding at the selected temperature within ±15 °C for a time commensurate with section thickness, and rapidly cooling.

3.4 Properties:

The product shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8M.

TABLE 2 - Minimum Tensile Properties

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
Up to 0.25, excl	725	310	--
0.25 to 0.50, excl	725	310	29
0.50 to 4.75, incl	725	310	35
Over 4.75 to 50.00, incl	690	275	35
Over 50.00	655	275	35

3.4.2 Bending: Product 4.75 mm and under in nominal thickness shall withstand,
(R) without cracking, bending at room temperature in accordance with ASTM E 290 through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 3 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 3 - Bending Parameters

Nominal Thickness Millimeters	Bend Factor
Up to 1.25, incl	1.5
Over 1.25 to 4.75, incl	2

3.4.3 Stress-Rupture Properties at 815 °C: A tensile specimen, maintained at 815 °C ± 2 while a load sufficient to produce an initial axial stress of 110 MPa is applied continuously, shall not rupture in less than the time indicated in Table 4. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than shown in Table 4. Tests shall be conducted in accordance with ASTM E 139.

Table 4 - Stress-Rupture Parameters

Nominal Thickness Millimeters	Time to Rupture Hours, minimum	Elongation % in 4D minimum
0.25 to 0.50, excl	15	3
0.50 and over	24	8

3.4.3.1 The test of 3.4.3 may be conducted using a load higher than required to produce an initial axial stress of 110 MPa but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in Table 4.

3.4.3.2 (R) The test of 3.4.3 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 110 MPa shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 to 16 hours, preferably 8 to 10 hours, thereafter, the stress shall be increased in increments of 15 MPa. Time to rupture and elongation requirements shall be as specified in Table 4.

3.4.3.2.1 The test of 3.4.3.2 applies only to product 0.50 mm and over in nominal thickness.

3.4.4 (R) Grain Size: Sheet and strip 3.00 mm and under in nominal thickness shall have average grain size of ASTM No. 4 or finer, determined in accordance with ASTM E 112.