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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

MAM 5536

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ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT
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. AMS 5536 is the equivalent, specified in inch/pound units, of this MAM.

1.2 Application: Primarily for parts requiring oxidation resistance up to 1205°C and relatively high strength up to 815°C.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

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 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

REAFFIRMED
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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tension Testing of Metallic Materials
ASTM E112 - Determining Average Grain Size
ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials
ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E354 or by spectrochemical or other analytical methods approved by purchaser:

	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 (3.1.1)	--	0.50
Titanium	--	0.15
Boron (3.1.1)	--	0.010
Copper	--	0.50
Nickel	remainder	

3.1.1 Shall be present but shall not exceed the specified limit.

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 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:

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: The product shall be solution heat treated by heating in a suitable atmosphere to 1175°C + 15, except that sheet and strip 0.75 mm and under in nominal thickness may be heated to as low as 1150°C + 15, holding at heat for a time commensurate with product thickness, and rapidly cooling.

3.4 Properties: The product shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as specified in Table I, determined in accordance with ASTM E8.

TABLE I

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
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, without cracking, bending at room temperature in accordance with ASTM E290 through an angle of 180 deg around a diameter equal to the bend factor times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

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

3.4.2.1 Bending requirements for plate over 4.75 mm in nominal thickness shall be as agreed upon by purchaser and vendor.

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 below. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than shown below. Tests shall be conducted in accordance with ASTM E139.

Nominal Thickness Millimetres	Time to Rupture Hours, min	Elongation % in 4D
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 3.4.3.

3.4.3.2 When permitted by purchaser, 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 hr, whichever occurs first. After the 24 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 15 MPa. Time to rupture and elongation requirements shall be as specified in 3.4.3.

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 Grain Size: Sheet and strip 3.00 mm and under in nominal thickness shall have average grain size of 4 or finer, determined in accordance with ASTM E112. Grain size requirements for product over 3.00 mm in nominal thickness shall be as agreed upon by purchaser and vendor.

3.5 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 Tolerances: Shall conform to all applicable requirements of MAM 2262.

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.