SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE MAM 5598A

Issued 1 OCT 1987
Revised 1 JUL 1993

Superseding MAM 5598

Submitted for recognition as an American National Standard

NICKEL ALLOY, CORROSION AND HEAT RESISTANT, SHEET, STRIP, AND PLATE
72Ni - 15.5Cr - 0.95(Cb + Ta) - 2.5Ti - 0.70Al - 7.0Fe
Consumable Electrode or Vacuum Induction Melted
Solution Heat Treated, Precipitation Hardenable

UNS N07750

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 5598 is the inch/pound version of this MAM.

1.2 Application:

These products have been used typically for parts requiring high strength up to 815 °C and oxidation resistance up to 980 °C and for bellows and flat springs requiring optimum resistance to relaxation up to 540 °C with moderate or relatively low stresses, particularly where welding is involved, but usage is not limited to such applications. Parts may be formed, welded if required, and then heat treated to improve strength at elevated temperatures.

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 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112 Determining the Average Grain Size
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:

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	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel + Cobalt	70.00	--
Columbium + Tantalum	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Cobalt	--	1.00
Copper	--	0.50

3.1.1 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:

The product shall be supplied in the following condition:

3.3.1 Sheet: Hot rolled 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 a commercial corrosion-resistant steel No. 2D finish (See 8.2).

3.3.2 Strip: Cold rolled and solution heat treated. Strip need not be bright and may have an oxidized surface.

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

3.4 Solution Heat Treatment:

No specific heat treating instructions are specified but it is recommended that the product be solution heat treated by heating in a suitable protective atmosphere to 980 °C ± 15, holding at heat for a time commensurate with product thickness, and cooling at a rate equivalent to an air cool or faster.

3.5 Properties:

The product shall conform to the following requirements:

3.5.1 As Solution Heat Treated:

3.5.1.1 Tensile Properties: Shall be as shown in Table 2 and Table 3, determined in accordance with ASTM E 8M.

3.5.1.1.1 Strip:
(R)

TABLE 2 - Strip Tensile Properties

Nominal Thickness Millimeters	Tensile Strength MPa, max	Elongation in 50 mm or 4D %, min
Up to 0.25, excl	965	--
0.25 to 4.75 incl	930	18

3.5.1.1.2 Sheet:
(R)

TABLE 3 - Sheet Tensile Properties

Nominal Thickness Millimeters	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation in 50 mm or 4D %, min
0.25 to 0.60, incl	930	515	30
Over 0.60 to 4.75, incl	930	515	35

3.5.1.2 Bending: Sheet and strip shall withstand, without cracking, bending in accordance with ASTM E 290 at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 4 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.
(R)

TABLE 4 - Bending Parameters

Nominal Thickness Millimeters	Bend Factor
Up to 1.25, incl	1
Over 1.25 to 4.75, incl	2

3.5.1.3 (R) Grain Size: Sheet and strip 0.25 to 4.75 millimeters, inclusive, in nominal thickness shall have grain size of ASTM No. 5 or finer, determined in accordance with ASTM E 112.

3.5.2 After Precipitation Heat Treatment: The product shall have the following properties after being precipitation heat treated by heating to 730 °C ± 8, holding at heat for 8 hours ± 0.5, cooling at a rate of 55 C ± 8 degrees per hour to 620 °C ± 8, holding at 620° ± 8 for 8 hours ± 0.5, and cooling in air. Instead of the 55 C ± 8 degrees per hour cooling rate to 620 °C ± 8, product may be furnace cooled at any rate provided the time at 620 °C ± 8 is adjusted to give a total precipitation heat treatment time of 18 hours.

3.5.2.1 (R) Tensile Properties: Shall be as shown in Table 5, determined in accordance with ASTM E 8M.

TABLE 5 - Minimum Tensile Properties

Product	Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
Strip	Up to 0.25, excl	1070	--	--
	0.25 to 4.75, incl	1105	--	12
Sheet	0.25 to 4.75, incl	1170	795	18
Plate	4.76 to 100.00, incl	1105	725	18

3.5.2.2 (R) Hardness: Shall be not lower than shown in Table 6, or equivalent, determined in accordance with ASTM E 18 (See 8.3).