

# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 5878A

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Superseding AMS 5878

NICKEL ALLOY, CORROSION AND HEAT RESISTANT, SHEET, STRIP, AND PLATE  
59Ni - 22Cr - 2Mo - 14W - 0.35Al - 0.03La  
Solution Heat Treated

UNS N06230

## 1. SCOPE:

### 1.1 Form:

This specification covers a corrosion and heat resistant alloy in the form of sheet, strip, and plate.

### 1.2 Application:

These products have been used typically for parts requiring oxidation resistance up to 2100 °F (1149 °C) and relatively high strength 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 on the date of the purchase order.

### 2.1 SAE Publications:

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

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

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## 2.2 ASTM Publications:

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

ASTM E 8	Tension Testing of Metallic Materials
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 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
ASTM E 384	Microhardness of Materials

## 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	0.05	0.15
Manganese	0.30	1.00
Silicon	0.25	0.75
Phosphorus	--	0.03
Sulfur	--	0.015
Chromium	20.00	24.00
Molybdenum	1.00	3.00
Tungsten	13.00	15.00
Aluminum	0.20	0.50
Lanthanum	0.005	0.05
Cobalt	--	5.00
Titanium	--	0.10
Boron	--	0.015
Iron	--	3.00
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:

The product shall be solution heat treated by heating to a temperature within the range 2150 to 2275 °F (1177 to 1246 °C), holding at the selected temperature within  $\pm 25^\circ\text{F}$  ( $\pm 14^\circ\text{C}$ ) for a time commensurate with section thickness, and cooling rapidly. Pyrometry shall be in accordance with AMS 2750.

3.4 Properties:

Product 0.015 to 1.5 inch (0.38 to 38 mm) in nominal thickness shall conform to the following requirements:

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

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	115 ksi (793 MPa)
Yield Strength at 0.2% Offset	50.0 ksi (345 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	40%

3.4.2 Hardness: Shall be not higher than 25 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18. For thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Product shall not be rejected on the basis of hardness if the tensile properties of 3.4.1, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness, are acceptable.

- 3.4.3 Average Grain Size: Shall be not larger than shown in Table 3, determined in accordance with ASTM E 112.

TABLE 3 - Maximum Average Grain Size

Nominal Thickness Inch	Nominal Thickness Millimeters	ASTM Grain Size No.
0.015 to 0.125, incl	0.38 to 3.18, incl	4
Over 0.125 to 0.1874, incl	Over 3.18 to 4.760, incl	3
Over 0.1874	Over 4.760	3

- 3.4.4 Stress-Rupture Properties at 1700 °F (927 °C): A tensile specimen, maintained at 1700 °F ± 3 (927 °C ± 2) while a load sufficient to produce an initial axial stress of 9.0 ksi (62 MPa) or higher is applied continuously, shall not rupture in less than 36 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 10% in 2 inches (50.8 mm). Tests shall be conducted in accordance with ASTM E 139.

- 3.4.4.1 The test of 3.4.4 may be conducted using incremental loading. In such case, a load sufficient to produce an initial axial stress of 9.0 ksi (62 MPa) or higher shall be used to rupture or for 36 hours, whichever occurs first. After the 36 hours and at intervals of 8 to 16 hours, preferably 8 to 10 hours thereafter, the stress shall be increased in increments of 1.0 ksi (6.9 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.4.

- 3.4.5 Bending: Product shall withstand, 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 4 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 4 - Bending Parameters

Nominal Thickness Inch	Nominal Thickness Millimeters	Bend Factor
Up to 0.050, incl	Up to 1.27, incl	1.5
Over 0.050 to 0.1874, incl	Over 1.27 to 4.760, incl	2.0

- 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.