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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

# AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5869A

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Superseding AMS 5869

Submitted for recognition as an American National Standard

## NICKEL ALLOY, CORROSION AND HEAT RESISTANT, SHEET, STRIP, AND PLATE
62Ni - 21.5Cr - 9.0Mo - 3.7Cb
Solution Heat Treated

UNS N06625



1. SCOPE:

1.1 Form:

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

1.2 Application:

These products have been used typically for parts requiring resistance to corrosion, oxidation, creep, and rupture up to 2000 °F (1093 °C), but usage is not limited to such applications.

1.2.1 The 2000 °F (1093 °C) solution heat treatment temperature optimizes properties for use above 1100 °F (593 °C).

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 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 8 Tension Testing of Metallic Materials
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.

(R) TABLE 1 - Composition

| Element | min | max |
|---|---|---|
| Carbon | -- | 0.10 |
| Manganese | -- | 0.50 |
| Silicon | -- | 0.50 |
| Phosphorus | -- | 0.015 |
| Sulfur | -- | 0.015 |
| Chromium | 20.00 | 23.00 |
| Molybdenum | 8.00 | 10.00 |
| Columbium | 3.15 | 4.15 |
| Cobalt (3.1.1) | -- | 1.00 |
| Titanium | -- | 0.40 |
| Tantalum (3.1.1) | -- | 0.05 |
| Aluminum | -- | 0.40 |
| Iron | -- | 5.00 |
| Nickel | remainder | |

3.1.1 Determination not required for routine acceptance.

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 (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 not lower than 2000 °F (1093 °C), holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with section thickness, and cooling at a rate equivalent to an air cool or faster.

3.3.1 Product may be given a subsequent stabilization treatment at a temperature not lower than 1800 °F (982 °C) to increase resistance to sensitization.

3.4 Properties:

The product shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as shown in Table 2 for product up to 1.000 inch (25.40 mm) in nominal thickness, determined in accordance with ASTM E 8 or ASTM E 8M.



TABLE 2 - Minimum Tensile Properties

| Property | Value |
|---|---|
| Tensile Strength | 100 ksi (689 MPa) |
| Yield Strength at 0.2% Offset | 40.0 ksi (276 MPa) |
| Elongation in 2 Inches (50.8 mm) or 4D | 30% |

3.4.1.1 Yield strength requirement does not apply to product under 0.020 inch (0.51 mm) in nominal thickness.

3.4.1.2 Elongation requirement does not apply to product under 0.010 inch (0.25 mm) in nominal thickness.

3.4.2 (R) 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 3 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 3 - Bending Parameters

| Nominal Thickness Inch | Nominal Thickness Millimeters | Bend Factor |
|---|---|---|
| Up to 0.050, incl | Up to 1.27, incl | 1 |
| Over 0.050 to 0.1874, incl | Over 1.27 to 4.760, incl | 2 |

3.4.3 Average Grain Size: Shall be as follows, determined by comparison of a polished and etched specimen with the chart in ASTM E 112:

3.4.3.1 (R) Sheet and Strip: Not finer than shown in Table 4:

TABLE 4 - Average Grain Size

| Nominal Thickness Inch | Nominal Thickness Millimeters | ASTM No. |
|---|---|---|
| Up to 0.050, incl | Up to 1.27, incl | 7 |
| Over 0.050 to 0.1874, incl | Over 1.27 to 4.760, incl | 6 |

3.4.3.2 Plate: Not finer than ASTM No. 6.

3.4.3.3 Sheet, Strip, and Plate: Not coarser than ASTM No. 2.

3.4.4 Stress-Rupture Properties at 1500 °F (816 °C): A tensile specimen, maintained at 1500 °F ± 3 (816 °C ± 2) while a load sufficient to produce an initial axial stress of 19.0 ksi (131 MPa) or higher is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture without change of load. Time to rupture and elongation after rupture shall be reported. Test shall be conducted in accordance with ASTM E 139.

3.4.4.1 (R) The test of 3.4.4 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 19.0 ksi (131 MPa) or higher shall be used to rupture or for 23 hours, whichever occurs first. After the 23 hours and at intervals of 8 to 16 hours, preferably 8 to 10 hours, thereafter, the stress shall be increased in increments of 2.0 ksi (13.8 MPa). Time to rupture requirement shall be as specified in 3.4.4.