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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5874B

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Superseding AMS 5874A

Alloy, Corrosion and Heat Resistant, Sheet, Strip, and Plate
29Fe - 22Cr - 21Ni - 18.5Co - 3.2Mo - 2.8W - 0.78Ta - 0.30Al - 0.05Zr - 0.05La - 0.20N
Solution Heat Treated

UNS R30556

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 formed, drawn, and welded parts requiring high strength and oxidation resistance up to 2000 °F (1093 °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 2242	Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
MAM 2242	Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS 2248	Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and other Highly-Alloyed Steels, and Iron Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

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 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

2.3 U.S. Government Publications:

Available from Standardization Documents Order 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	0.50	2.00
Silicon	0.20	0.80
Phosphorus	--	0.04
Sulfur	--	0.015
Chromium	21.00	23.00
Nickel	19.00	22.50
Cobalt	16.00	21.00
Molybdenum	2.50	4.00
Tungsten	2.00	3.50
Tantalum	0.30	1.25
Aluminum	0.10	0.50
Zirconium	0.001	0.10
Lanthanum	0.005	0.10
Nitrogen	0.10	0.30
Columbium	--	0.30
Boron	--	0.02
Iron	remainder	

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248; check analysis limits for lanthanum shall be 0.002 under minimum and 0.01 over maximum.

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 surface, descaled having a surface appearance comparable to a commercial corrosion-resistant steel finish 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 2100 to 2225 °F (1149 to 1218 °C), holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with section thickness but not more than 30 minutes, and cooling rapidly.

3.4 Properties:

The product shall conform to the following requirements:

3.4.1 Grain Size: Shall be 3 or finer, determined by comparison of a polished and etched specimen with the chart in ASTM E 112.

3.4.2 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	100 ksi (689 MPa)
Yield Strength at 0.2% Offset	47.0 ksi (324 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	
Nominal Thickness	
Up to 0.020 inch (0.51 mm), incl	35%
Over 0.020 inch (0.51 mm)	40%

3.4.3 Hardness: Shall be not higher than 21 HRC, or equivalent, determined in accordance with ASTM E 18 (See 8.2).

3.4.4 Bending: Product 0.187 inch (4.75 mm) and under in nominal thickness shall withstand, without cracking, bending 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	1.5
Over 0.050 to 0.187, incl	Over 1.27 to 4.75, incl	2.0

3.4.5 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 the initial axial stress specified in Table 4 is applied continuously, shall not rupture in less than 24 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be as specified in Table 4. Tests shall be conducted in accordance with ASTM E 139.

TABLE 4 - Stress Rupture Parameters

Nominal Thickness Inch	Nominal Thickness Millimeters	Stress ksi	Stress MPa	Elongation in 2 Inches (50.8 mm) or 4D %, min
Up to 0.020, incl	Up to 0.51, incl	18.0	124	20
Over 0.020	Over 0.51	19.0	131	25

3.4.5.1 The test of 3.4.5 may be conducted using a load higher than required to produce the initial axial stress specified in Table 4 but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.5.

3.4.5.2 When permitted by purchaser, the test of 3.4.5 may be conducted using incremental loading. In such case, a load sufficient to produce the initial axial stress specified in Table 4 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 2000 psi (14 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.5.

3.4.6 Oxidation Resistance: Product shall meet the following oxidation requirements, determined in accordance with 4.4.1:

3.4.6.1 Metal converted to oxide scale plus any continuous intergranular oxidation shall not exceed an average of 0.0015 inch (0.038 mm) per side or 0.003 inch (0.08 mm) per specimen.

3.4.6.2 Specimens displaying localized areas greater than 0.062 inch (1.57 mm) in diameter with excessive oxidation attack, unless such attack can be attributed to contact with ceramic supports, shall be considered invalid and the tests repeated. If the condition is duplicated, the product is not acceptable.

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 AMS 2242 or MAM 2242.

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. 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.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), grain size (3.4.1), tensile properties (3.4.2), bending (3.4.4), stress-rupture properties (3.4.5), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests for hardness (3.4.3) and oxidation resistance (3.4.6) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2371.

4.4 Test Methods:

4.4.1 Oxidation Resistance:

4.4.1.1 Specimen Preparation: Specimens shall have surface area not less than 1.5 square inches (9.7 cm^2) available for exposure in excess of material required for fixturing. Both sides of the specimen shall have a 120-grit (125 µm) surface finish. Specimen dimensions shall be measured to within ±0.0003 inch (±7.6 µm). Specimens shall be degreased.

4.4.1.2 Testing: Specimens shall be exposed for four cycles, each cycle consisting of heating in air to 2000 °F ± 25 (1093 °C ± 14), holding at heat for 25 hours ± 1, and cooling in air to 300 °F (149 °C) or lower between each cycle, for a total of 100 hours ± 4 at heat. Specimens may be partially inserted into inert ceramic bricks or suspended from inert ceramic rods or suitable metallic rods, but shall not be placed in crucibles. The specimens may be tested in a muffle or comparable furnace provided that air flow is such that the required surface areas are equally exposed to the flowing air and temperature.

4.4.1.3 Examination: Specimens shall be cross sectioned and examined metallographically in the as-polished condition at not lower than 500X magnification. Not less than eight randomly selected surface areas, 0.008 inch (0.20 mm) in length, shall be measured and the values averaged to determine compliance with 3.4.6.1.