SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

AMS 5536M

Issued MAY 1954
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Superseding AMS 5536L

Nickel Alloy, Corrosion and Heat-Resistant, Sheet, Strip, and Plate
47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe
Solution Heat Treated

(Composition similar to UNS N06002)

RATIONALE

AMS 5536M is a Five Year Review and update of this specification.

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 inch/pound units.

1.2 Application

These products have been used typically for parts requiring oxidation resistance up to 2200 °F and relatively high strength up to 1500 °F, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS 2262	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate
AMS 2269	Chemical Check Analysis, 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
AS4194	Sheet and Strip Surface Finish Nomenclature

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A 480/A 480M	Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM E 8	Tension Testing of Metallic Materials
ASTM E 112	Determining 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

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	--	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	--	0.50
Titanium	--	0.15
Boron	--	0.010
Copper	--	0.50
Nickel	remainder	

3.1.1 Check Analysis

Composition variations shall meet the applicable 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 in accordance with ASTM A 480/A480M and AS4194 comparable to 3.2.1.1 or 3.2.1.2 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 within the range 2100 to 2150 °F, holding at the selected temperature within ± 25 °F 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 2, determined in accordance with ASTM E 8.

TABLE 2 - Minimum Tensile Properties

Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D MPa
Upto 0.010,excl	105	45.0	--
0.010to 0.020,excl	105	45.0	29
0.020to 0.1874,incl	105	45.0	35
Over0.1874to 2.000,incl	100	40.0	35
Over2.000	95.0	40.0	35

3.4.2 Bending

Product 0.1874 inch and under in nominal thickness 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	Bend Factor
Up to 0.050, incl	1.5
Over 0.050 to 0.1874, incl	2

3.4.3 Stress-Rupture Properties at 1500 °F

A tensile specimen, maintained at 1500 °F ± 3 while a load sufficient to produce an initial axial stress of 16.0 ksi is applied continuously, shall not rupture in less than the time indicated in Table 4. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than shown in Table 4. Tests shall be conducted in accordance with ASTM E 139.

TABLE 4 - Stress Rupture Parameters

Nominal Thickness Inches	Time to Rupture Hours, minimum	Elongation % in 4D
0.010 to 0.020, excl	15	3
0.020 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 16,0 ksi but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in Table 4.

3.4.3.2 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 16.0 ksi shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 hours minimum, thereafter, the stress shall be increased in increments of 2000 psi. Time to rupture and elongation requirements shall be as specified in Table 4.

3.4.3.2.1 The test of 3.4.3.2 applies only to product 0.020 inch and over in nominal thickness.

3.4.4 Average Grain Size

Sheet and strip 0.125 inch and under in nominal thickness shall have average grain size of ASTM No. 4 or finer, determined in accordance with ASTM E 112.

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 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.4.1), bending (3.4.2), grain size (3.4.4), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Stress-rupture properties (3.4.3) is a periodic test 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 Reports

The vendor of the product shall furnish with each shipment a report showing the results of tests for composition of each heat and for tensile and bending properties and grain size of each lot and, when performed, the results of tests to determine conformance to the stress rupture property requirements. This report shall include the purchase order number, heat and lot numbers, AMS 5536M, size, and quantity.