



AEROSPACE MATERIAL SPECIFICATION

AMS 5873

Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

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Revised

ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT
Nickel Base - 15.8Cr - 15.2Mo - 0.30Al - 0.05La

1. SCOPE:

- 1.1 Form: This specification covers a corrosion and heat resistant nickel-base alloy in the form of sheet, strip, and plate.
- 1.2 Application: Primarily for formed and drawn parts such as turbine seals, burner liners, exhaust cone assemblies, and nozzle diaphragm vanes requiring relatively high strength to 1800° F (982° C) and oxidation resistance to 2000° F (1093° C).
2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

- AMS 2262 - Tolerances, Nickel, Nickel-Base, and Cobalt-Base Alloy Sheet, Strip, and Plate
- AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel and Nickel-Base Alloys
- AMS 2350 - Standards and Test Methods
- AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

- ASTM E8 - Tension Testing of Metallic Materials
- ASTM E112 - Estimating Average Grain Size of Metals
- ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
- ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials
- ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt-Base Alloys

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3.1 Federal Standards:

- Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

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	min	max
Carbon	--	0.02
Manganese	0.30 -	1.00
Silicon	0.20 -	0.75
Phosphorus	--	0.020
Sulfur	--	0.015
Chromium	14.50 -	17.00
Molybdenum	14.00 -	16.50
Aluminum	0.10 -	0.50
Lanthanum	0.01 -	0.10
Cobalt	--	2.00
Tungsten	--	1.00
Boron	--	0.015
Iron	--	3.00
Copper	--	0.35
Nickel	remainder	

- 3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269; check analysis limits for lanthanum shall be 0.00 under min or 0.01 over maximum.
- 3.2 Condition: The product shall be supplied in the following condition; standards for acceptance shall be as agreed upon by purchaser and vendor.
- 3.2.1 Sheet and Strip: Hot or cold rolled, solution heat treated, and descaled unless solution heat treatment is performed in an atmosphere yielding a bright finish, having a surface appearance as close as possible to a commercial corrosion resistant steel No. 1 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 $1950^{\circ}\text{F} \pm 25$ ($1065.6^{\circ}\text{C} \pm 14$), holding at heat for a time commensurate with thickness, and cooling rapidly in air.
- 3.4 Properties: The product shall conform to the following requirements:
- 3.4.1 Grain Size: Shall be predominantly 4 or finer with occasional grains as large as 2 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.
- 3.4.2 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:
- | | |
|--|-----------------------|
| Tensile Strength, min | 105,000 psi (724 MPa) |
| Yield Strength at 0.2% Offset, min | 45,000 psi (310 MPa) |
| Elongation in 2 in. (50.8 mm) or 4D, min | 40% |
- 3.4.3 Bending: Product up to 0.1875 in. (4.762 mm), incl, in nominal thickness shall withstand, without cracking, bending in accordance with ASTM E290 through an angle of 180 deg (3.14 rad) around a diameter equal to two times the nominal thickness of the product with axis of bend parallel to the direction of rolling. Bending requirements for product over 0.1875 in. (4.762 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.
- 3.4.4 Stress-Rupture Test at 1500° F (815.6°C): A tensile test specimen, maintained at $1500^{\circ}\text{F} \pm 3$ ($815.6^{\circ}\text{C} \pm 1.7$) while a load sufficient to produce an initial axial stress of 15,000 psi (103 MPa) is applied continuously, shall not rupture in less than 23 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 4D. Tests shall be conducted in accordance with ASTM E139.

- 3.4.4.1 The test of 3.4.4 may be conducted using a load higher than required to produce an initial axial stress of 15,000 psi (103 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.4.
- 3.4.4.2 When permitted by purchaser, the test of 3.4.4 may be conducted using incremental loading. In such cases, the load required to produce an initial axial stress of 15,000 psi (103 MPa) shall be used to rupture or for 23 hr, whichever occurs first. After the 23 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 2,000 psi (13.8 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.4.

3.5 Quality:

- 3.5.1 Material shall be produced by multiple melting using consumable electrode practice in the remelt cycle.
- 3.5.2 The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.
- 3.6 Tolerances: Unless otherwise specified, 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 and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.
- 4.3 Sampling: Shall be in accordance with AMS 2371 and the following; a heat shall be the consumable electrode remelted ingots produced from alloy originally melted as a single furnace charge:
 - 4.3.1 Tensile test specimens from widths 9 in. (229 mm) and over shall be taken with the axis perpendicular to the direction of rolling; for widths less than 9 in. (229 mm), tensile test specimens shall be taken with the axis parallel to the direction of rolling.
- 4.4 Reports:
 - 4.4.1 The vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment and the results of tests on each thickness from each heat to determine conformance to the other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number, size, and quantity from each heat.
 - 4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.
- 4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.