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

AEROSPACE MATERIAL SPECIFICATION

AMS 5872

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Revised

ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT
Nickel Base, 20Cr - 20Co - 5.9Mo - 2.2Ti - 0.45Al
Solution Heat Treated

1. SCOPE:

1.1 Form: This specification covers a solution and precipitation heat treatable, corrosion and heat resistant nickel-base alloy in the form of sheet, strip, and plate.

1.2 Application: Primarily for parts and assemblies, such as combustion chamber liners and exhaust cones, requiring high strength up to 1500° F (816° C) and oxidation resistance up to 2000° F (1093° C), particularly those which are formed or welded and then heat treated to develop required strength properties.

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 E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E21 - Elevated Temperature Tension Tests 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

Printed in U.S.A.

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:

	min	max
Carbon	0.04	0.08
Manganese	0.20	0.60
Silicon	0.10	0.40
Phosphorus	--	0.015
Sulfur	--	0.007
Chromium	19.00	21.00
Cobalt	19.00	21.00
Molybdenum	5.60	6.10
Titanium	1.90	2.40
Aluminum	0.30	0.60
Titanium + Aluminum	2.40	2.80
Iron	--	0.70
Copper	--	0.20
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; 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 corrosion resistant steel No. 1 finish.

3.2.2 Plate: Hot rolled, solution heat treated, and descaled.

3.3 Solution Heat Treatment: The product shall be solution heat treated by heating to 2100° F ± 25° (1148.9° C ± 14°), holding at heat for a time commensurate with section thickness but not less than 5 min., and cooling at a rate equivalent to air cool or faster.

3.4 Properties:

3.4.1 As Solution Heat Treated: The product shall conform to the following requirements:

3.4.1.1 Hardness: Shall be not higher than 70 HR15N or equivalent, determined in accordance with ASTM E18.

3.4.1.2 Bending: The product shall withstand, without cracking, bending in accordance with ASTM E290 through an angle of 180 deg (3.14 rad) around a diameter equal to the bend factor times the nominal thickness of the material with axis of bend parallel to direction of rolling.

Nominal Thickness		
Inch	(Millimeters)	Bend Factor
Up to 0.050, incl	(Up to 1.27, incl)	1
Over 0.050 to 0.187, incl	(Over 1.27 to 4.75, incl)	2

3.4.1.3 Grain Size: Shall be predominantly 5 or finer with occasional grains as large as 3 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

3.4.1.4 Microstructure: Metallographic examination shall disclose no significant alloy depleted layer or other undesirable surface condition. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4.2 After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1475° F ± 25° (801.7° C ± 14°), holding at heat for 8 hr ± 30 min., and cooling in air.

3.4.2.1 Tensile Properties at 1435° F (779.4° C): Shall be as follows, determined in accordance with ASTM E21 on test specimens heated to 1435° F ± 10° (779.4° C ± 5.6°), held at heat for 30 min. before testing, and tested at 1435° F ± 10° (779.4° C ± 5.6°) at a strain rate of 0.003 - 0.007 in. per in. per min. (0.003 - 0.007 mm/mm/min.) to the yield strength and a rate of 0.03 - 0.07 in. per in. per min. (0.03 - 0.07 mm/mm/min.) above the yield strength.

Tensile Strength, min	78,500 psi (541 MPa)
Yield Strength at 0.2% Offset, min	58,500 psi (403 MPa)
Elongation in 1 in. (25.4 mm), min	9%

3.4.2.2 Creep Test at 1435° F (779.4° C): A tensile test specimen, maintained at 1435° F ± 3° (779.4° C ± 1.7°) while a load sufficient to produce an initial axial stress of 16,800 psi (116 MPa) is applied continuously, shall not exceed 0.1% total plastic strain in 50 hours. Test shall be conducted in accordance with ASTM E139.

3.5 Quality: 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:

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 size from each heat to determine conformance to the other technical requirements. This report shall include the purchase order number, heat number, material specification number, thickness, 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.