



AEROSPACE MATERIAL

AMS 5541B

Superseding AMS 5541A

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. SPECIFICATION

TWO PENNSYLVANIA PLAZA, NEW YORK, N. Y. 10001

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ALLOY SHEET AND STRIP, CORROSION AND HEAT RESISTANT Nickel-Base - 15.5Cr - 2.4Ti - 0.70Al - 7.0Fe

1. SCOPE:

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

1.2 Application: Primarily for parts requiring high strength up to 1500° F (816° C) and oxidation resistance up to 1800° F (982° C). Parts may be formed and then heat treated to improve strength at elevated temperatures.

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 E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM E112 - Estimating Average Grain Size of Metals

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:

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standards or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

	min	max
Carbon	--	0.08
Manganese	--	1.00
Silicon	--	0.70
Sulfur	--	0.01
Chromium	14.00 -	17.00
Nickel + Cobalt	70.00	--
Cobalt (3.1.1)	--	1.00
Titanium	2.00 -	2.75
Aluminum	0.40 -	1.00
Iron	5.00 -	9.00
Copper	--	0.50

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: Cold rolled, annealed, and descaled unless annealing is performed in an atmosphere yielding a bright finish, having a surface appearance as close as possible to a commercial corrosion resistant steel no. 2D finish; standards for acceptance shall be as agreed upon by purchaser and vendor.

3.3 Properties:

3.3.1 As Annealed:

3.3.1.1 Tensile Properties: Shall be as shown in Table I, determined in accordance with ASTM E8:

TABLE I

Nominal Thickness Inch	Tensile Strength psi, max	Elongation in 2 in. or 4D %, min
0.010 to 0.024, incl	130,000	30
Over 0.024 to 0.250, incl	125,000	40

TABLE I (SI)

Nominal Thickness Millimeters	Tensile Strength MPa, max	Elongation in 50.8 mm or 4D %, min
0.25 to 0.61, incl	896	30
Over 0.61 to 6.35, incl	862	40

3.3.1.2 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 the direction of rolling.

Nominal Thickness		Bend Factor
Inch	(Millimeters)	
Up to 0.050, incl	(Up to 1.27, incl)	1
Over 0.050 to 0.250, incl	(Over 1.27 to 6.35, incl)	2

3.3.1.3 Grain Size: Product 0.010 in. (0.25 mm) and over in nominal thickness shall have average grain size not over 0.0060 in. (0.152 mm) in diameter (ASTM Grain Size No. 2.5), determined in accordance with ASTM E112.

3.3.2 After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1300° F \pm 25 (704.4° C \pm 14), holding at heat for not less than 16 hr, and cooling in air:

3.3.2.1 Tensile Properties: Shall be as shown in Table II, determined in accordance with ASTM E8.

TABLE II

Nominal Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
0.010 to 0.024, incl	140,000	90,000	15
Over 0.024 to 0.250, incl	140,000	90,000	20

TABLE II (SI)

Nominal Thickness Millimeters	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
0.25 to 0.61, incl	965	621	15
Over 0.61 to 6.35, incl	965	621	20

3.3.2.2 Hardness: Should be not lower than 23 HRC or equivalent, determined in accordance with ASTM E18, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.3.2.1 are met.

3.4 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.

3.5 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 thickness from each heat to determine conformance to all other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number and its revision letter, thickness, size, and quantity from each heat.