



# AEROSPACE MATERIAL SPECIFICATIONS

## AMS 5599

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 Lexington Ave., New York, N. Y. 10017

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Revised

### ALLOY SHEET, STRIP, AND PLATE, CORROSION AND HEAT RESISTANT

Nickel Base - 21.5Cr - 9.0Mo - 3.7(Cb + Ta)

- 1. ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
- 2. APPLICATION:** Primarily for parts and assemblies requiring good corrosion and oxidation resistance at temperatures up to approximately 2000 F (1093 C) and where such parts may require welding during fabrication.
- 3. COMPOSITION:**

	min	max
Carbon	--	0.10
Manganese	--	0.50
Silicon	--	0.50
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	20.00 -	23.00
Molybdenum	8.00 -	10.00
Columbium + Tantalum	3.15 -	4.15
Iron	--	5.00
Cobalt (1)	--	1.00
Titanium	Present but not exceeding	0.40
Aluminum	Present but not exceeding	0.40
Nickel	remainder	

(1) Determination not required for routine acceptance.

3.1 **Check Analysis:** Composition variations shall meet the requirements of the latest issue of AMS 2269.

4. **CONDITION:** Unless otherwise ordered, the product shall be supplied in the following condition:

4.1 **Sheet:** Cold rolled, annealed, and descaled, or cold rolled and bright annealed.

4.2 **Strip:** Cold rolled, annealed, and descaled, or cold rolled and bright annealed. Strip in the annealed condition need not be bright and may have a slightly discolored surface. Standards for acceptance and rejection shall be as agreed upon by purchaser and vendor.

4.3 **Plate:** Hot rolled, annealed, and descaled.

5. **TECHNICAL REQUIREMENTS:**

5.1 **Tensile Properties:** The product shall conform to the following requirements:

Tensile Strength, psi	120,000 min
Yield Strength at 0.2% Offset or at 0.0080 in. in 2 in, Extension Under Load (E = 29,800,000), psi	60,000 min
Elongation, % in 2 in. or 4D	30 min

SAE Technical Board rules provide that: "All technical reports, including standards approved by the Board, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard 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 liability for infringement of patents."

- 5.1.1 Yield strength requirement does not apply to material under 0.020 in. in thickness.
- 5.1.2 Elongation requirement does not apply to material under 0.010 in. in thickness.
- 5.1.3 For widths 9 in. and over, tensile test specimens shall be taken with the axis perpendicular to the direction of rolling. For widths less than 9 in., tensile test specimens shall be taken with the axis parallel to the direction of rolling.

5.2 **Stress-Rupture Test at 1500 F (815.6 C):** A tensile test specimen machined from material 0.020 in. and over in thickness, maintained at  $1500\text{ F} \pm 5$  ( $815.6\text{ C} \pm 2.8$ ) while an axial stress of 16,500 psi is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture. Elongation after rupture measured at room temperature, shall be not less than 15% in 2 in. or 4D. For material under 0.020 in. thick, the test shall be performed for information only.

5.2.1 The test of 5.2 may be conducted at a stress higher than 16,500 psi but stress shall not be changed while test is in process, unless otherwise specified or allowed. Time to rupture and elongation requirements shall be as specified in 5.2.

5.3 **Bending:** Material shall withstand, without cracking, bending at room temperature through an angle of 180 deg 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 Inch	Bend Factor
0.010 to 0.050 incl	1
0.050 to 0.250 incl	2

5.4 **Grain Size:** Shall be not larger than the following when determined in accordance with the issue of ASTM E112 listed in the latest issue of AMS 2350.

Form	Nominal Thickness Inches	ASTM Grain Size No.
Sheet & Strip	Up to 0.050, incl	5
	Over 0.050 to 0.250, incl	4
Plate		As agreed upon by purchaser and vendor

6. **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.

7. **TOLERANCES:** Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2262.

8. **REPORTS:**

8.1 Unless otherwise specified, 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 technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number, thickness, size, and quantity from each heat.