



AEROSPACE MATERIAL SPECIFICATION

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

AMS 6437B
Superseding AMS 6437A

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STEEL SHEET, STRIP, AND PLATE
5.0Cr - 1.3Mo - 0.50V (0.38 - 0.43C)

1. SCOPE:

- 1.1 Form: This specification covers an aircraft-quality, low-alloy steel in the form of sheet, strip, and plate.
- 1.2 Application: Primarily for parts requiring relatively high levels of strength, fatigue resistance, toughness, ductility, and thermal stability for operation up to 1000 F (540 C), and where such parts may require welding. In appropriate section sizes, this material is capable of meeting the transverse tensile property requirements of AMS 2310.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent indicated 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 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
AMS 2252 - Tolerances, Alloy Steel Sheet, Strip, and Plate
AMS 2301 - Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2310 - Steel, Transverse Strength and Ductility Requirements, Tensile Strength, 260,000 psi Minimum
AMS 2350 - Standards and Test Methods
ASM 2370 - Quality Assurance Sampling of Carbon and Low Alloy Steels, Wrought Products Except Forgings

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM E112 - Estimating Average Grain Size of Metals
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

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

2.3.1 Federal Standards:

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

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3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods.

	min	max
Carbon	0.38	0.43
Manganese	0.20	0.40
Silicon	0.80	1.00
Phosphorus	--	0.020
Sulfur	--	0.020
Chromium	4.75	5.25
Molybdenum	1.20	1.40
Vanadium	0.40	0.60
Nickel	--	0.25
Copper	--	0.35

- 3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248; check analysis tolerance for vanadium shall be 0.04 under min or over maximum.
- 3.2 Condition: The product shall be supplied in the following condition; tensile tests shall be conducted in accordance with ASTM A370.
- 3.2.1 Sheet and Strip: Cold finished and bright annealed; or hot rolled, annealed if necessary, and descaled; having tensile strength not higher than 125,000 psi (862 MN/m²).
- 3.2.2 Plate: Hot rolled, annealed if necessary, and descaled, having tensile strength not higher than 125,000 psi (862 MN/m²).
- 3.3 Properties: The product shall conform to the following requirements; hardness, tensile, and bend testing shall be performed in accordance with ASTM A370:
- 3.3.1 Decarburization:
- 3.3.1.1 Product Under 0.045 In. (1.143 mm) in Thickness: The method of test and the allowance shall be as agreed upon by purchaser and vendor.
- 3.3.1.2 Product 0.045 to 0.375 In. (1.143 to 9.525 mm), Excl, Thick:
- 3.3.1.2.1 Specimens: Shall be the full thickness of the material except that specimens from plate over 0.249 in. (6.325 mm) thick shall be slices approximately 0.250 in. (6.35 mm) thick cut parallel to and preserving one original surface of the plate. Recommended specimen size is 1 x 4 in. (25.4 x 101.6 mm)
- 3.3.1.2.2 Procedure: Specimens shall be hardened by austenitizing and quenching; preferably, they shall not be tempered but, if tempered, the tempering temperature shall be not higher than 300 F (149 C). During heat treatment, specimens shall be protected by suitable atmosphere or medium or by suitable plating to prevent carburization or further decarburization. Protective plating, if used, shall then be removed from specimens of product 0.045 to 0.250 (1.143 - 6.35 mm), excl, in thickness and a portion of the specimen shall be step ground to a depth of 0.050 in. (1.27 mm), or half thickness, whichever is less. Specimens from product 0.250 in. to 0.375 in. (6.35 - 9.525 mm), excl, in thickness shall be ground to remove 0.020 in. (0.508 mm) of metal from the original surface of the plate and a portion of the specimen shall be further ground to a depth of at least 1/3 the original thickness of the specimen. At least three Rockwell hardness readings shall be taken on each prepared step and each group of readings averaged.

3.3.1.2.3 Allowance:

3.3.1.2.3.1 Product 0.045 to 0.250 In. (1.143 - 6.35 mm), Excl, Thick: Unless otherwise specified, the product shall be free from complete decarburization as determined microscopically at a magnification not exceeding 100X. It shall also be free from partial decarburization to the extent that the difference in hardness between the surface and the nondecarburized depth below the surface shall be not greater than 2 points HRA.

3.3.1.2.3.2 Material 0.250 to 0.375 In. (6.35 - 9.525 mm), Excl, Thick: Shall be free from decarburization to the extent that the difference in hardness between the two prepared steps shall be not greater than 2 points HRC.

3.3.1.3 Material 0.375 In. (9.525 mm), and Over in Thickness: The total decarburization as determined microscopically on the plate as supplied shall be not greater than shown in Table I:

TABLE I

Nominal Thickness Inches	Depth of Decarburization Inch
0.375 to 0.500, incl	0.015
Over 0.500 to 1.000, incl	0.025
Over 1.000 to 2.000, incl	0.035

TABLE I (SI)

Nominal Thickness Millimeters	Depth of Decarburization Millimeters
9.525 to 12.70, incl	0.381
Over 12.70 to 25.40, incl	0.635
Over 25.40 to 50.80, incl	0.889

3.3.2 Bending: The product shall withstand, without evidence of cracking when examined at 20X magnification, free bending through the angle indicated in Table II around a diameter equal to three times the nominal thickness of the material with axis of bend parallel to the direction of rolling.

TABLE II

Nominal Thickness Inch	Angle deg, min
Up to 0.250, incl	180
Over 0.250 to 0.437, incl	90

TABLE II (SI)

Nominal Thickness Millimeters	Angle rad, min
Up to 6.35, incl	3.14
Over 6.35 to 11.10	1.57

3.3.3 Properties After Heat Treatment: Specimens austenitized by heating to $1850\text{ F} \pm 25$ ($1010\text{ C} \pm 14$), holding at heat for 15 - 25 min., and cooling in air to room temperature and then tempered three times by heating to not lower than 1000 F (538 C), holding at heat for 2 - 3 hr, and cooling in air shall have the following properties:

3.3.3.1 Tensile Properties:

Tensile Strength, min	260,000 psi (1793 MN/m ²)
Yield Strength at 0.2% Offset, min	220,000 psi (1517 MN/m ²)
Elongation in 2 in. (50.8 mm) or 4D, min	5%

3.3.3.2 Hardness: Should be 50 - 56 HRC or equivalent but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.3.3 Grain Size: Predominantly 7 or finer with occasional grains as large as 5 permissible, ASTM E112; the procedure used shall be as agreed upon by purchaser and vendor.

3.4 Quality: Steel shall be aircraft quality conforming to AMS 2301. 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 performance of parts.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2252.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor 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 routine control tests.

4.3 Sampling: Shall be in accordance with AMS 2370 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), 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 and AMS 2301 frequency-severity rating of each heat in the shipment and the results of tests on each size from each heat to determine conformance to the tensile property and grain size requirements after heat treatment. This report shall include the purchase order number, heat number, material specification number and its revision letter, 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 and its revision letter, 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.