Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS6437C
Superseding AMS 6437B
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UNS T20811

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.

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., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2252 - Tolerances, Low-Alloy Steel Sheet, Strip, and Plate
AMS 2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2301 - Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2350 - Standards and Test Methods
AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM E112 - Estimating the 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 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

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

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

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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 analytical methods approved by purchaser:

	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

Ø 3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

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 MPa).

3.2.2 Plate: Hot rolled annealed if necessary, and descaled, having tensile strength not higher than Ø 125,000 psi (862 MPa) or equivalent hardness.

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. (1.14 mm) in Nominal 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. (1.14 to 9.52 mm), Excl, in Nominal Thickness:

3.3.1.2.1 Specimens: Shall be the full thickness of the product except that specimens from plate over 0.249 in. (6.32 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 x 100 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 (150°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 in. (1.14 - 6.35 mm), excl, in nominal thickness and a portion of the specimen shall be step ground to a depth of 0.050 in. (1.27 mm) or one-half thickness, whichever is less. Specimens from product 0.250 in. to 0.375 in. (6.35 - 9.52 mm), excl, in nominal thickness shall be ground to remove 0.020 in. (0.51 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 one-third 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.

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3.3.1.2.3 Allowance:

3.3.1.2.3.1 Product 0.045 to 0.250 In. (1.14 - 6.35 mm), Excl, in Nominal Thickness: The product shall show no layer of complete decarburization, 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 original surface and the portion ground as in 3.3.1.2.2 shall be not greater than 2 units on the Rockwell "A" Scale.

3.3.1.2.3.2 Product 0.250 to 0.375 In. (6.35 - 9.52 mm), Excl, in Nominal Thickness: Shall be free from decarburization to the extent that the difference in hardness between the two prepared steps shall be not greater than 3 units on the Rockwell "A" Scale.

3.3.1.3 Product 0.375 In. (9.52 mm), and Over in Nominal Thickness: The total decarburization, determined microscopically at a magnification not exceeding 100X on the as-supplied plate, 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 Millimetres	Depth of Decarburization Millimetre
9.52 to 12.70, incl	0.38
Over 12.70 to 25.40, incl	0.64
Over 25.40 to 50.80, incl	0.89

3.3.2 Bending: Product 0.437 in. (11.10 mm) and under in nominal thickness shall withstand, without evidence of cracking when examined at 20X magnification, free bending through the angle indicated below around a diameter equal to three times the nominal thickness of the product with axis of bend parallel to the direction of rolling:

Nominal Thickness		Angle
Inch	Millimetres	deg, min
Up to 0.250, incl	Up to 6.35, incl	180
Over 0.250 to 0.437, incl	Over 6.35 to 11.10	90

3.3.3 Response to Heat Treatment: Specimens as in 4.3.1 shall meet the following requirements after being austenitized by heating to 1850°F ± 25 (1010°C ± 15), holding at heat for 15 - 25 min., and cooling in air to room temperature and tempered three times by heating to not lower than 1000°F (540° C), holding at heat for 2 - 3 hr, and cooling in air:

3.3.3.1 Tensile Properties:

Tensile Strength, min	260,000 psi (1793 MPa)
Yield Strength at 0.2% Offset, min	220,000 psi (1517 MPa)
Elongation in 2 in. (50 mm) or 4D, min	5%

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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 grains as large as 5 permissible, determined in accordance with ASTM E112.

3.4 Quality:

3.4.1 Steel shall be aircraft quality conforming to AMS 2301.

3.4.2 The product, as received by purchaser, shall be uniform in quality and condition, sound, and free ø from foreign materials and from internal and external imperfections detrimental to usage of the product.

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 of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported ø to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform such confirmatory testing as he deems necessary to ensure 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 tests and shall be performed on each lot. ø

4.3 Sampling: Shall be in accordance with AMS 2370 and the following:

4.3.1 Specimens for tensile tests of widths 9 in. (225 mm) and over shall be taken with the axis of the specimen perpendicular to the direction of rolling; for widths less than 9 in. (225 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 showing the results of tests for chemical composition and AMS 2301 frequency-severity rating of each heat and the results of tests on each lot to determine conformance to the tensile property, hardness, and grain size requirements after heat treatment. This report shall include the purchase order number, heat number, AMS 6437C, 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, AMS 6437C, 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.

ø 4.5 Resampling and Retesting: Shall be in accordance with AMS 2370.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as in 5.1.1 unless purchaser permits a method from 5.1.2.

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