

**AEROSPACE
MATERIAL
SPECIFICATION**

Submitted for recognition as an American National Standard

AMS 5859B
Superseding AMS 5859A

Issued 1-15-77
Revised 7-1-85

STEEL SHEET, STRIP, AND PLATE, CORROSION RESISTANT
15Cr - 6.5Ni - 0.75Mo - 0.30(Cb+Ta) - 1.5Cu
Consumable Electrode Melted, Solution Heat Treated
Precipitation Hardenable

UNS S45000

1. SCOPE:

1.1 Form: This specification covers a premium aircraft-quality, corrosion-resistant steel in the form of sheet, strip, and plate.

1.2 Application: Primarily for parts requiring corrosion resistance approximating that of steels of the 18-8 type and high strength exceeding that of the 12Cr martensitic type up to 700°F (370°C). This steel can be used in the solution heat treated condition and can be precipitation heat treated to tensile strengths as high as 180,000 psi (1240 MPa). Although this steel is relatively immune to stress-corrosion cracking, reference should be made to ARP 1110 for recommended practices to minimize such conditions.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications and Aerospace Recommended Practices shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE Technical Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

AMS documents are protected under United States and international copyright laws. Reproduction of these documents by any means is strictly prohibited without the written consent of the publisher.

2.1.1 Aerospace Material Specifications:

- AMS 2242 - Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
- MAM 2242 - Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
- AMS 2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
- AMS 2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
- MAM 2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
- AMS 2350 - Standards and Test Methods
- AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

2.1.2 Aerospace Recommended Practices:

- ARP 1110 - Minimizing Stress Corrosion Cracking in Heat Treatable Wrought Low Alloy and Martensitic Corrosion Resistant Steels

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

- ASTM A370 - Mechanical Testing of Steel Products
- ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight,
 Ø determined by wet chemical methods in accordance with ASTM E353 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Carbon	--	0.05
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.020
Sulfur	--	0.015
Chromium	14.00 -	16.00
Nickel	6.00 -	7.00
Molybdenum	0.50 -	1.00
Columbium + Tantalum	8xC	--
Copper	1.25 -	1.75

- 3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

- 3.2 Condition: The product shall be supplied in the following condition:

- 3.2.1 Sheet and Strip: Cold rolled, solution heat treated, and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled having a surface appearance comparable to the following commercial corrosion-resistant steel finishes:

- 3.2.1.1 Sheet: No. 2D finish.

- 3.2.1.2 Strip: No. 1 strip finish.

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

- 3.3 Solution Heat Treatment: The product, except as specified in 3.3.1, shall be solution heat treated by heating to $1900^{\circ}\text{F} + 25$ ($1040^{\circ}\text{C} + 15$), holding at heat for 5 - 30 min., and quenching rapidly. Plate over 1.250 in. (31.75 mm) in nominal thickness shall be water or oil quenched.

- 3.3.1 For product heat treated in a continuous process, the product shall be solution heat treated by heating to $1900^{\circ}\text{F} + 25$ ($1040^{\circ}\text{C} + 15$), holding at Ø heat for a time commensurate with thickness and the heating equipment and procedure used, and cooling in air.

- 3.4 Properties: The product shall conform to the following requirements; tensile, hardness, and bend testing shall be performed in accordance with ASTM A370:

- 3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties: Shall be as follows:

Tensile Strength, min	125,000 psi (860 MPa)
Yield Strength at 0.2% Offset, min	95,000 psi (655 MPa)
Elongation in 2 in. (50 mm) or 4D, min	4%

3.4.1.2 Hardness: Product 0.010 in. (0.25 mm) and over in nominal thickness should have hardness not higher than 33 HRC, or equivalent, but shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.1.1 are met. Hardness requirements for product under 0.010 in. (0.25 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.1.3 Bending: Product under 0.1875 in. (4.75 mm) in nominal thickness shall withstand, without cracking, free bending through an angle of 180 deg around a diameter equal to 6 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

3.4.1.3.1 Bending requirements for plate 0.1875 in. (4.75 mm) and over in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2 After Precipitation Heat Treatment: Product shall have the following properties after being precipitation heat treated by heating to $1050^{\circ}\text{F} \pm 15$ ($565^{\circ}\text{C} \pm 8$), holding at heat for 4 - 8 hr, and cooling in air:

3.4.2.1 Tensile Properties: Shall be as specified in Table I.

TABLE I

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 0.020, incl	145,000	135,000	5
Over 0.020 to 0.062, incl	145,000	135,000	6
Over 0.062	145,000	135,000	8

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
Up to 0.50, incl	1000	930	5
Over 0.50 to 1.55, incl	1000	930	6
Over 1.55	1000	930	8

3.4.2.2 Hardness: Product 0.010 in. (0.25 mm) and over in nominal thickness should have hardness not lower than 34 HRC, or equivalent, but shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.1 are met. Hardness requirements for product 0.010 in. (0.25 mm) and under in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.3 After Other Precipitation Heat Treatment: Properties after precipitation heat treatment at temperatures other than $1050^{\circ}\text{F} \pm 15$ ($565^{\circ}\text{C} \pm 8$) shall be as agreed upon by purchaser and vendor.

3.5 QUALITY:

3.5.1 Steel shall be premium aircraft-quality conforming to AMS 2300 or MAM 2300; it shall be multiple melted using consumable electrode practice in the remelt cycle.

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

3.6 Tolerances: Shall conform to all applicable requirements of AMS 2242 or MAM 2242 except that flatness tolerances shall be as agreed upon by purchaser and vendor.

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 to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed 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 heat or lot as applicable.

4.3 Sampling: Shall be in accordance with AMS 2371; a heat shall be the consumable electrode remelted ingots produced from steel originally melted as a single furnace charge.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition and frequency-severity cleanliness rating of each heat and the results of tests on each lot to determine conformance to the other acceptance tests requirements of this specification. This report shall include the purchase order number, heat number, AMS 5859B, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 5859B, 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 either a statement that the material conforms or copies of laboratory reports showing the results of tests to determine conformance.