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400 Commonwealth Drive, Warrendale, PA 15096-0001

**AEROSPACE
MATERIAL
SPECIFICATION**

SAE

AMS 5859C

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Superseding AMS 5859B

Submitted for recognition as an American National Standard

STEEL, CORROSION RESISTANT, SHEET, STRIP, AND PLATE
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 18-8 type steels and strength exceeding that of 12Cr martensitic-type steels up to 700°F (371°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 ksi (1241 MPa).
- 1.2.1 This steel is relatively immune to stress-corrosion cracking, however reference should be made to ARP1110 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 SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

- 2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

REAFFIRMED

MAY 1995

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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 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock
- AMS 2750 - Pyrometry

2.1.2 Aerospace Recommended Practices:

- ARP1110 - Minimizing Stress Corrosion Cracking in Heat Treatable Wrought Low Alloy and Martensitic Corrosion Resistant Steels

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

- ASTM A 370 - Mechanical Testing of Steel Products
- ASTM E 353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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, \emptyset determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to 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 -	175

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 3.2.1.1 or 3.2.1.2 as applicable (See 8.2).

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 \emptyset be solution heat treated by heating to $1900^{\circ}\text{F} \pm 25$ ($1038^{\circ}\text{C} \pm 14$), holding at heat for 5 - 30 minutes, and quenching rapidly. Plate over 1.250 inches (31.75 mm) in nominal thickness shall be water or oil quenched. Pyrometry shall be in accordance with AMS 2750.

3.3.1 For product heat treated in a continuous process, the product shall be solution heat treated by heating to $1900^{\circ}\text{F} \pm 25$ ($1038^{\circ}\text{C} \pm 14$), holding at 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 A 370:

3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties: Shall be as follows:

Tensile Strength, minimum	125 ksi (862 MPa)
Yield Strength at 0.2% Offset, minimum	95 ksi (655 MPa)
Elongation in 2 inches (50.8 mm) or 4D, minimum	4%

3.4.1.2 Hardness: Product 0.010 inch (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.

3.4.1.2.1 Hardness requirements for product under 0.010 inch (0.25 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.1.3 Bending: Product under 0.1875 inch (4.762 mm) in nominal thickness shall withstand, without cracking, free bending through an angle of 180 degrees around a diameter equal to six 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 inch (4.762 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°F ± 15 (566°C ± 8), holding at heat for 4 - 8 hours, and cooling in air:

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

TABLE I

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

TABLE I (SI)

Nominal Thickness Millimeters	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 0.51, incl	1000	931	5
Over 0.51 to 1.57, incl	1000	931	6
Over 1.57	1000	931	8

3.4.2.2 Hardness: Product 0.010 inch (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.

3.4.2.2.1 Hardness requirements for product under 0.010 inch (0.25 mm) 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°F ± 15 (566°C ± 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 \emptyset samples for vendor's tests and shall be responsible for performing all required tests. 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:

4.2.1 Acceptance Tests: Tests for composition (3.1), tensile properties (3.4.1.1 and 3.4.2.1), hardness (3.4.1.2 and 3.4.2.2), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests for bending (3.4.1.3) and steel cleanliness (3.5.1) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

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

4.4 Reports: 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 for tensile properties and hardness of each lot, and when performed, the results of tests to determine conformance to periodic test requirements. This report shall include the purchase order number, lot number, AMS 5859C, size, and quantity.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.