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

AEROSPACE MATERIAL SPECIFICATION

AMS 5859

Issued 1-15-77
Revised

UNS S45000

STEEL SHEET, STRIP, AND PLATE, CORROSION RESISTANT
15Cr - 6.5Ni - 0.75Mo - 0.6(Cb+Ta) - 1.5Cu
Consumable Electrode Melted, Solution Heat Treated

1. SCOPE:

1.1 Form: This specification covers a 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 types and high strength exceeding that of 12Cr martensitic types at temperatures up to 700°F (320°C). Material can be used in the solution heat treated condition and can be precipitation heat treated to tensile strengths as high as 180,000 psi (1241 MPa). Although this material 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 (AMS) and Aerospace Recommended Practices (ARP) 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 2242 - Tolerances, Corrosion and Heat Resistant Steel and Iron Base Alloy Sheet, Strip, and Plate and Titanium and Titanium Alloy Sheet, Strip, and Plate
AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
AMS 2300 - Premium Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings

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 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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E353, by spectographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	--	0.05
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.015
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: Cold rolled, solution heat treated, and descaled (No. 2D Finish).

3.2.2 Strip: Cold rolled, solution heat treated, and descaled (No. 1 Strip Finish).

3.2.3 Plate: Hot rolled, solution heat treated, and descaled.

3.3 Solution Heat Treatment: The product shall be solution heat treated by heating to 1900°F ± 25 (1038°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.

3.4 Properties: The product shall conform to the following requirements; hardness, tensile, 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 (862 MPa)
Yield Strength at 0.2% Offset, min	95,000 psi (655 MPa)
Elongation in 2 in. (50.8 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.

3.4.1.3 Bending: Product less than 0.1875 in. (4.762 mm) in nominal thickness shall withstand, without cracking, free bending through an angle of 180 deg (3.14 rad) 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. (4.762 mm) and over in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2 After Precipitation Heat Treatment: The solution heat treated product shall have the following properties after being precipitation heat treated by heating to 1050°F ± 15 (565°C ± 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 50.8 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 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.

3.4.3 After Other Precipitation Heat Treatment: Properties after precipitation heat treatment at temperatures other than 1050°F ± 15 (565°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; it shall be multiple melted using consumable electrode practice in the remelt cycle.

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

3.6 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2242.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product 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 ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following are classified as acceptance tests:

4.2.1.1 Tests of the product to determine conformance to composition (3.1) requirements.

4.2.1.2 Tests of sheet, strip, and plate as solution heat treated to determine conformance to tensile property (3.4.1.1), hardness (3.4.1.2), and bending (3.4.1.3) requirements.

4.2.1.3 Tests of sheet, strip, and plate after precipitation heat treatment as in 3.4.2 to determine conformance to tensile property (3.4.2.1) and hardness (3.4.2.2) requirements.

4.2.1.4 Tests of sheet, strip, and plate to determine conformance to tolerance (3.6) requirements.

4.2.2 Periodic Tests: Tests to determine conformance to agreed-upon tensile property and hardness (3.4.3) requirements after precipitation heat treatment at temperatures other than that specified in 3.4.2 are classified as periodic tests.

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

4.3.1 Specimens for tensile tests of widths 9 in. (229 mm) and over shall be taken with the axis of the specimen 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 showing the results of tests for chemical composition of each heat and the results of tests on each thickness from each heat to determine conformance to the other acceptance test requirements of this specification. This report shall include the purchase order number, heat number, material specification number, 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 purchase order number, material specification number, 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: Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each sheet, strip, and plate shall be marked on one face, in the respective location indicated below, with AMS 5859, heat number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be removable in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the product or its performance and shall be sufficiently stable to withstand normal handling.

5.1.1 Flat Strip 6 In. (152 mm) and Under in Width: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm).