

AEROSPACE MATERIAL SPECIFICATION



AMS 5864A

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Superseding AMS 5864

Steel, Corrosion Resistant, Plate
13Cr - 8.0Ni - 2.2Mo - 1.1Al
Vacuum Induction Plus Consumable Electrode Melted
Solution Heat Treated, Precipitation Hardenable

UNS S13800

1. SCOPE:

1.1 Form:

This specification covers a corrosion-resistant steel in the form of plate up to 3.00 inches (76.2 mm), inclusive, in nominal thickness.

1.2 Application:

This plate has been used typically for parts requiring corrosion resistance, stress-corrosion resistance, high strength up to 600 °F (315 °C), and good ductility and strength in the transverse direction in thick sections, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause this plate to become susceptible to stress-corrosion cracking; ARP1110 recommends 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.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, Pa 15096-0001.

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 and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing
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 112	Determining the Average Grain Size
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 DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.05
Manganese	--	0.10
Silicon	--	0.10
Phosphorus	--	0.010
Sulfur	--	0.008
Chromium	12.25	13.25
Nickel	7.50	8.50
Molybdenum	2.00	2.50
Aluminum	0.90	1.35
Nitrogen	--	0.010

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248 except that variations is not permitted for nitrogen.

3.2 Melting Practice:

Steel shall be multiple melted using vacuum induction followed by consumable electrode remelting.

3.3 Condition:

Hot rolled, solution heat treated, and descaled.

3.4 Heat Treatment:

Plate shall be solution heat treated by heating to $1700^{\circ}\text{F} \pm 25$ ($927^{\circ}\text{C} \pm 14$), holding at heat for not less than 30 minutes, and cooling as required to below 60°F (16°C).

3.5 Properties:

Plate shall conform to the following requirements; tensile and hardness testing shall be performed in accordance with ASTM A 370:

3.5.1 As Solution Heat Treated:

3.5.1.1 Tensile Properties: As agreed upon by purchaser and vendor.

3.5.1.2 Hardness: Not higher than 38 HRC, or equivalent (See 8.2).

3.5.1.3 Grain Size: Shall be ASTM No. 5 or finer with occasional grains as large as ASTM No. 3, determined by comparison of a polished and etched specimen with the chart in ASTM E 112. Sample for grain size estimation may be hardened to any of the conditions of Table 2 to define better grain boundaries.

- 3.5.2 After Precipitation Heat Treatment: Specimens from the solution heat treated plate, precipitation heat treated to a particular condition in accordance with the times and temperatures shown in Table 2 and cooled in air, shall have the properties shown in Table 2 and Table 3 for that particular condition. Tensile and hardness tests shall be made in only the H1000 precipitation heat treated condition, unless otherwise specified.

TABLE 2 - Heat Treatment

Condition	Temperature	Time, Hours
H950	950 °F ± 10 (510 °C ± 6)	4 ± 0.25
H1000	1000 °F ± 10 (538 °C ± 6)	4 ± 0.25
H1025	1025 °F ± 10 (552 °C ± 6)	4 ± 0.25
H1050	1050 °F ± 10 (566 °C ± 6)	4 ± 0.25
H1100	1100 °F ± 10 (593 °C ± 6)	4 ± 0.25
H1150	1150 °F ± 10 (621 °C ± 6)	4 ± 0.25

- 3.5.2.1 Tensile Properties: Shall be as shown in Table 3:

TABLE 3A - Minimum Tensile Properties, Inch/Pound Units

Condition	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %	Reduction of Area %
H950	Longitudinal	220	205	10	45
	Long.-Trans.	220	205	10	45
	Short-Trans.	220	205	10	35
H1000	Longitudinal	205	190	10	50
	Long.-Trans.	205	190	10	50
	Short-Trans.	205	190	10	40
H1025	Longitudinal	185	175	11	50
	Long.-Trans.	185	175	11	50
	Short-Trans.	185	175	11	45
H1050	Longitudinal	175	165	12	50
	Long.-Trans.	175	165	12	50
	Short-Trans.	175	165	12	45
H1100	Longitudinal	150	135	14	50
	Long.-Trans.	150	135	14	50
	Short-Trans.	150	135	14	50
H1150	Longitudinal	135	90	14	50
	Long.-Trans.	135	90	14	50
	Short-Trans.	135	90	14	50

TABLE 3B - Minimum Tensile Properties, SI Units

Condition	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %	Reduction of Area %
H950	Longitudinal	1517	1413	10	45
	Long.-Trans.	1517	1413	10	45
	Short-Trans.	1517	1413	10	35
H1000	Longitudinal	1413	1310	10	50
	Long.-Trans.	1413	1310	10	50
	Short-Trans.	1413	1310	10	40
H1025	Longitudinal	1276	1207	11	50
	Long.-Trans.	1276	1207	11	50
	Short-Trans.	1276	1207	11	45
H1050	Longitudinal	1207	1138	12	50
	Long.-Trans.	1207	1138	12	50
	Short-Trans.	1207	1138	12	45
H1100	Longitudinal	1034	931	14	50
	Long.-Trans.	1034	931	14	50
	Short-Trans.	1034	931	14	50
H1150	Longitudinal	931	621	14	50
	Long.-Trans.	931	621	14	50
	Short-Trans.	931	621	14	50

3.5.2.1.1 Short-transverse tensile property requirements apply only to plate 2.50 inches (63.5 mm) and over in nominal thickness.

3.5.2.1.2 Plate tested in the long- or short-transverse direction need not be tested in the longitudinal direction.

3.5.2.2 Ferrite Determination: The delta ferrite content of plate under 2.50 inches (63.5 mm) in nominal thickness shall be less than 2% and the length/thickness ratio of delta ferrite inclusions shall average less than 4:1 with no single stringer greater than 8:1 in each metallographic sample. Overaging is permissible to highlight the ferrite.

- 3.5.2.3 Hardness: Shall be not lower than shown in Table 4, or equivalent, for the corresponding precipitation hardened condition (See 8.2).

TABLE 4 - Minimum Hardness Requirements

Condition	Hardness, HRC
H950	45
H1000	43
H1025	41
H1050	40
H1100	34
H1150	30

3.6 Quality:

Plate, 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 plate.

- 3.6.1 Steel shall be premium aircraft-quality conforming to AMS 2300 or MAM 2300.

3.7 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 plate shall supply all 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 plate conforms to the requirements of this specification.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: Tests for composition (3.1), hardness (3.5.1.2 and 3.5.2.3), grain size (3.5.1.3), tensile properties (3.5.2.1), and tolerances (3.7) are acceptance tests and shall be performed on each heat or lot as applicable.
- 4.2.2 Periodic Tests: Tests for ferrite content (3.5.2.2) and conformance to AMS 2300 or MAM 2300 (3.6.1) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.