G-31-50

SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5520D

Issued 6-15-59
Revised 1-1-90

Superseding AMS 5520C

STEEL SHEET, STRIP, FOIL, AND PLATE, CORROSION AND MODERATE HEAT RESISTANT 15Cr - 7.1Ni - 2.5Mo - 1.1Al Solution Heat Treated, Precipitation Hardenable

UNS S15700

1. SCOPE:

1.1 Form: This specification covers a corrosion and moderate heat resistant steel in the form of sheet, strip, foil, and plate.

1.2 Application: Primarily for parts requiring corrosion resistance and high strength up to 600°F (316°C) and where such parts may require welding during fabrication.

1.2.1 Certain design and processing procedures may cause these products 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 as specified in AMS 2350.

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

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 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:

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.

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 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, 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	--	0.09
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	14.00	16.00
Nickel	6.50	7.75
Molybdenum	2.00	3.00
Aluminum	0.75	1.50

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). Ø

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. Ø

3.3 Solution Heat Treatment: The product shall be solution heat treated by heating to 1950°F ± 25 (1066°C ± 14), holding at heat for a time commensurate with section thickness, and cooling at a rate equivalent to an air cool or faster. Ø

3.4 Properties: Product 0.0015 inch (0.038 mm) and over in nominal thickness shall conform to the following requirements; properties for product under 0.0015 inch (0.038 mm) in nominal thickness shall be as agreed upon by purchaser and vendor. Tensile, hardness, and bend testing shall be performed in accordance with ASTM A 370: Ø

3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties: Shall be as follows: Ø

TABLE I

Nominal Thickness Inches	Tensile Strength psi, max	Yield Strength at 0.2% Offset psi, max	Elongation In 2 Inches or 4D %, min
0.0015 to 0.005, excl	165,000	--	15
0.005 and over	150,000	65,000	25

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation In 50.8 mm or 4D %, min
0.038 to 0.13, excl	1138	--	15
0.13 and over	1034	448	25

3.4.1.2 Hardness: Should be not higher than 100 HRB, or equivalent, but the product 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 0.0015 to 0.275 inch (0.038 to 6.98 mm) in nominal thickness shall withstand, without cracking, bending through the angle indicated below around a diameter equal to the bend factor times the nominal thickness of the product with axis of bend parallel to the direction of rolling. Only one type of test will be required in routine inspection; in case of dispute, results of tests using the V-block procedure shall govern.

Nominal Thickness		Type of Bend	Angle deg, min	Bend Factor
Inch	Millimetres			
0.0015 to 0.187, incl	0.038 to 4.75, incl	Free Bend	180	1
		V-Block	135	1
Over 0.187 to 0.275, incl	Over 4.75 to 6.98, incl	Free Bend	180	3
		V-Block	135	3

3.4.1.3.1 Bending requirements for plate over 0.275 inch (6.98 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2 As Austenite Conditioned and Precipitation Heat Treated: The product shall have the following properties after being austenite conditioned by heating to 1400°F ± 25 (760°C ± 14), holding at heat for 90 minutes ± 5, cooling to 55°F ± 5 (13°C ± 3) within 60 minutes, holding at that temperature for not less than 30 minutes, and precipitation heat treated by heating to 1050°F ± 10 (566°C ± 6), holding at heat for 90 minutes ± 5, and cooling to room temperature:

3.4.2.1 Product 0.0015 to 0.500 Inch (0.038 to 12.70 mm), Incl, in Nominal Thickness:

3.4.2.1.1 Tensile Properties: Shall be as specified in Table II and 3.4.2.2.

TABLE II

Nominal Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min
0.0015 to 0.005, excl	190,000	170,000	2
0.005 to 0.010, excl	190,000	170,000	3
0.010 to 0.020, excl	190,000	170,000	4
0.020 to 0.1875, excl	190,000	170,000	5
0.1875 to 0.500, incl	190,000	170,000	6

TABLE II (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
0.038 to 0.13, excl	1310	1172	2
0.13 to 0.25, excl	1310	1172	3
0.25 to 0.51, excl	1310	1172	4
0.51 to 4.762, excl	1310	1172	5
4.762 to 12.70, incl	1310	1172	6

3.4.2.1.2 Hardness: Should be not lower than 40 HRC, or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.1.1 are met.

3.4.2.2 Product Over 0.500 Inch (12.70 mm) in Nominal Thickness: Tensile property and hardness requirements shall be as agreed upon by purchaser and vendor.

3.4.3 As Austenite Conditioned, Sub-Zero Transformed, and Precipitation Heat Treated: The product shall have the following properties after being austenite conditioned by heating to 1750°F ± 25 (954°C ± 14), holding at heat for not less than 10 minutes, rapidly cooling to room temperature, sub-zero transformed by cooling to -100°F ± 10 (-73°C ± 6), holding at that temperature for not less than 8 hours, warming in air to room temperature, and precipitation heat treated by heating to 950°F ± 10 (510°C ± 6), holding at heat for 60 minutes ± 5, and cooling to room temperature:

3.4.3.1 Product 0.0015 to 0.500 Inch (0.038 to 12.70 mm), Incl, in Nominal Thickness:

3.4.3.1.1 Tensile Properties: Shall be as specified in Table III and 3.4.3.2.

TABLE III

Nominal Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min
0.0015 to 0.005, excl	225,000	200,000	1
0.005 to 0.010, excl	225,000	200,000	2
0.010 to 0.020, excl	225,000	200,000	3
0.020 to 0.1875, excl	225,000	200,000	4
0.1875 to 0.500, incl	225,000	200,000	5

TABLE III (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
0.038 to 0.13, excl	1551	1379	1
0.13 to 0.25, excl	1551	1379	2
0.25 to 0.51, excl	1551	1379	3
0.51 to 4.762, excl	1551	1379	4
4.762 to 12.70, incl	1551	1379	5

3.4.3.1.2 Hardness: Should be not lower than 45 HRC, or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.3.1.1 are met.

3.4.3.2 Product Over 0.500 Inch (12.70 mm) in Nominal Thickness: Tensile property and hardness requirements shall be as agreed upon by purchaser and vendor.

3.5 Quality: 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.

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:

4.2.1 Acceptance Tests: Tests for composition (3.1), tensile properties as solution heat treated (3.4.1.1) and as austenite conditioned and precipitation heat treated (3.4.2.1.1), 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 as solution heat treated (3.4.1.3), hardness (3.4.1.2, 3.4.2.1.2, and 3.4.3.1.2), and tensile properties as austenite conditioned, sub-zero transformed, and precipitation heat treated (3.4.3.1.1) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.