

AEROSPACE MATERIAL SPECIFICATION



AMS 5520F

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Superseding AMS 5520E

Steel, Corrosion and Heat-Resistant, Sheet, Strip, Foil, and Plate
15Cr - 7.1Ni - 2.5Mo - 1.1Al
Solution Heat Treated, Precipitation Hardenable
(Composition similar to UNS S15700)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat-resistant steel in the form of sheet, strip, foil, and plate.

1.2 Application:

These products have been used typically for parts requiring corrosion resistance and high strength up to 600 °F (316 °C) and where such parts may require welding during fabrication, but usage is not limited to such applications.

- 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 issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent supplied herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2242	Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
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
AS4194	Sheet and Strip Surface Finish Nomenclature
ARP1110	Minimizing Stress Corrosion Cracking in Wrought Forms of Steels and Corrosion Resistant Steels and Alloys

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM A 370	Mechanical Testing of Steel Products
ASTM A 480/A 480M	Flat Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM E 353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E 384	Microindentation Hardness of Materials

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	--	0.09
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 applicable 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 in accordance with ASTM A 480/A 480M and AS4194 comparable to 3.2.1.1 or 3.2.1.2 as applicable.

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 shall be solution heat treated by heating to a temperature within the range 1925 to 1975 °F (1052 to 1079 °C), holding at the selected temperature for a time commensurate with thickness and the heating equipment and procedure used, and cooling at a rate equivalent to an air cool or faster.

3.4 Properties:

Product 0.0015 inch (0.038 mm) and over in nominal thickness 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 shown in Table 2.

TABLE 2A - Tensile Properties, Inch/Pound Units

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

TABLE 2B - Tensile Properties, SI Units

Nominal Thickness Millimeters	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: Shall be not higher than 100 HRB, or equivalent (See 8.2); for thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Product shall not be rejected on the basis of hardness if the tensile properties of 3.4.1.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.4.1.3 Bending: Product shall withstand, without cracking, bending through the angle shown in Table 3 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.

TABLE 3 - Bending Parameters

Nominal Thickness Inch	Nominal Thickness Millimeters	Angle deg, min	Bend Factor
0.0015 to 0.1874, incl	0.038 to 4.76, incl	180	1
Over 0.1874 to 0.275, incl	Over 4.76 to 6.98, incl	180	3

3.4.2 Response to Austenite Conditioning and Precipitation Heat Treatment: 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 Tensile Properties: Shall be as shown in Table 4.

TABLE 4A - Minimum Tensile Properties, Inch/Pound Units

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

TABLE 4B - Minimum Tensile Properties, SI Units

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
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

3.4.2.2 Hardness: Shall be not lower than 40 HRC, or equivalent (See 8.2); for thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Product shall not be rejected on the basis of hardness if the tensile properties of 3.4.2.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.4.3 Response to Austenite Conditioning, Sub-Zero Transformation, and Precipitation Heat Treatment: The product shall have the following properties after being austenite conditioned by heating to $1750^{\circ}\text{F} \pm 25$ ($954^{\circ}\text{C} \pm 14$), holding at heat for not less than 10 minutes, rapidly cooling to room temperature, sub-zero transformed by cooling to $-100^{\circ}\text{F} \pm 10$ ($-73^{\circ}\text{C} \pm 6$), holding at that temperature for not less than 8 hours, warming in air to room temperature, and precipitation heat treated by heating to $950^{\circ}\text{F} \pm 10$ ($510^{\circ}\text{C} \pm 6$), holding at heat for 60 minutes ± 5 , and cooling to room temperature:

3.4.3.1 Tensile Properties: Shall be as shown in Table 5.

TABLE 5A - Minimum Tensile Properties, Inch/Pound Units

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

TABLE 5B - Minimum Tensile Properties, SI Units

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
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

3.4.3.2 Hardness: Shall be not lower than 45 HRC, or equivalent (See 8.2); for thin gages where superficial hardness testing is impractical, microhardness testing in accordance with ASTM E 384 may be used. Product shall not be rejected on the basis of hardness if the tensile properties of 3.4.3.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

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.