AEROSPACE MATERIAL SPECIFICATION

AMS5520™	REV. H

Issued 1959-06
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Revised 2021-07

Superseding AMS5520G

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)

RATIONALE

AMS5520H prohibits unauthorized exceptions (1.1, 3.5, 3.8, 4.4.1, 5.1.1, 8.6), updates composition testing (3.1), adds AMS2761 (3.3.1), adds continuous heat treatment (3.3.2), adds strain rate (3.4.1), adds country of origin (4.4), updates heat treatment to table formatting (Tables 4 and 6), allows prior revisions (8.5), and is the result of a Five-Year Review and update of the specification.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant steel in the form of sheet, strip, foil, and plate 0.0015 inch (0.038 mm) and greater in nominal thickness.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5520H/

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2242	Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS2248	Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS2761	Heat Treatment of Steel Raw Materials
AMS2807	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 Wrought Forms of Steels and Corrosion Resistant Steels and Alloys
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications
AS4194	Sheet and Strip Surface Finish Nomenclature

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A370	Mechanical Testing of Steel Products
ASTM A480/A480M	Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A751	Chemical Analysis of Steel Products
ASTM E140	Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
ASTM E290	Bend Testing of Material for Ductility
ASTM E384	Microindentation Hardness of Materials

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 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 AMS2248.

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 the following commercial corrosion-resistant steel finishes as described in ASTM A480/A480M and AS4194, and 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

3.3.1 The product shall be solution heat treated in accordance with AMS2761, 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.

3.3.2 Continuous Heat Treatment

When continuous heat treating is used process parameters (e.g., furnace temperature set points, heat input, travel rate, etc.) for continuous heat treating lines shall be established by the material producer and validated by testing of product to the requirements of 3.4.

3.4 Properties

Product 0.0015 inch (0.038 mm) and over in nominal thickness shall conform to the following requirements. Tensile and hardness testing shall be performed in accordance with ASTM A370.

3.4.1 Unless otherwise specified, the strain rate shall be at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. The strain rate after yield may be increased to any value up to 0.5 in/in/min (or mm/mm/min) or equivalent crosshead speed as a function of gage length.

3.4.2 As Solution Heat Treated

3.4.2.1 Tensile Properties

Shall be 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 mm or 4D %, Min
0.038 to 0.13, excl	1138	--	15
0.13 and over	1034	448	25

3.4.2.2 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 E384 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.

3.4.2.3 Bending

Product shall be tested in accordance with ASTM E290, using a sample prepared nominally 0.75 inch (19.0 mm) in width, with the axis of bending parallel to the direction of rolling, and shall withstand, without cracking, when bending at room temperature through the angle shown in Table 3 around a diameter equal to the bend factor times the nominal thickness of the product. In case of dispute, the results of tests using the guided bend test of ASTM E290 shall govern.

Table 3 - Bending parameters

Nominal Thickness Inches	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 6.99, incl	180	3

3.4.3 Response to Austenite Conditioning and Precipitation Heat Treatment

The product shall have the following properties after being austenite conditioned in accordance with Table 4.

Table 4 - Response to heat treatment processing

	Processing Step [1]	Temperature	Time at Temperature Minutes
1	Heat	1400 °F ± 25 °F (760 °C ± 14 °C)	90 ± 5
2	Within 60 minutes cool to	60 °F or cooler (16 °C or cooler)	30 minimum
3	Precipitation HT	1050 °F ± 10 °F (566 °C ± 6 °C)	90 ± 5

[1] Note that all processing must be performed in the order noted.

3.4.3.1 Tensile Properties

Shall be shown in Table 5.

Table 5A - Minimum tensile properties, inch/pound units

Nominal Thickness Inches	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 5B - Minimum tensile properties, SI units

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 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 4.763, excl	1310	1172	5
4.763 to 12.70, incl	1310	1172	6

3.4.3.2 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 E384 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.

3.4.4 Response to Austenite Conditioning, Sub-Zero Transformation, and Precipitation Heat Treatment

The product shall have the following properties after being austenite conditioned in accordance with Table 6.

Table 6 - Response to heat treatment processing with sub-zero transformation

	Processing Step [1]	Temperature	Time at Temperature
1	Heat	1750 °F ± 25 °F (954 °C ± 14 °C)	10 minutes min
2	Rapidly cool	Room temperature	--
3	Subzero cool	-90 °F or cooler (-68 °C or cooler)	8 hours min
4	Warm in air to	Room temperature	--
5	Precipitation heat treat	950 °F ± 10 °F (510 °C ± 6 °C)	60 minutes ± 5 minutes

[1] Note that all processing must be performed in the order noted.

3.4.4.1 Tensile Properties

Shall be shown in Table 7.

Table 7A - Minimum tensile properties, inch/pound units

Nominal Thickness Inches	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 7B - 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 4.763, excl	1551	1379	4
4.763 to 12.70, incl	1551	1379	5

3.4.4.2 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 E384 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 Mechanical property requirements for product outside the size range covered by 1.1 shall be agreed upon between purchaser and producer and reported per 4.4.1.

3.6 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.

3.7 Tolerances

Shall conform to all applicable requirements of AMS2242.

3.8 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.