AEROSPACE MATERIAL SPECIFICATION

AMS5542™	REV. R

Issued 1947-09
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Superseding AMS5542P

Nickel Alloy, Corrosion- and Heat-Resistant, Sheet, Strip, and Plate
72Ni - 15.5Cr - 0.95Cb(Nb) - 2.5Ti - 0.70Al - 7.0Fe (X750)
Annealed

(Composition similar to UNS N07750)

RATIONALE

AMS5542R is the result of a Five-Year Review and update of the specification. The revision updates composition testing and reporting requirements (see 3.1, 3.1.1, 4.2, and Table 1), clarifies finish and bending requirements (see 3.2.1 and 3.3.1.2), adds pyrometry (see 3.3.2), adds strain rate requirements to tensile testing (see 3.3.2.1.2), adds hardness information (see 3.3.2.2 and 8.2), and updates the exceptions requirements (see 3.3.3 and 8.5).

1. SCOPE

1.1 Form

This specification covers a corrosion- and heat-resistant nickel alloy in the form of sheet and strip up to 0.1874 inch (4.76 mm), inclusive, in thickness and plate up to 4.000 inches (101.6 mm), inclusive, in thickness.

1.2 Application

These products have been used typically for parts requiring high strength up to approximately 1500 °F (816 °C) and oxidation resistance up to approximately 1800 °F (980 °C), and for bellows and flat springs requiring optimum resistance to relaxation up to approximately 1000 °F (538 °C) with moderate or relatively low stresses, but usage is not limited to such applications.

1.2.1 Parts may be formed and then heat treated to improve strength at elevated temperatures.

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 specified 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/AMS5542R

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.

AMS2262 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate

AMS2269 Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys

AMS2283 Composition Testing Methods for Nickel- and Cobalt-Based Alloys

AMS2371 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS2750 Pyrometry

AMS2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

AS7766 Terms Used in Aerospace Metals Specifications

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 E8/E8M Tension Testing of Metallic Materials

ASTM E18 Rockwell Hardness of Metallic Materials

ASTM E112 Determining Average Grain Size

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

2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2283 or by other analytical methods acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	--	0.08
Manganese	--	1.00
Silicon	--	0.50
Sulfur	--	0.01
Chromium	14.00	17.00
Columbium (Niobium)	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Cobalt	--	1.00
Tantalum	--	0.05
Copper	--	0.50
Nickel + Cobalt	70.00	--

3.1.1 The producer may test for any element not listed in Table 1 and include this analysis in the report of 4.4. Reporting of any element not listed in the composition table is not a basis for rejection unless limits of acceptability are specified by the purchaser.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Sheet and Strip

Sheet and strip shall be cold rolled, annealed, and, unless annealing is performed in an atmosphere yielding a bright finish, descaled, producing a uniform finish.

3.2.2 Plate

Plate shall be hot rolled and annealed. When ordered, plate shall be descaled.

3.3 Properties

The product shall conform to the following requirements:

3.3.1 As Annealed

3.3.1.1 Tensile Properties

Tensile properties shall be determined in accordance with ASTM E8/E8M.

3.3.1.1.1 Strip

Tensile properties of strip shall be as shown in Table 2.

Table 2A - Tensile properties, inch/pound units

Nominal Thickness Inches	Tensile Strength ksi, Max	Elongation in 2 Inches or 4D %, Min
Up to 0.010, excl	140	--
0.010 to 0.025, excl	130	20

Table 2B - Tensile properties, SI units

Nominal Thickness Millimeters	Tensile Strength MPa, Max	Elongation in 50 mm or 4D %, Min
Up to 0.25, excl	965	--
0.25 to 0.64, excl	896	20

3.3.1.1.2 Sheet

Tensile properties of sheet shall be as shown in Table 3.

Table 3A - 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
0.010 to 0.024, incl	140	--	30
Over 0.024 to 0.125, incl	130	60	40
Over 0.125 to 0.1874, incl	130	65	40

Table 3B - 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
0.25 to 0.61, incl	965	--	30
Over 0.61 to 3.18, incl	896	414	40
Over 3.18 to 4.76, incl	896	448	40

3.3.1.2 Bending

Product 0.1874 inch (4.76 mm) and under in nominal thickness shall be tested in accordance with ASTM E290 using a sample prepared nominally 0.75 inch (19.0 mm) in width with its axis of bending parallel to the direction of rolling. Testing shall be performed at room temperature through an angle of 180 degrees around a diameter equal to the bend factor times the nominal thickness of the product in accordance with Table 4. The specimen shall exhibit no cracking when visually examined. In case of dispute, the results of tests using the guided bend test of ASTM E290 shall govern.

Table 4 - Bending parameters

Nominal Thickness Inches	Nominal Thickness Millimeters	Bend Factor
Up to 0.050, incl	Up to 1.27, incl	1T
Over 0.050 to 0.1874, incl	Over 1.27 to 4.76, incl	2T

3.3.1.3 Average Grain Size

Sheet and strip 0.010 to 0.1874 inch (0.25 to 4.76 mm) in nominal thickness shall have an average grain size not over 0.0060 inch (0.152 mm) in diameter (ASTM Grain Size No. 2.5), determined in accordance with ASTM E112.

3.3.1.3.1 Grain size requirements for sheet and strip under 0.010 inch (0.25 mm) in nominal thickness and for plate shall be as agreed upon by the purchaser and producer.

3.3.2 Response to Precipitation Heat Treatment

Samples from the product shall conform to the following requirements after being precipitation heat treated by heating to 1300 °F ± 25 °F (704 °C ± 14 °C), holding at heat for 20 hours ± 1 hour, and cooling in air; pyrometry shall be in accordance with AMS2750:

3.3.2.1 Tensile Properties

Tensile properties shall be as specified in Table 5, determined in accordance with ASTM E8/E8M.

Table 5A - Minimum tensile properties - response to heat treatment, inch/pound units

Product	Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Strip	Up to 0.010, excl	150	--	--
	0.010 to 0.025, excl	155	--	15
	0.025 to 0.1874, incl	155	--	15
Sheet	0.010 to 0.1874, incl	165	105	20
Plate	0.1875 to 4.000, incl	155	100	20

Table 5B - Minimum tensile properties - response to heat treatment, SI units

Product	Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
Strip	Up to 0.25, excl	1034	--	--
	0.25 to 0.64, excl	1069	--	15
	0.64 to 4.760, incl	1069	--	15
Sheet	0.25 to 4.760, incl	1138	724	20
Plate	4.762 to 101.60, incl	1069	689	20

3.3.2.1.1 Elongation requirements do not apply to strip under 0.020 inch (0.51 mm) in nominal thickness.

3.3.2.1.2 Unless otherwise specified, the strain rate shall be set 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. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced parallel section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min). The requirement for compliance becomes effective for material produced 1 year after the publication date of this specification.