



AEROSPACE MATERIAL SPECIFICATION	AMS5541™	REV. J
	Issued 1957-07 Reaffirmed 2011-08 Revised 2024-06 Superseding AMS5541H	
Nickel Alloy, Corrosion- and Heat-Resistant, Sheet and Strip 73Ni - 15.5Cr - 2.4Ti - 0.7Al - 7.0Fe (Alloy 722) Annealed (Composition similar to UNS N07722)		

RATIONALE

AMS5541J is the result of a Five-Year Review and update of the specification. The revision updates composition testing requirements and reporting (see 3.1, Table 1, 3.1.1, and 4.2), clarifies finish and bend test requirements (see 3.2 and 3.4.1.2), adds pyrometry controls (see 3.4.2), adds strain rate control (see 3.4.2.1.1), adds note on hardness (see 8.2), and updates the requirements for exceptions to this specification (see 3.4.3, 4.4.1, 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 0.010 to 0.250 inch (0.25 to 6.25 mm), inclusive, in thickness.

1.2 Application

These products have been used typically for parts requiring high strength up to 1500 °F (816 °C) and oxidation resistance up to 1800 °F (982 °C), but usage is not limited to such applications. 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.

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

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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 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	--	0.70
Sulfur	--	0.01
Chromium	14.00	17.00
Nickel	70.00	--
Titanium	2.00	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Cobalt	--	1.00
Copper	--	0.50

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

Cold rolled, annealed, and, unless annealing is performed in an atmosphere yielding a bright finish, descaled, producing a uniform finish.

3.3 Heat Treatment

Product shall be annealed by heating to a temperature within the range 1750 to 1850 °F (954 to 1010 °C), holding at the selected temperature within ± 25 °F (± 14 °C) for a time commensurate with section thickness, and cooling rapidly. Pyrometry shall be in accordance with AMS2750.

3.3.1 Continuous Heat Treatment

When continuous annealing 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 producer and validated by testing of product to the requirements of 3.4.

3.4 Properties

The product shall conform to the following requirements:

3.4.1 As Annealed

3.4.1.1 Tensile Properties

Tensile properties shall be as shown in Table 2, determined in accordance with ASTM E8/E8M.

Table 2A - Tensile properties, inch/pound units

Nominal Thickness Inches	Tensile Strength ksi, Max	Elongation in 2 Inches or 4D %, Min
0.010 to 0.024, incl	130.0	30
Over 0.024 to 0.250, incl	125.0	40

Table 2B - Tensile properties, SI units

Nominal Thickness Millimeters	Tensile Strength MPa, Max	Elongation in 50 mm or 4D %, Min
0.25 to 0.61, incl	896	30
Over 0.61 to 6.35, incl	862	40

3.4.1.2 Bending

Product 0.250 inch (6.35 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 3. 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 3 - Bending parameters

Nominal Thickness Inches	Nominal Thickness Millimeters	Bend Diameter
Up to 0.050, incl Over 0.050 to 0.250, incl	Up to 1.27, incl Over 1.27 to 6.35, incl	1T 2T

3.4.2 Response to Precipitation Heat Treatment

Samples from product shall have the following properties after being precipitation heat treated by heating to 1300 °F ± 25 °F (704 °C ± 14 °C), holding at heat for not less than 16 hours, and cooling in air. Pyrometry shall be in accordance with AMS2750.

3.4.2.1 Tensile Properties

Tensile properties shall be as shown in Table 4, determined in accordance with ASTM E8/E8M.

Table 4A - Minimum tensile properties - response to heat treatment, inch/pound units

Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
0.010 to 0.024, incl Over 0.024 to 0.250, incl	140 140	90 90	15 20

Table 4B - Minimum tensile properties - response to heat treatment, SI units

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
0.25 to 0.61, incl Over 0.61 to 6.35, incl	965 965	621 621	15 20

3.4.2.1.1 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.

3.4.2.2 Hardness

Hardness should be not lower than 23 HRC, or equivalent (see 8.2), determined in accordance with ASTM E18, but the product shall not be rejected on the basis of hardness if the tensile properties determined on specimens taken from the same sample as that with nonconforming hardness or another sample with similar nonconforming hardness are acceptable.