



AEROSPACE MATERIAL SPECIFICATION	AMS5698™	REV. H
	Issued 1953-06 Reaffirmed 2007-08 Revised 2022-05	
Superseding AMS5698G		
Nickel Alloy, Corrosion- and Heat-Resistant, Wire 72Ni - 15.5Cr - 0.95Cb - 2.5Ti - 0.70Al - 7.0Fe Solution Heat Treated, Precipitation Hardenable (Composition similar to UNS N07750)		

RATIONALE

AMS5698H is the result of a Five-Year Review and update of the specification. The revision updates the title, scope, and response to heat treatment (1.1, 3.3.3) to clarify the purchased material condition, prohibits unauthorized exceptions (3.3.4, 3.6, 4.4.2, 5.2.3, 8.5), updates composition reporting (3.1.1), adds continuous heat treatment and pyrometry controls (3.2), clarifies reduction requirements (3.2.2), adds strain rate requirements for tensile testings (3.3.1), adds country of origin requirements (4.4.1), corrects Table 6B conversions, updates definitions (8.2), and allows prior revisions (8.4).

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant nickel alloy in the form of round, square, and flat wire 0.500 inch (12.70 mm) and under in nominal diameter or thickness, capability tested in a No. 1 temper condition.

1.2 Application

This wire has been used typically for helical springs requiring optimum resistance to relaxation up to 1000 °F (538 °C) with moderate or relatively low stresses, but usage is not limited to such applications.

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.

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

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

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AMS2750 Pyrometry

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 E354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM E354, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	--	0.08
Manganese	--	1.00
Silicon	--	0.50
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel	70.00	--
Columbium	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

3.1.1 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 drawn from hot finished wire or rod which has had suitable surface preparation for removal of scale, seams, and other injurious surface imperfections. Wire shall be solution heat treated by heating within the range 2000 to 2200 °F (1093 to 1204 °C) before reducing to the size ordered. Pyrometry shall be in accordance with AMS2750.

3.2.1 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 3.3.

3.2.2 Wire in the size range 0.025 to 0.500 inch (0.64 to 12.70 mm) in nominal diameter or thickness shall be cold reduced approximately 15%, in cross sectional area, following solution heat treatment.

3.2.3 All traces of lubricant shall be removed after cold reduction.

3.3 Properties

3.3.1 Wire shall conform to the following requirements; tensile testing shall be performed in accordance with ASTM E8/E8M

3.3.1.1 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. The strain rate after yield may be increased to any value up to 0.5 in/in/min (or 0.5 mm/mm/min) or equivalent crosshead speed as a function of gage length.

3.3.2 As Received

3.3.2.1 Tensile Properties

Shall be as shown in Table 2.

Table 2A - Tensile strength, inch/pound units

Nominal Diameter or Thickness Inches	Tensile Strength ksi, Min	Tensile Strength ksi, Max
Up to 0.025, incl	--	150
Over 0.025 to 0.500, incl	130	165

Table 2B - Tensile strength, SI units

Nominal Diameter or Thickness Millimeters	Tensile Strength MPa, Min	Tensile Strength MPa, Max
Up to 0.64, incl	--	1034
Over 0.64 to 12.70, incl	896	1138

3.3.2.2 Wrapping

Wire shall withstand, without cracking, wrapping at room temperature five full, closely spaced turns around a diameter as shown in Table 3.

Table 3 - Wrapping parameters

Wire Shape	Wrapping Diameter
Round	Nominal diameter of wire
Square	Nominal diagonal of wire
Flat	Nominal width of wire

3.3.3 Response to Precipitation Heat Treatment (No. 1 Temper)

Wire shall have tensile properties as shown in Table 4 after being precipitation heat treated by heating to 1350 °F \pm 25 °F (732 °C \pm 14 °C), holding at heat for 16 hours \pm 0.5 hour, and cooling at a rate equivalent to air cooling.

Table 4A - Minimum tensile strength, inch/pound units

Nominal Diameter or Thickness Inches	Tensile Strength ksi
Up to 0.025, incl	155
Over 0.025 to 0.500, incl	165

Table 4B - Minimum tensile strength, SI units

Nominal Diameter or Thickness Millimeters	Tensile Strength MPa
Up to 0.64, incl	1069
Over 0.64 to 12.70, incl	1138

3.3.4 Mechanical property requirements for product outside the size range covered by 1.1 shall be agreed upon between purchaser and producer and reported per 4.4.2.

3.4 Quality

Wire, as received by purchaser, shall be uniform in quality and condition and free from kinks, twists, scrapes, splits, cold shuts, and other imperfections detrimental to usage of the wire. The surface of the wire shall be free from lubricant and have a bright, smooth finish free from pits, abrasions, and other defects.

3.5 Tolerances

Shall be as follows:

3.5.1 Round Wire and Square Wire

Shall be as shown in Table 5.

Table 5A - Round and square wire tolerance, inch/pound units

Nominal Diameter or Thickness Inches	Tolerance Inches Plus and Minus
0.003 to 0.005, excl	0.0001
0.005 to 0.008, excl	0.0002
0.008 to 0.012, excl	0.0003
0.012 to 0.024, excl	0.0004
0.024 to 0.033, excl	0.0005
0.033 to 0.044, excl	0.0008
0.044 to 0.312, excl	0.0010
0.312 to 0.500, incl	0.0015

Table 5B - Round and square wire tolerance, SI units

Nominal Diameter or Thickness Millimeters	Tolerance Millimeters Plus and Minus
0.08 to 0.13, excl	0.003
0.13 to 0.20, excl	0.005
0.20 to 0.30, excl	0.008
0.30 to 0.61, excl	0.010
0.61 to 0.84, excl	0.013
0.84 to 1.12, excl	0.020
1.12 to 7.92, excl	0.025
7.92 to 12.70, incl	0.038

3.5.2 Out-of-Roundness

Round wire shall not be out-of-round by more than one-half the total permissible tolerance in 3.5.1.

3.5.3 Flat Wire 0.062 to 0.375 inch (1.57 to 9.52 mm), Inclusive, in Nominal Width

Shall be as shown in Table 6.

Table 6A - Flat wire tolerances, inch/pound units

Nominal Thickness Inches	Tolerance Inches Plus and Minus Thickness	Tolerance Inches Plus and Minus Width
Up to 0.029, excl	0.0010	0.005
0.029 to 0.035, excl	0.0015	0.005
0.035 to 0.3125, incl	0.0020	0.005

Table 6B - Flat wire tolerances, SI units

Nominal Thickness Millimeters	Tolerance Millimeters Plus and Minus Thickness	Tolerance Millimeters Plus and Minus Width
Up to 0.74, excl	0.025	0.13
0.74 to 0.89, excl	0.038	0.13
0.89 to 7.94, incl	0.051	0.13

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of wire shall supply all samples for vendor'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 wire conforms to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing

Shall be in accordance with AMS2371.

4.4 Reports

4.4.1 The vendor of wire shall furnish with each shipment a report showing the vendor's name and country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations and the results of tests for composition of each heat and for tensile properties and wrapping requirements of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS5698H, size, and quantity.