AEROSPACE MATERIAL SPECIFICATION

AMS5580™	REV. M

Issued 1939-12
Reaffirmed 2012-04
Revised 2022-05

Superseding AMS5580L

Nickel Alloy, Corrosion and Heat-Resistant, Seamless Tubing
74Ni - 15.5Cr - 8.0Fe
Annealed
(Composition similar to UNS N06600)

RATIONALE

AMS5580M prohibits unauthorized exceptions (1.1, 3.4.1.5, 3.7, 4.4.1, 5.2.1, 8.5), updates composition testing (3.1, 3.1.1), updates condition and fabrication requirements including final cleaning (3.2, 3.2.3, 3.3), updates tensile testing (3.4.1.1), provides exceptions for small diameter tube testing (3.4.1.2, 8.6), updates inspection requirements (3.5), adds cleanliness check (3.5.1), allows alternate NDT inspections (3.5.2), adds NDT and country of origin (4.4), clarifies identification (5.2), updates definition (8.2), allows prior revisions (8.4), and is the result of a Five-Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant nickel alloy in the form of seamless tubing up to and including 9.250 inches (234.95 mm) nominal OD.

1.2 Application

This tubing has been used typically for parts requiring corrosion and oxidation resistance up to 2000 °F (1093 °C), particularly where such parts may require welding during fabrication, 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.

AMS2243 Tolerances, Corrosion and Heat-Resistant Steel Tubing

AMS2263 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Tubing

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/AMS5580M/

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

AMS2700 Passivation of Corrosion Resistant Steels

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 B751 Standard Specification for General Requirements for Nickel and Nickel Alloy Welded Tube

ASTM B829 Standard Specification for General Requirements for Nickel and Nickel Alloys Seamless Pipe and Tube

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	--	0.15
Manganese	--	1.00
Silicon	--	0.50
Sulfur	--	0.015
Chromium	14.00	17.00
Nickel	72.00	--
Iron	6.00	10.00
Cobalt	--	1.00
Columbium	--	1.00
Titanium	--	0.50
Aluminum	--	0.35
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

Tubing shall be supplied in the following condition:

3.2.1 Tubing 6.625 inches (168.28 mm) and under in nominal OD with nominal wall thickness 0.382 inch (9.70 mm) and under shall be cold drawn and annealed.

3.2.2 Tubing over 6.625 inches (168.28 mm) in nominal OD or over 0.382 inch (9.70 mm) in nominal wall thickness shall be hot finished and annealed.

3.2.3 Anneal shall be performed in an atmosphere yielding a bright finish. Alternately, product shall be chemically cleaned to produce a uniform finish. It is permissible to pickle prior to final cleaning treatment. Final chemical cleaning may take place after any final finishing (see 3.3.3). After final chemical cleaning, tube cleanliness shall be verified using the corrosion resistance test methods specified in AMS2700 for class 2 parts, or alternate method acceptable to the purchaser.

3.3 Fabrication

3.3.1 Tubing shall be produced by a seamless process. Finishing operations shall be performed prior to final heat treatment. Tubing shall not be centerless ground. A light polish to improve external surface appearance or meet surface finish requirements may be employed after final heat treatment and, if performed, the product shall be subsequently chemically cleaned.

3.3.2 Bore conditioning is permitted after final anneal provided the tubing is not sized by metal removal methods beyond the allowable tolerances (see 8.2.1). If bore conditioning is used, 100% visual inspection of each tube shall be performed. The tube ID shall be uniformly shiny with no evidence of remnant material, neither metallic nor nonmetallic in nature.

3.3.3 Tubing shall be chemically cleaned after any ID or OD finishing that occurs after final heat treatment.

3.4 Properties

Tubing shall conform to the following requirements:

3.4.1 Tensile Properties

Shall be as follows, determined in accordance with ASTM E8/E8M.

3.4.1.1 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 mm/mm/min) or equivalent crosshead speed as a function of gage length. The requirement for compliance becomes effective for material produced 1 year after the publication date of this document.

3.4.1.2 For tubing with an OD less than 1/8 inch (3.2 mm) or a wall thickness under 0.015 inch (0.38 mm), alternate testing and acceptance methods may be agreed with the purchaser (see 8.6).

3.4.1.3 Cold Drawn and Annealed

Shall be as shown in Table 2.

Table 2A - Minimum tensile properties, inch/pound units

Nominal OD Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up to 5.000, incl	80.0	35.0	30
Over 5.000 to 6.625, incl	80.0	30.0	35

Table 2B - Minimum tensile properties, SI units

Nominal OD Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
Up to 127.00, incl	552	241	30
Over 127.00 to 168.28, incl	552	207	35

3.4.1.4 Hot Finished and Annealed

Shall be as shown in Table 3.

Table 3A - Minimum tensile properties, inch/pound units

Nominal OD Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
2.500 to 5.000, incl	80.0	30.0	35
Over 5.000 to 9.250, incl	75.0	25.0	35

Table 3B - Minimum tensile properties, SI units

Nominal OD Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
63.50 to 127.00, incl	552	207	35
Over 127.00 to 234.95, incl	517	172	35

3.4.1.5 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.

3.4.2 Flarability

Specimens as in 4.3.1 from cold drawn tubing with nominal OD of 0.188 to 2.000 inches (4.78 to 50.80 mm), inclusive, having nominal wall thickness of 0.125 inch (3.18 mm) and under shall withstand, without formation of cracks or other visible defects, flaring at room temperature by being forced axially with steady pressure over a hardened and polished tapered steel pin having a 74 degree included angle to produce a flare having a permanent expanded OD not less than 1.2 times the original nominal OD.

3.5 Quality

Tubing, as received by purchaser, shall be uniform in quality and condition and shall have a finish conforming to the best practice for high quality aircraft tubing. Both ID and OD surfaces shall be smooth and free from grease, oil and other foreign matter, heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other imperfections detrimental to the usage of the tubing. Surface imperfections, such as handling marks, straightening marks, mandrel or die marks, and scale patterns are acceptable providing the imperfections are removable within the tolerances specified for wall thickness but removal of such imperfections is not required.

3.5.1 A clean white cloth or plug drawn or blown through the length of the bore of a test sample at least 12 inches (30cm) in length, shall show no visual evidence of metallic flakes or particles. Discoloration of the cloth or plug, without the presence of flakes or particles, is acceptable. Alternate methods for evaluating tube cleanliness may be used for tubing 0.500 inch (12.7mm) and under ID.

3.5.2 Tubing shall be subjected to either ultrasonic inspection or to electromagnetic (eddy-current) testing in accordance with ASTM B751 or ASTM B829 except that suspect indications shall not be accepted based on visual observation, i.e., indications must be either rejected or reconditioned and retested to pass the test. Alternate methods of inspection may be used for tube 0.25 inch (0.64cm) and under in nominal diameter.

3.6 Tolerances

Shall be as follows:

3.6.1 Cold Drawn and Annealed Tubing

Shall conform to all applicable requirements of AMS2263.

3.6.2 Hot Finished and Annealed Tubing

3.6.2.1 Length and Straightness

Shall conform to all applicable requirements of AMS2243.

3.6.2.2 Diameter and Wall Thickness

Shall be as shown in Table 4.

Table 4A - Tolerances, inch/pound units

Nominal OD Inches	OD Tolerance Inches Plus and Minus	Wall Thickness Tolerance % of Nominal Wall Thickness Plus and Minus
2.500 to 5.000, excl	0.031	12.5
5.000 to 9.250, incl	0.047	12.5

Table 4B - Tolerances, SI units

Nominal OD Millimeters	OD Tolerance Millimeters Plus and Minus	Wall Thickness Tolerance % of Nominal Wall Thickness Plus and Minus
63.50 to 127.00, excl	0.79	12.5
127.00 to 234.95, incl	1.19	12.5

3.7 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 tubing 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 tubing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.4.1), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Nondestructive testing (3.5.2) shall be performed on each finished tube to assure the requirements of 3.5 are met.