AEROSPACE MATERIAL SPECIFICATION

AMS5554™	REV. H

Issued 1957-09
Revised 2022-05

Superseding AMS5554G

Steel, Corrosion and Heat-Resistant, Seamless Tubing
16.5Cr - 4.5Ni - 2.9Mo - 0.10N
Solution Heat Treated
(Composition similar to UNS S35000)

RATIONALE

AMS5554H is the result of a Five-Year Review and update of the specification. The revision updates the Title and document to better identify heat treatment, updates composition testing and reporting (3.1, 3.1.1), clarifies heat treatment, adds passivation and standardizes processing requirements with similar tubing (3.2, 3.3), provides heat treatment in a table format (3.5.2), updates tensile testing and adds note on small diameter limitations (3.5.2.1), updates white cloth test (3.6.1), adds NDT (3.6.2), clarifies type of tubing (3.7, 5.2), prohibits unauthorized exceptions (3.8, 4.4.1, 5.2.1, 8.5), adds country of origin and NDT acceptance and reporting requirements (4.2.1, 4.4, 8.6), provides definitions (8.2), and allows prior revisions (8.4).

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant steel in the form of thin-wall seamless tubing.

1.2 Application

This tubing has been used typically for parts, such as fluid lines, requiring high strength and oxidation resistance up to 800 °F (427 °C), 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

AMS2248 Chemical Check Analysis Limits Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

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/AMS5554H/

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

AMS2634 Ultrasonic Inspection Thin Wall Metal Tubing

AMS2700 Passivation of Corrosion Resistant Steels

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

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 A370 Mechanical Testing of Steel Products

ASTM A751 Chemical Analysis of Steel Products

ASTM A1016/A1016M General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes

ASTM E426 Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Titanium, Austenitic Stainless Steel and Similar Alloys

ASTM E1417/E1417M Liquid Penetrant Testing

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	0.08	0.12
Manganese	0.50	1.25
Silicon	--	0.50
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	16.00	17.00
Nickel	4.00	5.00
Molybdenum	2.50	3.25
Nitrogen	0.07	0.13

3.1.1 Producer may test for any element not listed in Table 1 and include this analysis in the report of 4.5. 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 AMS2248.

3.2 Condition

Cold drawn and solution heat treated (see 8.2.1). Solution heat treatment shall be performed in an atmosphere yielding a bright finish. Alternately, product shall be passivated in accordance with AMS2700 to produce a uniform finish. It is permissible to pickle prior to passivation. Passivation may take place after any final finishing (see 3.3.3).

3.3 Fabrication

3.3.1 Tubing shall be produced by a seamless process. Surface finishing operations applied to remove objectionable pits and surface blemishes 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 solution heat treatment and, if performed, the product shall be subsequently passivated.

3.3.2 Bore conditioning is permitted after final heat treatment providing the tubing is not sized by metal removal methods and the tubing is passivated after any such conditioning (see 8.2.2). 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 passivated in accordance with AMS2700 after any ID or OD finishing that occurs after solution heat treatment.

3.4 Heat Treatment

Tubing shall be solution heat treated by heating to 1850 to 1975 °F (1010 to 1079 °C), holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with cross-sectional wall thickness, and cooling as rapidly as possible to room temperature.

3.5 Properties

Tubing shall conform to the following requirements:

3.5.1 As Received

3.5.1.1 Flarability

Specimens as in 4.3.1 from tubing 0.500 to 2.000 inches (12.70 to 50.80 mm), inclusive, in nominal OD 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 1.20 times the original nominal OD.

3.5.1.1.1 Flarability requirements for tubing under 0.500 inch (12.70 mm) or over 2.000 inches (50.80 mm) in nominal OD shall be as agreed upon by purchaser and producer.

3.5.2 Response to Heat Treatment

Samples from tubing shall have the following properties after being heat treated in accordance with Table 2.

Table 2 - Response to precipitation heat treatment

Processing Step [1]		Temperature	Min Time at Temperature (Based on Tube Nominal Wall Thickness)
1	Austenite Condition	1710 °F ± 25 °F (932°C ± 14°C)	45 minutes/inch (25 mm)
2	Cool as rapidly as possible to Room Temperature		
3	Subzero treatment	-100 °F or lower (-73 °C) or lower	1 hour ≤0.010 inch (0.25 mm)
			3 hours >0.010 inch (0.25 mm)
4	Warm in air to Room Temperature		
5	Temper	850 °F ± 25 °F (454 °C ± 14°C)	3 hours, cooling at a rate equivalent to air or faster

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

3.5.2.1 Tensile Properties

Shall be as shown in Table 3, determined in accordance with ASTM A370.

Table 3 - Minimum tensile properties (SCT 850 condition)

Property	Value
Tensile Strength	185 ksi (1276 MPa)
Yield Strength at 0.2% Offset[1]	150 ksi (1034 MPa)
Elongation in 2 inches (50 mm)	8%

[1] Yield strength is not required to be determined for OD sizes less than 0.125 inch (3.2 mm) or for wall thicknesses less than 0.015 inch (0.38 mm).

3.5.2.1.1 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. 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 specification.

3.6 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. It shall be smooth and free from heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other imperfections detrimental to usage of the tubing. Surface imperfections, such as handling marks, straightening marks, light mandrel and die marks, and scale pattern, will not be considered injurious if the imperfections are removable within the tolerances specified for wall thickness, but removal of such imperfections is not required.

3.6.1 Tubing shall be free from grease or other foreign matter. Metallic flakes or particles shall not be collected on a clean white cloth or plug drawn or blown through the bore of a sample tube. Discoloration of the cloth, without the presence of flakes or particles, is acceptable. Alternate methods, as agreed with the purchaser, for evaluating tube cleanliness may be used for tubing 0.500 inch (12.7 mm) and under ID.

3.6.2 When no inspection is specified by the purchaser, tubing shall be subjected to either ultrasonic or eddy current inspection in accordance with ASTM A1016/A1016M, 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 performed when approved by the cognizant engineering organization for tube 0.25 inch (0.64 cm) and under in nominal diameter.

3.6.3 When specified by purchaser, tubing shall be subjected to fluorescent penetrant inspection in accordance with ASTM E1417/E1417M, to ultrasonic inspection in accordance with AMS2634, to electromagnetic (Eddy-Current) examination in accordance with ASTM E426, or to any combination thereof. Standards for acceptance shall be as established by purchaser (see 8.6).

3.7 Tolerances

Shall conform to all applicable requirements of AMS2243 for hydraulic tubing.

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 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), cleanliness of tubing (3.6.1), and tolerances (3.8) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Nondestructive testing (3.6.2 or 3.6.3 when applicable) shall be performed on each finished tube. Inspection to 3.6.2 shall become effective one year after the publication of this document.

4.2.2 Periodic Tests

Flarability (3.5.1.1) and tensile properties (3.5.2.1) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2371 and the following:

4.3.1 Specimens for flarability test (3.5.1.1) shall be full tubes or sections cut from a tube. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded.

4.4 Reports

The producer of the product shall furnish with each shipment a report showing the producer’s name and the 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 nondestructive inspection, when specified, and tolerances 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, AMS5554H, size, and quantity.