AEROSPACE MATERIAL SPECIFICATION

AMS5567™	REV. G

Issued 1964-01
Reaffirmed 2012-10
Revised 2021-12

Superseding AMS5567F

Steel, Corrosion Resistant, Seamless or Welded Hydraulic Tubing 19Cr - 10Ni (304) Solution Heat Treated (Composition similar to UNS S30400)

RATIONALE

AMS5567G is the result of a Five-Year Review and update of the specification. The revision prohibits unauthorized exceptions (3.7, 4.4.5, 5.2.1, 8.5), updates composition (3.1), adds passivation and updates condition and fabrication (3.2, 3.3), adds strain rate control (3.4.1.2), revises hydrostatic testing consistent with other committees (3.4.3), updates quality (3.5, 4.2.1), clarifies requirements for hydraulic tubing (3.6, 5.2), revises reporting (4.4.2, 4.4.3), provides additional definitions (8.2.1, 8.2.2), and allows prior revisions (8.4).

1. SCOPE

1.1 Form

This specification covers a corrosion-resistant steel in the form of seamless or welded tubing.

1.2 Application

This tubing has been used typically for parts, such as fluid lines, subject to medium high pressures and requiring corrosion resistance, but usage is not limited to such applications. Welding, brazing, or other exposure to temperatures over 800 °F (427 °C) during fabrication may impair corrosion resistance.

1.3 Classification

The tubing covered by this specification is classified as follows:

Type 1 - Seamless

Type 2 - Welded and drawn

1.3.1 Unless a specific type is specified, either Type 1 or Type 2 may be supplied.

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/AMS5567G/

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 producer 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
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
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
ARP1917	Clarification of 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 A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
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 E112	Determining Average Grain Size

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
Manganese	--	2.00
Silicon	--	0.75
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	18.00	20.00
Nickel	8.00	12.00
Molybdenum	--	0.75
Copper	--	0.75

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

3.2 Condition

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 3.3.4).

3.3 Fabrication

3.3.1 Tubing shall be produced by either a seamless or a welded and drawn process. Any finishing operation applied to remove objectionable pits and surface blemishes shall be performed prior to final solution heat treatment. A light polish to improve external surface appearance may be employed after solution heat treatment and if performed, the product shall be subsequently passivated.

3.3.2 Welded (Type 2) tubing shall be sufficiently cold reduced after welding (but prior to solution heat treatment) to remove any dimensional indication of the presence of the weld.

3.3.3 Bore conditioning is permitted after final heat treatment provided the tubing is not sized by metal removal methods beyond the allowable tolerances (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.

3.3.4 Tubing shall be passivated in accordance with AMS2700 after any ID or OD finishing that occurs after solution heat treatment.

3.4 Properties

Tubing shall conform to the following requirements, determined in accordance with ASTM A370:

3.4.1 Tensile Properties

3.4.1.1 Shall be as shown in Table 2, except that yield strength requirements do not apply to tubing 0.188 inch (4.78 mm) and under in OD with wall thickness 0.010 inch (0.25 mm) and under.

3.4.1.2 Unless otherwise specified, the strain rate shall be set at 0.005 inch/inch/minute (0.005 mm/mm/minute) 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.

Table 2A - Tensile properties, inch/pound units

Nominal OD Inches	Nominal Wall Thickness Inches	Tensile Strength ksi, Max	Yield Strength at 0.2% Offset ksi, Min	Elongation in 2 inches (Strip) %, Min	Elongation in 2 inches (Full Tube) %, Min
Up to 0.188, incl	Up to 0.016, incl	115	30.0	--	35
	Over 0.016	100	30.0	--	40
Over 0.188 to 0.500, incl	Up to 0.010, incl	110	--	--	37
	Over 0.010	100	30.0	--	40
Over 0.500	Over 0.010	100	30.0	35	40

Table 2B - Tensile properties, SI units

Nominal OD Millimeters	Nominal Wall Thickness Millimeters	Tensile Strength MPa, Max	Yield Strength at 0.2% Offset MPa, Min	Elongation in 50.8 mm (Strip) %, Min	Elongation in 50.8 mm (Full Tube) %, Min
Up to 4.78, incl	Up to 0.41, incl	793	207	--	35
	Over 0.41	689	207	--	40
Over 4.78 to 12.70, incl	Up to 0.25, incl	758	--	--	37
	Over 0.25	689	207	--	40
Over 12.70	Over 0.25	689	207	35	40

3.4.2 Flarability

Tubing shall withstand flaring at room temperature, without formation of cracks or other visible defects, 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 shown in Table 3.

Table 3A - Minimum flarability, inch/pound units

Nominal OD Inches	Expanded OD Inches	Nominal OD Inches	Expanded OD Inches
0.125	0.200	0.750	0.937
0.188	0.302	1.000	1.187
0.250	0.359	1.250	1.500
0.312	0.421	1.500	1.721
0.375	0.484	1.750	2.106
0.500	0.656	2.000	2.356
0.625	0.781	2.500	2.856
		3.000	3.356

Table 3B - Minimum flarability, SI units

Nominal OD Millimeters	Expanded OD Millimeters	Nominal OD Millimeters	Expanded OD Millimeters
3.18	5.08	19.05	23.80
4.78	7.67	25.40	30.15
6.35	9.12	31.75	38.10
7.92	10.69	38.10	43.71
9.52	12.29	44.45	53.49
12.70	16.66	50.80	59.84
15.88	19.84	63.50	72.54
		76.20	85.24

3.4.2.1 Tubing with nominal OD between any two standard sizes shown in Table 3 shall take the same percentage flare as shown for the larger of the two sizes.

3.4.3 Hydrostatic Test

Tubing shall withstand an internal hydrostatic pressure (P), based on Equation 1, without developing leaks, cracks, or local bulges and without an increase in mean diameter of more than 0.2%.

$$P = S\frac{D^2-d^2}{D^2+d^2} \quad \text{(Eq. 1)}$$

where:

P = test pressure in ksi (MPa)

S = 30.0 ksi (207 MPa) (minimum yield strength)

D = maximum OD in inches (mm) (defined as nominal [i.e., ordered or specified] OD plus tolerance)

d = maximum ID in inches (mm) (maximum OD [D] minus twice the minimum wall thickness)

Mean diameter is the average of two diameters at right angles to each other in the same transverse plane; measurements before and after testing should be taken at substantially the same location.

3.4.4 Susceptibility to Intergranular Attack

Specimens from tubing, as shipped, shall pass the intergranular corrosion test performed in accordance with ASTM A262, Practice E.

3.4.5 Corrosion Rate

Specimens from tubing shall exhibit a general corrosion rate of less than 0.0015 inch (0.038 mm) penetration per month, determined from a boiling nitric acid test conducted in accordance with ASTM A262, Practice C.

3.4.6 Average Grain Size

Shall be ASTM No. 5 or finer, determined in accordance with ASTM E112 on a transverse section polished and electrolytically etched in a 10% oxalic acid solution.

3.5 Quality

3.5.1 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 patterns are acceptable if imperfections are removable within the tolerances specified for wall thickness; removal of such imperfections is not required.

3.5.2 Tubing shall be free from grease or other foreign matter. Metallic flakes or particles shall not be collected by a clean cloth or plug drawn or blown through the length of the bore of a 12 inch (30 cm) test sample. 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 0.5000 inch (12.7 mm) and under ID.

3.5.3 Tubing shall be subjected to either ultrasonic inspection or to electromagnetic (eddy-current) testing in accordance with ASTM A1016/1016M, 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 when approved by the cognizant engineering organization for tube 0.25 inch (0.64 cm) and under in nominal diameter.

3.6 Tolerances

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

3.7 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.5.

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), average grain size (3.4.6), cleanliness (3.5.2), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Nondestructive testing (3.5.3) shall be performed on each finished tube.

4.2.2 Periodic Tests

Flarability (3.4.2), hydrostatic test (3.4.3), susceptibility to intergranular attack (3.4.4), and corrosion rate (3.4.5) 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 (3.4.2) 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 following results of tests and relevant information:

4.4.1 For Each Heat

Composition

4.4.2 For Each Lot

Tensile properties
Average grain size
Cleanliness

4.4.3 A statement that the product conforms to the other technical requirements, including NDT method and acceptance standard used.