



AEROSPACE MATERIAL SPECIFICATION

AMS5567™**REV. F**

Issued 1964-01
Reaffirmed 2012-10
Revised 2015-12

Superseding AMS5567E

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

RATIONALE

AMS5567F revises Fabrication (3.3) to add option to perform bore conditioning on final product and Quality (3.5, 3.5.2) and Acceptance Tests (4.2.1.1) to add nondestructive testing requirements to all tubing.

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.

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.

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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
AMS2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

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 A1016	General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes
ASTM E112	Determining Average Grain Size
ASTM E353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E353, by spectrochemical methods, 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

Annealed and pickled as required or passivated.

3.3 Fabrication

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 annealing heat treatment. A light polish to improve external surface appearance may be employed after solution heat treatment. Bore conditioning is permitted after solution heat treatment provided the tubing is not sized by metal removal methods and the tubing is passivated after any such conditioning (see 8.2.1).

3.3.1 Welded (Type 2) tubing shall be sufficiently cold reduced after welding to remove any dimensional indication of the presence of the weld.

3.4 Properties

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

3.4.1 Tensile Properties

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.

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 Pressure Test

The tubing shall show no bulges, leaks, pinholes, cracks, or other defects when subjected to an internal hydrostatic pressure (P), except that a diametric permanent set of 0.002 inch per inch (0.002 mm/mm) of diameter is acceptable. The hydrostatic pressure (P) shall be determined using Equation 1:

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

where:

P = Test pressure in ksi (MPa)

S = 30.0 ksi (207 MPa)

D = Nominal OD in inches (mm) (nominal OD plus tolerance)

d = Nominal ID in inches (mm) (nominal OD minus twice the minimum wall thickness)

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

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, shallow pits, and scale patterns are acceptable providing their depth does not result in violation of minimum wall thickness requirements and their termination is not sharp when viewed by the naked eye.

3.5.1 Tubing shall be free from grease or other foreign matter. Metallic flakes or particles shall not be collected by a clean cloth drawn through the length of the bore of a test sample. Discoloration of the cloth, without the presence of flakes or particles, is acceptable.

3.5.2 Tubing shall be subjected to either ultrasonic inspection or to electromagnetic (eddy-current) testing in accordance with ASTM A1016 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.

3.6 Tolerances

Shall conform to all applicable requirements of AMS2243.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of tubing 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 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), 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. This requirement shall become effective July 1, 2016.

4.2.2 Periodic Tests

Flarability (3.4.2), pressure 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 vendor unless frequency of testing is specified by purchaser.