AEROSPACE
MATERIAL SPECIFICATIONS
SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

AMS 5567

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Revised

STEEL TUBING, SEAMLESS OR WELDED, CORROSION RESISTANT
19Cr - 10Ni (SAE 30304)
Hydraulic, Solution Treated

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for parts and assemblies, such as fluid lines subject to medium high pressures, requiring corrosion resistance. Welding, brazing, or other exposure to temperatures over 800 F (425 C) during fabrication may impair corrosion resistance.

3. COMPOSITION:

	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	--	0.50
Copper	--	0.50

3.1 Check Analysis: Composition variations shall conform to the requirements of the latest issue of AMS 2248.

4. CONDITION: Solution heat treated and descaled, or as ordered.

4.1 Fabrication: The tubing may be produced by either the seamless or welded and drawn process. The external and internal surface finishes may be produced by pickling, bright annealing, or any method producing a surface condition as specified in the technical requirements and quality sections which does not affect limits of wall thickness or corrosion resistance, with the exception that centerless ground finish is not acceptable. A light polish to improve surface appearance may be employed. Passivation treatment shall follow any surface treatment used.

5. TECHNICAL REQUIREMENTS: When ASTM methods are specified for determining conformance to the following requirements, tests shall be conducted in accordance with the issue of the ASTM method listed in the latest issue of AMS 2350.

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5.1 Tensile Properties:

Nominal OD, Inches	Nominal Wall Thickness Inch	Tensile Strength psi, max	Yield Strength at 0.2% Offset or at Extension Indicated (E = 27,000,000) psi min	Extension Under Load in. in 2 in.	Elongation % in 2 in., min Strip	Elongation % in 2 in., min Full Tube
Up to 0.188, incl	Up to 0.016, incl	115,000	30,000*	0.0062		35
	Over 0.016	100,000	30,000	0.0062		40
Over 0.188 to 0.500, incl	Up to 0.010, incl	110,000				37
	Over 0.010	100,000	30,000	0.0062		40
Over 0.500	Over 0.010	100,000	30,000	0.0062	35	40

*tubes having a wall thickness 0.010 in. and under. Yield strength need not be determined.

5.1.1 For sizes not covered herein, tensile properties shall be as agreed upon by purchaser and vendor.

5.2 Flarability: Tubing shall be capable of being flared without formation of cracks or other visible defects. Specimens for flaring may be cut from any portion of the tube, or an entire tube may be used as a specimen. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded. The specimen shall, at room temperature, be forced axially with steady pressure over a hardened and polished tapered steel pin having a 74 deg included angle, to produce a flare having the permanent expanded OD specified in the following table.

Nominal OD Inches	Expanded OD Inches, min	Nominal OD Inches	Expanded OD Inches, min
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

5.2.1 Tubing with intermediate nominal OD shall take the same percentage flare as that for the next larger OD.

5.2.2 Tubing with nominal OD greater than 3.000 in. or less than 0.125 in. shall have flarability as agreed upon by purchaser and vendor.

5.2.3 After flaring, the inside surface of the tubing shall be smooth and shall show no evidence of a bead that might prevent the assembly of fluid pressure tight joints.

5.3 Pressure Test: The tubing shall be capable of meeting the following test:

5.3.1 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 in. per in. of diameter is acceptable. The hydrostatic pressure (P) shall be based on

$$P = S \frac{D^2 - d^2}{D^2 + d^2}$$

Where, S = 30,000 psi
D = Maximum permissible outside diameter (nominal OD plus tolerance) inch
d = Maximum permissible inside diameter, in. (computed as D minus twice the minimum permissible wall thickness)

5.4 Corrosion Rate: The general corrosion rate of the material shall be less than 0.0015 in., penetration per month as determined from a 48 hr boiling nitric acid test conducted in accordance with ASTM A262. This test is normally not required. It will be performed on tubing showing questionable results when embrittlement tested as in 5.6.

5.5 Grain Size: Grain size of tubing in the as-received condition shall be 5 or finer, ASTM E112, when electrolytically etched in 10% oxalic acid solution and examined microscopically at 100 diameters magnification.

5.6 Embrittlement: Tubing shall be capable of meeting the following test:

5.6.1 Test specimens shall withstand immersion for 48 hr in a boiling aqueous solution containing 100 g of $CuSO_4 \cdot 5H_2O$ and 100 ml of H_2SO_4 (sp gr 1.84) per liter of solution under a reflux condenser, without evidence of intercrystalline surface attack. After such immersion, full cross-sectional specimens of tubing 0.625 in. or less in diameter shall then be flattened to a total thickness under load of 3 times the wall thickness of the tubing, and 1 in. long specimens of tubing over 0.625 in. in diameter shall be split and bent 180 deg with outside surface of tube on inside of bend, around a diameter equal to 4 times the wall thickness, without showing evidence of cracks or defects. In either flattening or bending, the fold shall be made parallel to the axis of the tube, and shall coincide with the weld.

Note. Care should be exercised in differentiating between cracks caused by intergranular corrosion and cracks resulting from superficial yielding or rupturing of the surface of the specimens. Cases where there is doubt as to whether superficial cracking is caused by intergranular corrosion should be resolved by metallographic examination.

6. QUALITY:

6.1 Tubing shall have a good workmanlike finish conforming to the best practice for high quality aircraft material. The internal and external surfaces of the tubing shall be free from scale, pickling residues, carbonaceous residues, discoloration, heat colors, and any surface contamination removable by standard pickling procedures. It shall be smooth, clean, and free from burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious imperfections. External and internal surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, seams, scores, and scale pattern will not be considered as injurious provided the imperfections are removable within the tolerances specified herein for diameter and wall thickness, and further provided that such imperfections do not prevent the assembly of liquid pressure tight joints after flaring.

6.2 Cleanliness of Tubing: Tubing shall be free from grease or other foreign matter. No metallic flakes or particles shall be collected by a clean white cloth when it is drawn through the length of the bore of a test sample. The presence of metallic flakes or particles on the cloth will be cause for rejection. Discoloration of the cloth, without the presence of flakes or grit, will not be cause for rejection.

6.3 Welded tubing shall be so processed as to remove completely the bead and any dimensional indication of the presence of welds.

7. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2243.

8. REPORTS:

8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report of the results of test for chemical composition and grain size of each heat in the shipment and the tensile properties of each size from each heat. This report shall include the purchase order number, heat number, material specification number, size, and quantity from each heat.

8.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.