Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5567B
Superseding AMS 5567A

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UNS S30400

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

1. SCOPE:

1.1 Form: This specification covers two types of a corrosion-resistant steel in the form of tubing.

1.2 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 (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 Either Type 1 or Type 2 may be supplied, unless a specific type is specified.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing
AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A262 - Detecting Susceptibility to Intergranular Attack in Stainless Steels
ASTM A370 - Mechanical Testing of Steel Products
ASTM E112 - Estimating the Average Grain Size of Metals
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	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 conform to the requirements of AMS 2248.

3.2 Condition: Solution heat treated and descaled.

3.3 Fabrication: Tubing shall be produced by a seamless or a welded and drawn process. The external and internal surface finishes may be produced by pickling, bright annealing, or any method which will provide the required surface condition and which will 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 shall follow any polishing treatment.

3.3.1 Welded (Type 2) tubing shall be processed to remove the bead and any dimensional indication of the presence of welds.

3.4 Properties: Tubing shall conform to the following requirements; tensile and bend testing shall be performed in accordance with ASTM A370:

3.4.1 Tensile Properties: Shall be as specified in Table I, except that yield strength requirements do not apply to tubing 0.188 in. (4.78 mm) and under in OD with wall thickness 0.010 in. (0.25 mm) and under.

TABLE I

Nominal OD Inches	Nominal Wall Thickness Inch	Tensile Strength psi, max	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. %, min	
				Strip	Full Tube
Up to 0.188, incl	Up to 0.016, incl	115,000	30,000	--	35
	Over 0.016	100,000	30,000	--	40
Over 0.188 to 0.500, incl	Up to 0.010, incl	110,000		--	37
	Over 0.010	100,000	30,000	--	40
Over 0.500	Over 0.010	100,000	30,000	35	40

TABLE I (SI)

Nominal OD Millimetres	Nominal Wall Thickness Millimetres	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm %, min	
				Strip	Full Tube
Up to 4.78, incl	Up to 0.41, incl	793	207	--	35
	Over 0.41	690	207	--	40
Over 4.78 to 12.70, incl	Up to 0.25, incl	758		--	37
	Over 0.25	690	207	--	40
Over 12.70	Over 0.25	690	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 deg (1.29 rad.) included angle to produce a flare having a permanent expanded OD not less than specified in Table II.

TABLE II

Nominal OD Inches	Expanded OD Inches	Nominal OD Inches	Expanded OD Inches
0.125	0.200	0.750	0.937
0.188	0.290	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 II (SI)

Nominal OD Millimetres	Expanded OD Millimetres	Nominal OD Millimetres	Expanded OD Millimetres
3.18	5.08	19.05	23.80
4.78	7.37	25.40	30.15
6.35	9.12	31.75	38.10
7.92	10.69	38.10	43.71
9.54	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 given in 3.4.2 shall take the same percentage flare as shown for the larger of the two sizes.

3.4.2.2 Tubing with nominal OD greater than 3.000 in. (76.20 mm) or less than 0.125 in. (3.18 mm) shall have flarability as agreed upon by purchaser and vendor.

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 in. per in. (0.002 mm/mm) of diameter is acceptable. The hydrostatic pressure (P) shall be determined from the formula:

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

where S = Yield strength from Table I
D = Nominal OD
d = Nominal ID

3.4.4 Embrittlement: Tubing, as received, shall pass the copper/copper sulfate/sulfuric acid test performed in accordance with ASTM A262, Practice E, without evidence of intercrystalline surface attack. After exposure, full cross-sectional specimens of tubing 0.625 in. (15.88 mm) or less in nominal OD shall be flattened to a total thickness under load of three times the wall thickness of the tubing, and 1 in. (25 mm) long specimens of tubing over 0.625 in. (15.88 mm) in nominal OD shall be split and bend 180 deg (3.14 rad), with outside surface of tube on inside of bend, around a diameter equal to four times the nominal wall thickness without showing cracks or other defects. In either flattening or bending, the fold shall be made parallel to the axis of the tube and shall coincide with the weld in welded (Type 2) tubing if the weld is visible.

3.4.4.1 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. Where there is doubt as to whether superficial cracking is caused by intergranular corrosion should be resolved by metallographic examination.

3.4.5 Corrosion Rate: The general corrosion rate of the tubing shall be less than 0.0015 in. (0.038 mm) penetration per month, determined from a boiling nitric acid test conducted in accordance with ASTM A262, Practice C. This test is normally not required. It shall be performed on tubing showing questionable results when embrittlement tested as in 3.4.4.

3.4.6 Grain Size: Shall be 5 or finer determined by comparison of a specimen, polished and electrolytically etched in 10% oxalic acid solution, with the chart in ASTM E112, using 100 X magnification.

3.5 Quality:

3.5.1 Tubing shall be uniform in quality and condition and shall have a finish conforming to the best practice for high quality tubing. It shall be smooth, clean, and free from heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious conditions. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered injurious if the imperfections are removable within the tolerances specified for wall thickness but removal of such surface imperfections is not required.

3.5.2 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, is acceptable.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, tubing will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.7 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2243.