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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5570L
Superseding AMS 5570K

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STEEL TUBING, SEAMLESS, CORROSION AND HEAT RESISTANT
18Cr - 11Ni - 0.40Ti (SAE 30321)
Solution Heat Treated

UNS S32100

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant steel in the form of seamless tubing.

1.2 Application: Primarily for parts requiring both corrosion and heat resistance, especially when such parts are welded during fabrication, and also for parts requiring oxidation resistance up to 1500°F (815°C) but useful at that temperature only when stresses are low.

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 SAE, 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 Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

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 E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. 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 analytical methods approved by purchaser:

	min	max
Carbon	--	0.08
Manganese	--	2.00
Silicon	0.40	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	17.00	19.00
Nickel	9.00	13.00
Titanium	5x(C+N)	0.70
Molybdenum	--	0.75
Copper	--	0.75
Nitrogen	--	0.10

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

3.2 Condition: Solution heat treated and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled.

3.3 Fabrication: Tubing shall be produced by a seamless process. Any surface finishing operation applied to remove objectionable pits and surface blemishes shall be performed prior to final solution heat treatment. A light polish to improve surface appearance may be employed after solution heat treatment. Passivation treatment shall follow any polishing treatment.

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.

TABLE I

Nominal OD Inches	Wall Thickness Inches	Tensile Strength psi, max	Elongation in 2 in. %, min	
			Strip	Full Tube
Up to 0.188, incl	Up to 0.016, incl	120,000	--	33
	Over 0.016	105,000	--	35
Over 0.188 to 0.500, incl	Up to 0.010, incl	115,000	30	35
	Over 0.010	105,000	30	35
Over 0.500	Up to 0.010, incl	120,000	25	30
	Over 0.010	105,000	30	35

TABLE I (SI)

Nominal OD Millimetres	Nominal Wall Thickness Millimetres	Tensile Strength MPa, max	Elongation in 50 mm %, min	
			Strip	Full Tube
Up to 4.70, incl	Up to 0.40, incl	825	--	33
	Over 0.40	725	--	35
Over 4.70 to 12.50, incl	Up to 0.25, incl	795	30	35
	Over 0.25	725	30	35
Over 12.50	Up to 0.25, incl	825	25	30
	Over 0.25	725	30	35

3.4.2 Flarability: Specimens as in 4.3.1 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 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		

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
9.52	12.29	44.45	53.49
12.70	16.66	50.80	59.84
15.88	19.84		

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 Flarability requirements for tubing over 2.000 in. (50.80 mm) or under 0.125 in. (3.18 mm) in nominal OD shall be as agreed upon by purchaser and vendor.

3.4.3 Embrittlement: Specimens from tubing, after sensitizing treatment, shall pass the copper/copper sulfate/sulfuric acid test performed in accordance with ASTM A262, Practice E, without evidence of inter-crystalline surface attack. After exposure, full cross-sectional specimens of tubing 0.625 in. (15.62 mm) and under 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. (15.62 mm) in nominal OD shall be split and bent 180 deg, with outside surface of tube on inside of bend, around a diameter equal to 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.

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 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 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight tubes will be acceptable in mill lengths of 6 - 20 ft (2 - 6 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.

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.4.1), and tolerances (3.7) are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for flarability (3.4.2) and embrittlement (3.4.3) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2371 and the following:

4.3.1 Specimens for flarability (3.4.2) test shall be full tubes or sections cut from tubes. 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: