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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5570M

Issued 4 DEC 1939
Revised 1 OCT 1992

Superseding AMS 5570L

Submitted for recognition as an American National Standard

STEEL, CORROSION AND HEAT RESISTANT, SEAMLESS TUBING 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:

This tubing has been used typically 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 (816 °C) but useful at that temperature only when stresses are low; usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2243 Tolerances, Corrosion and Heat Resistant Steel Tubing
MAM 2243 Tolerances, Metric, 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 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2807 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, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 262 Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A 370 Mechanical Testing of Steel Products
ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:
(R)

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.08
Manganese	--	2.00
Silicon	0.25	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:

(R)

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.

3.4 Properties:

Tubing shall conform to the following requirements; tensile and bend testing shall be performed in accordance with ASTM A 370:

3.4.1 Tensile Properties: Shall be as specified in Table 2.

TABLE 2A - Tensile Properties, Inch/Pound Units

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

TABLE 2B - Tensile Properties, SI Units

Nominal OD Millimeters	Nominal Wall Thickness Millimeter	Tensile Strength MPa, max	Elongation in 50.8 mm %, min Strip	Elongation in 50.8 mm %, min Full Tube
Up to 4.78, incl	Up to 0.41, incl	827	--	33
	Over 0.41	724	--	35
Over 4.78 to 12.70, incl	Up to 0.25, incl	793	30	35
	Over 0.25	724	30	35
Over 12.70	Up to 0.25, incl	827	25	30
	Over 0.25	724	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 degree included angle to produce a flare having a permanent expanded OD not less than specified in Table 3.

TABLE 3A - Flarability, Inch/Pound Units

Nominal OD Inch	Expanded OD Inch	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		

TABLE 3B - 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		

3.4.2.1 Tubing with nominal OD between any two standard sizes given in Table 3 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 inches (50.80 mm) or under 0.125 inch (3.18 mm) in nominal OD shall be as agreed upon by purchaser and vendor.

3.4.3 (R) Susceptibility to Intergranular Attack: Specimens from tubing, after sensitizing treatment, shall pass the intergranular corrosion test performed in accordance with ASTM A 262, Practice E. After exposure, full cross-sectional specimens of tubing 0.625 inch (15.88 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-inch (25-mm) long specimens of tubing over 0.625 inch (15.88 mm) in nominal OD shall be split and bent 180 degrees, 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 Tolerances:

Shall conform to all applicable requirements of AMS 2243 or MAM 2243.

4. QUALITY ASSURANCE PROVISIONS:

4.1 (R) Responsibility for Inspection:

The vendor of tubing shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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 for composition (3.1), tensile properties (3.4.1), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests for flarability (3.4.2) and susceptibility to intergranular attack (3.4.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 (R) Sampling and Testing:

Shall be in accordance with AMS 2371 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.