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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5567C

Issued 1-31-64
Revised 1-1-88

Superseding AMS 5567B

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

UNS S30400

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, such as fluid lines, subject to medium high pressures and requiring corrosion resistance. Welding, brazing, or other exposure to temperatures over 800°F (425°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 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
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 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 Austenitic Stainless Steels
ASTM A370 - Mechanical Testing of Steel Products
ASTM E112 - Determining Average Grain Size
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 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 or by spectrochemical or other analytical methods approved by purchaser:

	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 requirements of AMS 2248.

3.2 Condition: Annealed and descaled.
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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. (4.70 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 mm %, min	
				Strip	Full Tube
Up to 4.70, incl	Up to 0.40, incl	795	205	--	35
	Over 0.40	690	205	--	40
Over 4.70 to 12.50, incl	Up to 0.25, incl	760	--	--	37
	Over 0.25	690	205	--	40
Over 12.50	Over 0.25	690	205	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 included angle to produce a flare having a permanent expanded OD not less than that 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	0.302	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 II (SI)

Nominal OD Millimetres	Expanded OD Millimetres	Nominal OD Millimetres	Expanded OD Millimetres
3.00	4.95	18.75	23.40
4.70	7.55	25.00	29.70
6.25	9.00	31.25	37.50
7.75	10.50	37.50	43.00
9.50	12.15	43.75	52.65
12.50	16.40	50.00	58.90
15.50	19.50	62.50	71.40
		75.00	83.90

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 3.000 in. (75.00 mm) or under 0.125 in. (3.00 mm) in nominal OD shall be as agreed upon by purchaser and vendor.

3.4.3 Pressure Test: The tubing shall show no bulges, leaks, pinholes, cracks, Ø 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 equation:

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

where, P = Test pressure in psi (MPa)
S = Minimum yield strength from Table I
D = Nominal OD
d = Nominal ID

3.4.4 Embrittlement: Tubing, as received, shall pass the intergranular corrosion test performed in accordance with ASTM A262, Practice E.

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.

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

3.5 Quality:

3.5.1 Tubing, as received by purchaser, shall be uniform in quality and Ø 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.

3.5.2 Tubing shall be free from grease or other foreign matter. Metallic flakes or particles shall not be collected by a clean cloth when it is drawn through the length of the bore of a test sample. 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, straight tubing will be acceptable in mill lengths of 6 - 20 ft (2 - 6 mm) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

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

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of tubing shall supply all Ø 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 Ø composition (3.1), tensile properties (3.4.1), grain size (3.4.6), 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 Ø flarability (3.4.2), pressure test (3.4.3), embrittlement (3.4.4), and corrosion rate (3.4.5) 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 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.

4.4 Reports:

4.4.1 The vendor of tubing shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and for tensile properties of each lot, and stating that the tubing conforms to the other technical requirements of this specification. This report shall include the purchase order number, heat number, AMS 5567C, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 5567C, contractor or other direct supplier of tubing, part number, and quantity. When tubing for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of tubing to determine conformance to the requirements of this specification and shall include in the report either a statement that the tubing conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be as follows: