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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 6374

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STEEL TUBING, SEAM-FREE, ROUND
0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)
95,000 psi (655 MPa) Tensile Strength

UNS G41300

1. SCOPE:

1.1 Form: This specification covers an aircraft-quality, low-alloy steel in the form of round, non-welded tubing free from OD surface seams.

1.2 Application: Primarily for use in airframe tubular parts requiring a minimum tensile strength of 95,000 psi (655 MPa) as received, or up to 180,000 psi (1240 MPa) after heat treatment.

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 2253 - Tolerances, Carbon and Alloy Steel Tubing
MAM 2253 - Tolerances, Metric, Carbon and Alloy Steel Tubing
AMS 2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2301 - Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2350 - Standards and Test Methods
AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, 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 A370 - Mechanical Testing of Steel Products
ASTM E112 - Determining Average Grain Size
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

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 E350 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Carbon	0.28	0.33
Manganese	0.40	0.60
Silicon	0.15	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.80	1.10
Molybdenum	0.15	0.25
Nickel	--	0.25
Copper	--	0.35

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

3.2 Condition: Normalized by air cooling from a temperature within the range 1600° - 1700°F (870° - 925°C), cold drawn, and stress relieved.

3.3 Fabrication: Tubing shall be produced by piercing, intermediate reduction, and drawing. Normalizing, followed by grinding or turning, shall be applied prior to final drawing in order to preclude decarburization and seams in the final product. Intermediate stress relief treatments may be applied before, and a final stress relief treatment shall be applied after, final drawing. A light polish to improve surface appearance may be employed as a final operation.

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

3.4.1 Tensile Properties:

Tensile Strength, min	95,000 psi (655 MPa)
Yield Strength at 0.2% Offset, min	75,000 psi (515 MPa)
Elongation in 2 in. (50 mm), min	
Full Tube	12%
Strip	7%

3.4.2 Grain Size: Shall be predominantly 5 or finer with occasional grains as large as 3 permissible, determined in accordance with ASTM E112.

3.4.3 Decarburization: Tubing OD surface shall be free from decarburization. Tubing ID surface shall be free from complete decarburization and partial decarburization shall be not greater than one-tenth of the wall thickness or 0.004 in. (0.10 mm), whichever is greater, determined visually on etched specimens at 100X.

3.5 Quality: Tubing, as received by purchaser, shall be uniform in quality and condition, smooth, clean, with a surface finish conforming to the best practice for high quality aircraft tubing.

3.5.1 Steel from which tubing is made shall be equivalent in cleanliness to that required to meet AMS 2301, but testing of the steel or the tubing to determine conformance to AMS 2301 is not required. However, if a representative sample (See 4.3.1) from a lot of tubing is evaluated by either purchaser or supplier in accordance with AMS 2301, it shall meet the acceptance criteria therein.

3.5.2 Tubing OD shall be substantially free from seams (See 3.5.2.1); OD and ID shall be completely free from heavy scale, heavy oxide, burrs, tears, grooves, cracks, 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 are acceptable if they can be removed within tolerances specified but their removal is not required.

3.5.2.1 The term "seams" does not include nonmagnetic inclusions. "Substantially free from seams" means that the following are not acceptable:

3.5.2.1.1 Any piece of tubing found to contain a seam.

3.5.2.1.2 Any lot of tubing from which a representative sample (See 4.3.1) has been found to contain more than one seam over 1/4 in. (6 mm) in length.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight tubing shall be supplied in mill lengths of 12 - 20 ft (4 - 6 m).

3.7 Tolerances: Shall conform to AMS 2253 or MAM 2253 except that the tolerance for 1 in. (25 mm) and under OD shall be ±0.003 in. (±0.08 mm).

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), grain size (3.4.2), and decarburization (3.4.3) 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 steel cleanliness (3.5.1) 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 2370 and the following:

4.3.1 A representative sample shall consist of at least one 6-in. (150-mm) long specimen, selected at random, from each 100 ft (30 m) of tubing or fraction thereof.

4.3.1.1 For evaluation of nonmetallic inclusions, the representative samples shall be machined and polished, or ground, to remove material from the OD surface equivalent to not less than 10% of the nominal wall thickness.

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, grain size, and decarburization of each lot. This report shall include the purchase order number, heat number, AMS 6374, lot number, size, and quantity from each heat.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 6374, 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 reqirements 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 2370.