AEROSPACE MATERIAL SPECIFICATION

AMS6374™	REV. E

Issued 1985-07
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Revised 2020-06

Superseding AMS6374D

Steel Tubing, Seam-Free, Round
0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)
95.0 ksi (655 MPa) Tensile Strength
(Composition similar to UNS G41300)

RATIONALE

AMS6374E results from a Five-Year Review and update of this specification that revises analytical methods (3.1), adds grain size by composition option (3.1.1, 3.4.2) and tensile strain rates (3.4.1.1), prohibits unauthorized exceptions (3.7), revises testing criteria (4.2), and revises reporting and marking (4.4, 5.2).

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

This product has been used typically for use in airframe tubular parts requiring a minimum tensile strength of 95.0 ksi (655 MPa) as received, or up to 180.0 ksi (1241 MPa) after heat treatment, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2253 Tolerances, Carbon and Alloy Steel Tubing

AMS2259 Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels

AMS2301 Steel Cleanliness, Aircraft Quality, Magnetic Particle Inspection Procedure

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS6374E

AMS2370 Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock

AMS2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate and Aircraft Tubing

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A370 Mechanical Testing of Steel Products

ASTM A751 Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

ASTM E112 Determining Average Grain Size

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	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 Aluminum, vanadium, and columbium are optional grain refining elements and need not be determined or reported unless used to satisfy the average grain size requirements of 3.4.2.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Condition

Normalized by air cooling from a temperature within the range 1600 to 1700 °F (871 to 927 °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; tensile testing shall be performed in accordance with ASTM A370:

3.4.1 Tensile Properties

Shall be as shown in Table 2.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	95.0 ksi (655 MPa)
Yield Strength at 0.2 Offset	75.0 ksi (517 MPa)
Elongation in 2 Inches (50.8 mm)	
Full Tube	12%
Strip	7%

3.4.1.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min).

3.4.2 Average Grain Size

Average grain size shall be determined by either 3.4.2.1 or 3.4.2.2:

3.4.2.1 Shall be ASTM No. 5 or finer, determined in accordance with ASTM E112.

3.4.2.2 The product of a heat shall be considered to have an ASTM No. 5 or finer austenitic grain size if one or more of the following are determined by heat analysis (see 8.4):

3.4.2.2.1 A total aluminum content of 0.020 to 0.050%.

3.4.2.2.2 An acid soluble aluminum content of 0.015 to 0.050%.

3.4.2.2.3 A vanadium content of 0.02 to 0.08%.

3.4.2.2.4 A columbium content of 0.02 to 0.05%.

3.4.3 Decarburization

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

3.5 Quality

Tubing, as received by purchaser, shall be uniform in quality and condition, sound, clean, with a surface finish conforming to the best practice for high quality aircraft tubing. Tubing OD shall be substantially free from seams (see 3.5.1); 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 provided imperfections are removable within tolerances specified for wall thickness but removal of such imperfections is not required.

3.5.1 The term “seams” does not include nonmagnetic inclusions. “Substantially free from seams” means that the following are not acceptable:

3.5.1.1 Any piece of tubing found to contain a seam.

3.5.1.2 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 inch (6.4 mm) in length.

3.5.2 Steel shall be aircraft quality conforming to AMS2301.

3.6 Tolerances

In accordance to AMS2253 except that the tolerance for 1 inch (25 mm) and under OD shall be ±0.003 inch (±0.08 mm).

3.7 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of tubing shall supply all samples for producer’s tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.4.1), grain size (3.4.2), decarburization (3.4.3), frequency-severity cleanliness rating (3.5.2), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable. If grain refining elements (3.4.2.2) are not present, the ASTM E112 grain size test (3.4.2.1) shall be conducted on each lot.

4.2.2 Periodic Tests

If grain refining elements (3.4.2.2) are present, the ASTM E112 grain size test (3.4.2.1) shall be conducted on a periodic basis and shall be performed at a frequency selected by the producer (not to exceed 1 year) unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2370 and the following:

4.3.1 A representative sample (see 3.5.1.2) shall consist of at least one 6 inch (152 mm) long specimen, selected at random, from each 100 feet (30 m) of tubing or fraction thereof.

4.3.1.1 For evaluation of nonmetallic inclusions (as supplement to the AMS2301 test), 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.