ADOPTION NOTICE

SAE-AMS6362, "Steel Tubing, Seamless 0.95Cr - 0.20Mo (0.28-0.33C) (SAE 4130) 150,000 psi (1034 MPa) Tensile Strength", was adopted on 13-JAN-95 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOSD, Building 125, 2335 Seventh Street, Suite 6, Wright-Patterson AFB, OH 45433-7809. DoD activities may obtain copies of this standard from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 11911-5094. The private sector and other Government agencies may purchase copies from the Society of Automotive Engineers Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-6362 REV D

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Submitted for recognition as an American National Standard

STEEL TUBING, SEAMLESS
0.95Cr - 0.20Mo (0.28-0.33C) (SAE 4130)
150,000 psi (1034 MPa) Tensile Strength

UNS G41300

1. SCOPE:

1.1 Form: This specification covers an aircraft-quality, low-alloy steel in the form of round, seamless tubing having a wall thickness not greater than 0.188 inch (4.78 mm).

1.2 Application: Primarily for general use where a minimum tensile strength of 150,000 psi (1034 MPa) is required.

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.

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-2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock
AMS-2640 - Magnetic Particle Inspection

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 370 - Mechanical Testing of Steel Products
ASTM E 112 - Determining Average Grain Size
ASTM E 350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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 E 350, by spectrochemical methods, or by other analytical methods acceptable to 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: Hardened by quenching from a temperature within the range 1500° - 1600°F (816° - 871°C) and tempered to meet the requirements of 3.4.1.

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 heat treatment. A light polish to improve surface appearance may be employed after final heat treatment.

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

3.4.1 Tensile Properties:

Tensile Strength, minimum	150,000 psi (1034 MPa)
Yield Strength at 0.2% Offset, minimum	135,000 psi (931 MPa)
Elongation in 2 Inches (50.8 mm), minimum	
Full Tube	10%
Strip	6%

3.4.2 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, determined in accordance with ASTM E 112.

3.4.3 Decarburization:

3.4.3.1 Tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces. Decarburization on tubing ID shall not exceed the maximum depth specified in Table I.

3.4.3.2 Allowable decarburization of pierced billets, of tubing for redrawing, or of tubing ordered to specified microstructural requirements shall be as agreed upon by purchaser and vendor.

3.4.3.3 Ø Tubing to which 3.4.3.1 or 3.4.3.2 is not applicable shall be free from complete decarburization. Partial decarburization shall not exceed the limits specified in Table I.

TABLE I

Nominal Wall Thickness (T) Inch	Depth of Partial Decarburization Inch		
	ID	OD	ID+OD
Up to 0.040, incl	0.18T	0.18T	0.25T
Over 0.040 to 0.050, incl	0.009	0.009	0.012
Over 0.050 to 0.070, incl	0.010	0.010	0.014
Over 0.070 to 0.080, incl	0.012	0.012	0.016
Over 0.080 to 0.090, incl	0.014	0.014	0.018
Over 0.090 to 0.100, incl	0.015	0.015	0.020
Over 0.100 to 0.150, incl	0.017	0.017	0.022
Over 0.150 to 0.188, incl	0.020	0.020	0.026

TABLE I (SI)

Nominal Wall Thickness (T) Millimetres	Depth of Partial Decarburization Millimetre		
	ID	OD	ID+OD
Up to 1.02, incl	0.18T	0.18T	0.25T
Over 1.02 to 1.27, incl	0.23	0.23	0.30
Over 1.27 to 1.78, incl	0.25	0.25	0.36
Over 1.78 to 2.03, incl	0.30	0.30	0.41
Over 2.03 to 2.29, incl	0.36	0.36	0.46
Over 2.29 to 2.54, incl	0.38	0.38	0.51
Over 2.54 to 3.81, incl	0.43	0.43	0.56
Over 3.81 to 4.78, incl	0.51	0.51	0.66

3.4.3.4 Decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale or equivalent hardness testing method on hardened but untempered specimens protected during heat treatment to prevent changes in surface carbon content. Depth of decarburization, when measured by a hardness method, is defined as the perpendicular distance from the surface to the depth under that surface below which there is no further increase in hardness. Such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization or lack of decarburization thereon.

3.4.3.4.1 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the above limits by more than 0.005 inch (0.13 mm) and the width is 0.065 inch (1.65 mm) or less.

3.5 Quality:

3.5.1 Steel shall be aircraft quality conforming to AMS-2301.

3.5.2 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.

3.5.2.1 When specified, the tubing, either with or without machining of the surface, shall be subjected to magnetic particle inspection in accordance with AMS-2640. Standards for acceptance shall be as agreed upon by purchaser and vendor.

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 feet (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).

3.7 Tolerances: Shall conform to all applicable requirements of AMS-2253 or MAM-2253.

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. 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: Tests for all technical requirements are Ø acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing: Shall be in accordance with AMS-2370. Ø

4.4 Reports: The vendor of tubing shall furnish with each shipment a report showing the results of tests for chemical composition, grain size, and frequency-severity cleanliness rating of each heat and for tensile properties of each lot. This report shall include the purchase order number, lot number, AMS-6362D, size, and quantity.

4.5 Resampling and Retesting: Shall be in accordance with AMS-2370.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be as follows:

5.1.1 Straight Tubes 0.029 Inch (0.74 mm) and Over in Nominal Wall Thickness and 0.500 Inch (12.70 mm) and Over in Nominal OD, Minor Axis, or Least Width of Flat Surface: Shall be legibly marked, in a row of characters recurring at intervals not greater than 3 feet (914 mm), with AMS-6362D, lot number, manufacturer's identification, and nominal wall thickness. The characters shall be applied using a suitable marking fluid and shall be removable in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the tubing or its performance and shall be sufficiently stable to withstand normal handling.

5.1.2 Straight Tubes Under 0.029 Inch (0.74 mm) in Nominal Wall Thickness or Under 0.500 Inch (12.70 mm) in Nominal OD, Minor Axis, or Least Width of Flat Surface: Shall be securely bundled and identified by a durable tag marked with the information of 5.1.1 and the nominal OD and attached to each bundle or shall be boxed and the box marked with the same information.