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SAE-AMS6282, "STEEL TUBING, MECHANICAL - 0.50CR - 0.55NI - 0.25MO (0.33 - 0.38C) (SAE 8735)", was adopted on 15-AUG-90 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOI, Building 560, 2530 Loop Road West, Wright-Patterson AFB, OH 45433-7101. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001.
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AEROSPACE MATERIAL SPECIFICATION

AMS 6282G

Issued 11-1-44
Revised 10-1-89

Superseding AMS 6282F

Submitted for recognition as an American National Standard

STEEL TUBING, MECHANICAL
0.50Cr - 0.55Ni - 0.25Mo (0.33 - 0.38C) (SAE 8735)

UNS G87350

1. SCOPE:

1.1 Form: This specification covers an aircraft-quality, low-alloy steel in the form of mechanical tubing.

1.2 Application: Primarily for parts, 0.75 inch (19.0 mm) and under in section thickness at time of heat treatment, requiring a through-hardening steel capable of developing hardness as high as 40 HRC when properly hardened and tempered.

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 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

REAFFIRMED

APR '94

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2.1.1 (Continued):

- AMS 2350 - Standards and Test Methods
- AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock
- AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

2.1.2 Aerospace Standards:

- AS1182 - Standard Machining Allowance, Aircraft Quality and Premium Aircraft-Quality Steel Products

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

- ASTM A 255 - End-Quench Test for Hardenability of Steel
- 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
- ASTM E 381 - Macroetch Testing, Inspection, and Rating Steel Products Comprising Bars, Billets, Blooms, and Forgings

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 E 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	0.33	0.38
Manganese	0.75	1.00
Silicon	0.15	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.40	0.60
Nickel	0.40	0.70
Molybdenum	0.20	0.30
Copper	--	0.35

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

3.2 Condition: Cold finished having hardness not higher than 25 HRC, or \emptyset equivalent, except that tubing ordered hot finished and annealed or tempered shall have hardness not higher than 99 HRB, or equivalent; hardness shall be determined in accordance with ASTM A 370.

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

3.3.1 Macrostructure: Visual examination of transverse sections as in 4.3.1 from billets, tube rounds, or tubes, etched in accordance with ASTM E 381, shall show no pipe or cracks. Except as specified in 3.3.1.1, porosity, segregation, inclusions, and other imperfections shall be no worse than the following macrographs of ASTM E 381:

Section Size		Macrographs
Square Inches	Square Centimetres	
Up to 36, incl	Up to 232, incl	S2 - R1 - C2
Over 36 to 100, incl	Over 232 to 645, incl	S2 - R2 - C3
Over 100	Over 645	As agreed upon

3.3.1.1 If tubes are produced directly from ingots or large blooms, transverse sections may be taken from tubes rather than tube rounds. Macrostructure standards for such tubes shall be as agreed upon by purchaser and vendor.

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

3.3.3 Hardenability: Shall be J45=5 minimum and J41=6 minimum, determined on the standard end-quench test specimen in accordance with ASTM A 255 except that the steel shall be normalized at $1700^{\circ}\text{F} \pm 10$ ($927^{\circ}\text{C} \pm 6$) and the test specimen austenitized at $1500^{\circ}\text{F} \pm 10$ ($816^{\circ}\text{C} \pm 6$). The hardenability test is not required on tubing which will not yield a suitable specimen but the steel from which the tubing is made shall conform to the hardenability specified.

3.3.4 Decarburization:

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

3.3.4.2 Allowable decarburization of pierced billets, of tube rounds or tubing for redrawing or forging, or of tubing ordered to specified micro-structural requirements shall be as agreed upon by purchaser and vendor.

- 3.3.4.3 Decarburization of tubing to which 3.3.4.1 or 3.3.4.2 is not applicable shall be not greater than shown in Table I.

TABLE I

Nominal Wall Thickness Inches	<u>Depth of Decarburization. Inch</u>	
	ID	OD
Up to 0.109, incl	0.008	0.015
Over 0.109 to 0.203, incl	0.010	0.020
Over 0.203 to 0.400, incl	0.012	0.025
Over 0.400 to 0.600, incl	0.015	0.030
Over 0.600 to 1.000, incl	0.017	0.035
Over 1.000	0.020	0.040

TABLE I (SI)

Nominal Wall Thickness Millimetres	<u>Depth of Decarburization. Millimetre</u>	
	ID	OD
Up to 2.77, incl	0.20	0.38
Over 2.77 to 5.16, incl	0.25	0.51
Over 5.16 to 10.16, incl	0.30	0.64
Over 10.16 to 15.24, incl	0.38	0.76
Over 15.24 to 25.40, incl	0.43	0.89
Over 25.40	0.51	1.02

- 3.3.4.4 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.

- 3.3.4.4.1 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.

3.4 Quality:

- 3.4.1 Steel shall be aircraft quality conforming to AMS 2301.
- 3.4.2 Tubing, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the tubing.
- 3.4.3 Tubing ordered ground, turned, or polished shall be free from seams, laps, tears, and cracks open to the ground, turned, or polished surfaces.