



AEROSPACE MATERIAL SPECIFICATION

AMS6346

REV. B

Issued 1998-10
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Superseding AMS6346A

Steel Bars
0.95Cr - 0.20Mo (0.28 to 0.33C) (SAE 4130)
Hardened and Tempered, 125 Ksi (862 MPa) Tensile Strength
(Composition similar to UNS G41300)

RATIONALE

AMS6346B results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers an aircraft-quality, low-alloy steel in the form of heat treated bars 1.50 inches (38.1 mm) and less in diameter or least distance between parallel sides.

1.2 Application

These bars have been used typically for parts with sections 1.50 inch (38.1 mm) and under in nominal thickness requiring a minimum tensile strength of 125 ksi (862 MPa), but usage is not limited to such application.

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 724-776-4970 (outside USA), www.sae.org.

AMS2251 Tolerances, Low-Alloy Steel Bars

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

AMS2301 Steel Cleanliness, Aircraft Quality, Magnetic Particle Inspection Procedure

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

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- AMS2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys
- AS1182 Standard Stock Removal Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

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 E 8 / E 8M Tension Testing of Metallic Materials
- 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 Macrotech Testing, Steel Bars, Billets, Blooms, and Forgings
- ASTM E 384 Knoop and Vickers Hardness of Materials

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 350, by spectrochemical methods, 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 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Conditions

Bars shall be supplied in the following conditions:

3.2.1 Bars 0.500 Inch (12.70 mm) and Under in Nominal Diameter or Least Distance Between Parallel Sides

Hardened and tempered and cold finished.

3.2.2 Bars Over 0.500 Inch (12.70 mm) in Nominal Diameter or Least Distance Between Parallel Sides

Hot finished and hardened and tempered, or if specified, hardened and tempered and cold finished.

3.2.3 Bars shall not be cut from plate (Also see 4.4.2).

3.3 Properties

Bars shall conform to the following requirements:

3.3.1 Macrostructure

Visual examination of transverse full cross-sections from bars, and billets, etched in hot hydrochloric acid in accordance with ASTM E 381, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections shall be no worse than the macrographs of ASTM E 381 shown in Table 2.

TABLE 2 - MACROSTRUCTURE LIMITS

Cross-Sectional Area Square Inches			Cross-Sectional Area Square Centimeters			Macrographs
	Up to 36,	incl	Up to 232,	incl		S2 - R1 - C2
Over	36 to 133,	incl	Over 232 to 858,	incl		S2 - R2 - C3
Over	133		Over 858			Note 1

Note 1 Limits for larger sizes shall be agreed upon by purchaser and vendor. The purchaser shall have written approval of the agreement from the cognizant engineering organization.

3.3.2 Average Grain Size

Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112.

3.3.3 Longitudinal Tensile Properties

Shall be as shown in Table 3 for product 1.50 inches (38.1 mm) and less in diameter or least distance between parallel sides (See 8.2), determined in accordance with ASTM E 8 / E 8M.

TABLE 3 - LONGITUDINAL TENSILE PROPERTIES, MINIMUM

Property	Value
Tensile strength	125 ksi (862 MPa)
Yield strength at 0.2% Offset	100 ksi (689 MPa)
Elongation in 4D	17%
Reduction of Area	55%

3.3.3.1 Mechanical property requirements for product outside the size range covered by 3.3.3 shall be agreed upon between purchaser and producer.

3.3.4 Decarburization

3.3.4.1 Bars ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces.

3.3.4.2 Allowable decarburization of bars ordered to specified microstructural requirements shall be agreed upon by purchaser and vendor.

3.3.4.3 Decarburization of bars to which 3.3.4.1 or 3.3.4.2 is not applicable shall be not greater than shown in Table 4.

TABLE 4A - MAXIMUM DEPTH OF DECARBURIZATION, INCH/POUND UNITS

Nominal Diameter or Distance Between Parallel Sides Inches				Total Depth of Decarburization Inches
	Up	to	0.375, incl	0.010
Over	0.375	to	0.500, incl	0.012
Over	0.500	to	0.625, incl	0.014
Over	0.625	to	1.000, incl	0.017
Over	1.000	to	1.500, incl	0.020
Over	1.500	to	2.000, incl	0.025
Over	2.000	to	2.500, incl	0.030
Over	2.500	to	3.000, incl	0.035
Over	3.000	to	4.000, incl	0.045

TABLE 4B - MAXIMUM DEPTH OF DECARBURIZATION, SI UNITS

Nominal Diameter or Distance Between Parallel Sides Millimeters				Total Depth of Decarburization Millimeters
	Up	to	9.52, incl	0.25
Over	9.52	to	12.70, incl	0.30
Over	12.70	to	15.88, incl	0.36
Over	15.88	to	25.40, incl	0.43
Over	25.40	to	38.10, incl	0.51
Over	38.10	to	50.80, incl	0.64
Over	50.80	to	63.50, incl	0.76
Over	63.50	to	76.20, incl	0.89
Over	76.20	to	101.60, incl	1.14

3.3.4.4 Decarburization shall be measured by the metallographic method, or by a traverse method using microhardness testing in accordance with ASTM E 384. The microhardness method shall be conducted on a hardened but untempered specimen protected during heat treatment to prevent changes in surface carbon content. Depth of decarburization, when measured by the microhardness method, is defined as the perpendicular distance from the surface to the depth under that surface where there is no further increase in hardness. Such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization on the adjacent surface. In case of dispute, the depth of decarburization determined using the microhardness traverse method shall govern.

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 inches (0.13 mm) and the width is 0.065 inch (1.65 mm) or less.

3.4 Quality

Bars, 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 bars.

3.4.1 Steel shall be aircraft quality conforming to AMS2301.

3.4.2 Bars ordered hot rolled or cold drawn or ground, turned, or polished shall, after removal of the standard stock removal allowance in accordance with AS1182, be free from seams, laps, tears, and cracks open to the machined, ground, turned, or polished surface.

3.5 Tolerances

Shall conform to all applicable requirements of AMS2251.