



# AEROSPACE MATERIAL SPECIFICATION

## AMS 6432

Society of Automotive Engineers, Inc.  
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

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Revised

STEEL BARS, FORGINGS, AND TUBING  
1.05Cr - 0.55Ni - 1.0Mo - 0.11V (0.43 - 0.49C)

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. **FORM:** Bars, forgings, mechanical tubing, and forging stock.
3. **APPLICATION:** Primarily for ultra-high strength structural applications requiring a through-hardening, weldable material for use at temperatures up to 600 F (316 C).
4. **COMPOSITION:**

	min	max
Carbon	0.43	0.49
Manganese	0.60	0.90
Silicon	0.15	0.30
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.90	1.20
Nickel	0.40	0.70
Molybdenum	0.90	1.10
Vanadium	0.08	0.15
Copper	--	0.35

- 4.1 **Check Analysis:** Composition variations shall meet the requirements of the latest issue of AMS 2259, paragraph titled "Low Alloy Steels".
5. **CONDITION:** Unless otherwise ordered, the product shall be supplied in the following condition:
  - 5.1 **Bars:** In a machinable condition and hot finished having hardness not higher than Brinell 235 or equivalent, except that bars ordered cold finished may have hardness as high as Brinell 265 or equivalent.
  - 5.2 **Forgings:** As ordered.
  - 5.3 **Mechanical Tubing:** In a machinable condition and cold finished having hardness not higher than Rockwell C 30 or equivalent, except that tubing ordered hot finished shall have hardness not higher than Rockwell C 22 or equivalent.
  - 5.4 **Forging Stock:** As ordered by the forging manufacturer.
6. **TECHNICAL REQUIREMENTS:** When ASTM methods are specified for determining conformance to the following requirements, tests shall be conducted in accordance with the issue of the ASTM method listed in the latest issue of AMS 2350.
  - 6.1 **Grain Size:** Predominantly 5 or finer with occasional grains as large as 3 permissible, ASTM E112, McQuaid-Ehn test.

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6.2 **Macrostructure:** Visual examination of deep acid etched bars and forging stock shall show no evidence of pipes, internal cracks, excessive segregation, or other deleterious imperfections and, unless otherwise agreed upon, shall be equal to or better than the following macrographs of MIL-STD-430A.

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

6.3 **Decarburization:**

6.3.1 Bars and mechanical tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces. Inside decarburization of such tubing shall not exceed the maximum depth specified in 6.3.4.

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

6.3.3 Decarburization of bars to which 6.3.1 or 6.3.2 is not applicable shall be not greater than the following:

Nominal Diameter or Distance Between Parallel Sides Inches	Depth of Decarburization Inch
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

6.3.3.1 Limits for depth of decarburization of bars over 4.000 in. in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

6.3.4 Decarburization of mechanical tubing to which 6.3.1 or 6.3.2 is not applicable shall be not greater than the following:

Nominal Wall Thickness Inches	Depth of Decarburization, Inch	
	Inside	Outside
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

6.3.5 Unless otherwise agreed upon by purchaser and vendor, decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale hardness method, 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.

6.3.5.1 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the limits above by more than 0.005 in. and the width is 0.065 in. or less.

6.4 Properties After Heat Treatment: Tensile test specimens, machined from bars, forgings, and mechanical tubing, hardened by heating in a protective atmosphere to a temperature within the range 1600 - 1650 F (871.1 - 898.9 C), holding at the selected temperature within  $\pm 10$  F ( $\pm 5.6$  C) for 1 hr, and quenching in oil, then stress relieved at 400 F  $\pm 10$  (204.4 C  $\pm 5.6$ ) for 1 hr, cooled in air, and tempered for 4 hr at not lower than 1000 F (538 C), and cooled in air, shall conform to the following requirements:

6.4.1 Tensile Properties:

Tensile Strength, psi	225,000 min
Yield Strength at 0.2% Offset or at 0.0172 in. in 2 in. Extension Under Load (E = 29,500,000), psi	195,000 min
Elongation, % in 2 in. or 4D	7 min
Reduction in Area (round specimens), %	30 min

6.4.2 Hardness: Not lower than Rockwell C 47 or equivalent.

7. QUALITY: Steel shall be aircraft quality and shall conform to the latest issue of AMS 2301. The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

7.1 Surface Requirements:

7.1.1 Bars ordered ground, turned, or polished shall be free from seams, laps, tears, or cracks open to the ground, turned, or polished surfaces.

7.1.2 Product ordered to surface conditions other than ground, turned, or polished shall, after removal of the standard machining allowance, be free from seams, laps, tears, cracks, and other defects exposed to the machined surfaces. Standard machining allowance shall be in accordance with values shown in the latest issue of AMS 2301.

8. QUALITY ASSURANCE SAMPLING AND TESTING: Shall be in accordance with all applicable requirements of the latest issue of AMS 2370.

9. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the following:

9.1 Bars: The latest issue of AMS 2251; for all hexagons, tolerances for cold finished shall apply.

9.2 Mechanical Tubing: The latest issue of AMS 2253.

10. REPORTS:

10.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition, tensile properties, grain size, macrostructure, and AMS 2301 frequency-severity rating of each heat in the shipment. This report shall include the purchase order number, heat number, material specification number, size, and quantity from each heat. If forgings are supplied, the part number and size of stock used to make the forgings shall also be included.