



AEROSPACE MATERIAL SPECIFICATION

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

AMS 6267B

Superseding AMS 6267A

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STEEL BARS, FORGINGS, AND TUBING
1.2Cr - 3.25Ni - 0.12Mo (0.07 - 0.13C) (SAE 9310)
Premium Quality

1. SCOPE:

1.1 Form: This specification covers a premium-quality, low-alloy steel in the form of bars, forgings, mechanical tubing, and forging stock.

1.2 Application: Primarily for critical carburized parts requiring high minimum core hardness with narrow range and subject to very rigid magnetic particle inspection standards.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) and Aerospace Standards (AS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2251 - Tolerances, Alloy Steel Bars

AMS 2253 - Tolerances, Carbon and Alloy Steel Tubing

AMS 2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels

AMS 2300 - Premium Quality Steel Cleanliness, Magnetic Particle Inspection Procedure

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 2372 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Forgings and Forging Stock

AMS 2375 - Approval and Control of Critical Forgings

AMS 2808 - Identification, Forgings

2.1.2 Aerospace Standards:

AS 1182 - Standard Machining Allowance, Aircraft Quality and Premium Quality Steel Products

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM A255 - End-Quench Test for Hardenability of Steel

ASTM A370 - Mechanical Testing of Steel Products

ASTM A604 - Macroetch Testing of Consumable Electrode Vacuum Arc Remelted Steel Bars and Billets

ASTM E112 - Estimating Average Grain Size of Metals

ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

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2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	0.07	0.13
Manganese	0.40	0.70
Silicon	0.20	0.35
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	1.00	1.40
Nickel	3.00	3.50
Molybdenum	0.08	0.15
Copper	--	0.35

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2259, paragraph titled "Low-Alloy Steels".

3.2 Condition: The product shall be supplied in the following condition; hardness and tensile strength shall be determined in accordance with ASTM A370:

3.2.1 Bars:

3.2.1.1 Bars 0.500 In. (12.70 mm) and Under in Diameter or Distance Between Parallel Sides: Cold finished having tensile strength not higher than 125,000 psi (862 MPa) or equivalent hardness.

3.2.1.2 Bars Over 0.500 In. (12.70 mm) in Diameter or Distance Between Parallel Sides: Hot finished having hardness not higher than 229 HB or equivalent except that bars ordered cold finished may have hardness as high as 248 HB or equivalent.

3.2.2 Forgings: As ordered.

3.2.3 Mechanical Tubing: Cold finished having hardness not higher than 25 HRC or equivalent except that tubing ordered hot finished shall have hardness not higher than 99 HRB or equivalent.

3.2.4 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties: The product shall conform to the following requirements; hardness testing shall be performed in accordance with ASTM A370:

3.3.1 Hardenability: Shall be J41=1 max and J32=6 min, determined on the standard end-quench test specimen in accordance with ASTM A255 except that the steel shall be normalized at 1700° F ± 10 (926.7° C ± 5.6) and the test specimen austenitized at 1500° F ± 10 (815.6° C ± 5.6). The hardenability test is not required on a product which will not yield a suitable specimen but the steel from which the product is made shall conform to the hardenability specified.

3.3.2 Grain Size: Predominantly 5 or finer, with occasional grains as large as 3 permissible, ASTM E112, McQuaid-Ehn test.

3.3.3 Macrostructure: Visual examination of transverse sections from bars, billets, forging stock, and tube rounds or tubes, etched in accordance with ASTM A604 in hot hydrochloric acid (1:1) at 160° - 180° F (71.1° - 82.2° C) for sufficient time to develop a well-defined macrostructure, shall show no injurious imperfections such as pipe, cracks, porosity, segregation, and inclusions detrimental to fabrication or to performance of parts. Macrostructure shall be equal to or better than the following macrographs of ASTM A604:

Class	Condition	Severity
1	Freckles	B
2	White spots	B
3	Radial segregation	C
4	Ring pattern	As agreed upon

3.3.3.1 Macrostructure of Tubes: If tubes are produced directly from ingots or large blooms, transverse sections may be taken from tubes rather than tube rounds and macrostructure standards shall be as agreed upon by purchaser and vendor.

3.4 Quality:

3.4.1 Steel shall be premium quality conforming to AMS 2300; it shall be multiple melted using consumable electrode practice in the remelt cycle, unless otherwise permitted.

3.4.2 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.

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

3.4.2.2 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 AS 1182.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, bars and tubing will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.6 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of the following:

3.6.1 Bars: AMS 2251.

3.6.2 Mechanical Tubing: AMS 2253.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars and Tubing: AMS 2370.

4.3.2 Forgings and Forging Stock: AMS 2372.

4.4 Approval: When specified, approval and control of critical forgings shall be in accordance with AMS 2375.

4.5 Reports:

4.5.1 The vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition, hardenability, grain size, macrostructure, and AMS 2300 frequency-severity rating of each heat in the shipment. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Except as permitted by 4.6.1, failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

4.6.1 Should resampling for the macrostructure (3.3.3) test be required, one of the additional specimens shall be taken from the same position in each of the two available ingots most immediately adjacent in pouring sequence to that from which the failed specimen was taken and the third specimen shall be taken from the original nonconforming ingot after additional discard; should the latter specimen be unacceptable, resampling and retesting of that ingot may be repeated after as many consecutive discards as necessary and desired to attain sound material.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars and Tubing:

5.1.1.1 Each straight bar and tube 0.500 in. (12.70 mm) and over in OD or least width of flat surface shall be marked in a row of characters recurring at intervals not greater than 3 ft (914 mm) with AMS 6267B, heat number, and manufacturer's identification. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

5.1.1.2 Straight bars and tubes less than 0.500 in. (12.70 mm) in OD or least width of flat surface shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 6267B, heat number, nominal size, and manufacturer's identification and attached to each bundle or shall be boxed and the box marked with the same information.

5.1.1.3 Coiled bars shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 6267B, heat number, nominal size, and manufacturer's identification and attached to each coil or shall be boxed and the box marked with the same information.

5.1.2 Forgings: In accordance with AMS 2808.