Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 6327F
Superseding AMS 6327E

Issued 9-1-42
Revised 1-15-81

UNS G87400

STEEL BARS AND FORGINGS
0.50Cr - 0.55Ni - 0.25Mo (0.38 - 0.43C) (SAE 8740)
Heat Treated, 125,000 psi (862 MPa) Tensile Strength

1. SCOPE:

1.1 Form: This specification covers an aircraft-quality, low-alloy steel in the form of bars and forgings.

1.2 Application: Primarily for parts, such as nuts, bolts, and screws, 1.50 in. (38 mm) and under in section thickness requiring a minimum tensile strength of 125,000 psi (862 MPa).

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., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2251 - Tolerances, Low-Alloy Steel Bars
AMS 2259 - Chemical Check Analysis Limits, Wrought Low Alloy and Carbon Steels
AMS 2301 - Aircraft 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 - Control of Forgings Requiring First Article Approval
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys
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, PA 19103.

ASTM A370 - Mechanical Testing of Steel Products
ASTM E112 - Estimating the Average Grain Size of Metals
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron
ASTM E381 - Rating Macroetched Steel

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

2.3.1 Federal Standards:

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

2.3.2 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 E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Carbon	0.38	0.43
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: The product shall be supplied in the following condition:

3.2.1 Bars:

3.2.1.1 Bars 0.500 In. (12.50 mm) and Under in Nominal Diameter or Distance Between Parallel Sides: Cold finished, hardened, and tempered.

3.2.1.2 Bars Over 0.500 In. (12.50 mm) in Nominal Diameter or Distance Between Parallel Sides: Hot finished, or cold finished when so ordered, hardened, and tempered.

3.2.2 Forgings: Hardened and tempered.

3.3 Heat Treatment: Bars and forgings shall be hardened by quenching from 1550°F ± 25 (845°C ± 15) and tempered as required to meet the requirements of 3.4.4 and 3.4.5.

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

3.4.1 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, determined in accordance with ASTM E112.

3.4.2 Macrostructure: Visual examination of transverse sections as in 4.3.3 from bars, billets, or forging stock, etched in accordance with ASTM E381 in hot hydrochloric acid (1:1) at 160° - 180°F (71° - 82°C) for sufficient time to develop a well-defined macrostructure, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections shall be no worse than the following macrographs of ASTM E381:

Section Size		
Square Inches	(Square Centimetres)	Macrographs
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

3.4.3 Decarburization:

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

3.4.3.2 Decarburization of bars to which 3.4.3.1 is not applicable shall be not greater than shown in Table I.

TABLE I

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

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Depth of Decarburization Millimetre
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

3.4.3.2.1 Limits for depth of decarburization of bars over 1.500 in. (38.10 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.4.3.3 Decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale or equivalent hardness testing method on specimens cut from bars. 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.

3.4.3.3.1 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 in. (0.13 mm) and the width is 0.065 in. (1.65 mm) or less.

3.4.4 Tensile Properties: Test specimens cut from bars 1.500 in. (38.10 mm) and under in nominal diameter or distance between parallel sides and from forgings 1.500 in. (38.10 mm) and under in nominal cross section shall conform to the following requirements:

Tensile Strength, min	125,000 psi (862 MPa)
Yield Strength at 0.2% Offset, min	100,000 psi (690 MPa)
Elongation in 4D, min	16%
Reduction of Area, min	50%

3.4.4.1 Tensile properties of bars over 1.500 in. (38.10 mm) in nominal diameter or distance between parallel sides and of forgings over 1.500 in. (38.10 mm) in cross section shall be as agreed upon by purchaser and vendor.

3.4.5 Hardness: Shall be 262 - 311 HB or equivalent.

3.5 Quality:

3.5.1 Steel shall be aircraft quality conforming to AMS 2301.

3.5.2 Ø The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

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

3.5.2.2 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.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars 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).

3.7 Tolerances: Unless otherwise specified, tolerances for bars shall conform to all applicable requirements of AMS 2251.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Ø Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests 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 sample and to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Ø Acceptance Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.2.2 Ø Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed on the first-article shipment of a forging to a purchaser, when a change in material or processing requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.