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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 6290G

Issued DEC 1939
Revised JAN 1999

Superseding AMS 6290F

Submitted for recognition as an American National Standard

Steel, Bars and Forgings, Carburizing
1.8Ni - 0.25Mo (0.11 - 0.17C) (SAE 4615)

UNS G46150

1. SCOPE:

1.1 Form:

This specification covers an aircraft-quality, low-alloy steel in the form of bars, forgings, and forging stock.

1.2 Application:

These products have been used typically for carburized parts which require low minimum core hardness and allow wide hardness range in sections 0.375 inch (9.50 mm) and under in nominal thickness, but usage is not limited to such applications. The core may or may not be machinable after hardening.

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 publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2251	Tolerances, Low-Alloy Steel Bars
MAM 2251	Tolerances, Metric, Low-Alloy Steel Bars
AMS 2259	Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2301	Cleanliness, Aircraft Quality Steel Magnetic Particle Inspection Procedure
MAM 2301	Cleanliness, Aircraft Quality Steel Magnetic Particle Inspection Procedure Metric (SI) Measurement
AMS 2370	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel, Wrought Products and Forging Stock
AMS 2372	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Forgings
AMS 2806	Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

AMS 2808 Identification, Forgings

AS1182 Standard Machining Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 255 End-Quench Test for Hardenability of Steel
ASTM A 370 Mechanical Testing of Steel Products
ASTM E 112 Determining the 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 Steel Bars, Billets, Blooms, and Forgings

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 other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	Min	Max
Carbon	0.11	0.17
Manganese	0.45	0.65
Silicon	0.15	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Nickel	1.65	2.00
Molybdenum	0.20	0.30
Chromium	--	0.20
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; hardness and tensile strength shall be determined in accordance with ASTM A 370:

3.2.1 Bars:

3.2.1.1 Bars 0.500 Inch (12.70 mm) and Under in Nominal Diameter or Least Distance Between Parallel Sides: Cold finished having tensile strength not higher than 125 ksi (862 MPa) or equivalent hardness (See 8.2).

3.2.1.2 Bars Over 0.500 Inch (12.70 mm) in Nominal Diameter or Least Distance Between Parallel Sides: Hot finished, unless otherwise ordered, having hardness not higher than 229 HB, or equivalent (See 8.3). Bars ordered cold finished shall have hardness not higher than 241 HB, or equivalent.

3.2.2 Forgings: As ordered.

3.2.3 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 A 370:

3.3.1 Macrostructure: Visual examination of transverse full cross-sections from bars, billets, and forging stock, 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 230, incl	S2 - R1 - C2
Over 36 to 100, incl	Over 230 to 645, incl	S2 - R2 - C3
Over 100	Over 645	As agreed upon

3.3.2 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112 (See 8.4).

3.3.3 Hardenability: Shall be J 1/16 inch (1.588 mm) = HRC 43 maximum and J 6/16 inch (9.525 mm) = HRC 18 minimum (See 8.8), determined on the standard end-quench test specimen in accordance with ASTM A 255, except that the steel shall be normalized at 1700 °F ± 10 (927 °C ± 6) and the test specimen austenitized at 1700 °F ± 10 (927 °C ± 6).

3.4 Quality:

The product, 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 product.

3.4.1 Steel shall be aircraft-quality conforming to AMS 2301 or MAM 2301.

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

3.4.3 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings, showing no evidence of reentrant flow.

3.5 Tolerances:

Shall be as follows:

3.5.1 Bars: In accordance with AMS 2251 or MAM 2251.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), condition (3.2), macrostructure (3.3.1), average grain size (3.3.2), hardenability (3.3.3), frequency-severity cleanliness rating (3.4.1), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Grain flow of die forgings (3.4.4) is a periodic test and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be as follows: