SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 6308C

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Superseding AMS 6308B

Steel, Bars and Forgings
0.90Si - 1.0Cr - 2.0Ni - 3.2Mo - 2.0Cu - 0.10V (0.07 - 0.13C)
Vacuum Arc or Electroslag Remelted

(Composition similar to UNS K71040)

1. SCOPE:

1.1 Form:

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

1.2 Application:

These products have been used typically for highly-stressed carburized parts requiring high minimum case hardness and subject to very rigid magnetic particle inspection standards, but usage is not limited to such applications. These products are suitable for service up to 450 °F (232 °C).

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

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

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

AMS 2300	Steel Cleanliness, Premium Aircraft-Quality, Magnetic Particle Inspection Procedure
MAM 2300	Steel Cleanliness, Premium Aircraft-Quality, 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 Heat and Corrosion Resistant Steels and Alloys
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 or http://www.astm.org.

ASTM A 370	Mechanical Testing of Steel Products
ASTM A 604	Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets
ASTM E 45	Determining the Inclusion Content of Steel
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

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	0.07	0.13
Manganese	0.25	0.50
Silicon	0.60	1.20
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	0.75	1.25
Nickel	1.60	2.40
Molybdenum	3.00	3.50
Copper	1.80	2.30
Vanadium	0.05	0.15

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

3.2 Melting Practice:

Steel shall be multiple melted using either vacuum arc or electroslag practice in the remelt cycle.

3.3 Condition:

The product shall be supplied in the following condition; hardness and tensile strength shall be determined in accordance with ASTM A 370.

3.3.1 Bars:

3.3.1.1 Bars 0.500 Inch (12.70 mm) and Under in Nominal Diameter or Least Distance Between Parallel Sides: Annealed and cold-finished having tensile strength not higher than 135 ksi (931 MPa) or equivalent hardness (See 8.2).

3.3.1.2 Bars Over 0.500 Inch (12.70 mm) in Nominal Diameter or Least Distance Between Parallel Sides: Hot finished and annealed, unless otherwise ordered, having hardness not higher than 277 HB, or equivalent (See 8.3). Bars ordered annealed and cold finished may have hardness as high as 285 HB, or equivalent.

3.3.2 Forgings: Annealed.

3.3.3 Forging Stock: As ordered by the forging manufacturer.

3.4 Properties:

The product shall conform to the following requirements.

3.4.1 Macrostructure: Visual examination of transverse full cross-sections from bars, billets, and forging stock, etched in hot hydrochloric acid in accordance with ASTM A 604, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections for product 36 square inches (232 cm²) and under in nominal cross-sectional area shall be no worse than the macrographs of ASTM A 604 shown in Table 2.

TABLE 2 - Macrostructure Limits

Class	Condition	Severity
1	Freckles	A
2	White Spots	A
3	Radial Segregation	B
4	Ring Pattern	B

3.4.2 Micro-Inclusion Rating: No specimen shall exceed the limits shown in Table 3, determined in accordance with ASTM E 45, Method D.

TABLE 3 - Micro-Inclusion Rating Limits

	A Thin	A Heavy	B Thin	B Heavy	C Thin	C Heavy	D Thin	D Heavy
Worst Field Severity	2.0	1.0	1.5	1.0	1.5	1.0	1.5	1.0
Worst Field Frequency, Maximum	[a]	1	[a]	1	[a]	1	5	3
Total Rateable Fields, Frequency, maximum	[b]	1	[b]	1	[b]	1	[c]	3

[a] Combined A + B + C, no more than 3 fields.

[b] Combined A + B + C, not more than 8 fields.

[c] Any number of lower rateable D-type thin fields per specimen is permissible.

3.4.2.1 Thickness of D-type heavy shall not exceed 0.0005 inch (12.7 µm).

3.4.2.2 A rateable field is defined as one which has a type A, B, C, or D inclusion rating of at least 1.0 thin or heavy in accordance with the Jernkontoret chart, Plate III, ASTM E 45.

3.4.3 Average Grain Size of Bars: Shall be ASTM No. 6 or finer, determined in accordance with ASTM E 112.

3.4.4 Response to Heat Treatment: Product, 4.0 inches (102 mm) and under in nominal cross-section, shall have hardness not lower than 34 HRC at any location after being heated to 1675 °F ± 25 (913 °C ± 14) held at heat for 15 to 30 minutes, and quenched in oil.

3.5 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.

3.5.1 Steel shall be premium aircraft-quality conforming to AMS 2300 or MAM 2300.

3.5.2 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 surfaces.

3.5.3 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 grain flow.

3.6 Tolerances:

Bars shall conform to all applicable requirements of 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 to 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 (3.3), macrostructure (3.4.1), micro-inclusion rating (3.4.2) average grain size for bars (3.4.3), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Response to heat treatment (3.4.4), frequency-severity cleanliness rating (3.5.1), and grain flow of die forgings (3.5.3) are periodic tests 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:

4.3.1 Bars and Forging Stock: In accordance with AMS 2370.

4.3.2 Forgings: In accordance with AMS 2372.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition, macrostructure, and micro-inclusion rating of each heat, and for condition and average grain size of each lot, and stating that the product conforms to the other technical requirements. If forgings are supplied, the size and melt source of the stock used to make the forgings shall also be included.

4.5 Resampling and Retesting:

Shall be as follows:

4.5.1 Bars and Forging Stock: In accordance with AMS 2370.

4.5.2 Forgings: In accordance with AMS 2372.