



AEROSPACE MATERIAL SPECIFICATION

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

AMS 5610H

Superseding AMS 5610G

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STEEL BARS AND FORGINGS, CORROSION AND MODERATE HEAT RESISTANT
12.5Cr Low Carbon (SAE 51416F)
Free-Machining

1. SCOPE:

- 1.1 Form: This specification covers a free-machining, corrosion and moderate heat resistant steel in the form of bars, forgings, and forging stock.
- 1.2 Application: Primarily for parts requiring hardness up to 35 HRC on which the amount of machining warrants the use of a free-machining grade of steel with oxidation resistance up to 1000° F (538° C), but useful at the higher temperatures only when stresses are low.

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) 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 2241 - Tolerances, Corrosion and Heat Resistant Steel Bars and Wire
and Titanium and Titanium Alloy Bars and Wire
AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion
Resistant Steels and Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant
Alloys, Wrought Products Except Forgings
AMS 2808 - Identification, Forgings

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging,
and Other Similar Chromium-Nickel-Iron Alloys

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

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 E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

SAE Technical Board rules provide that: "All technical reports, including standards, applications, and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard, or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

	min	max
Carbon	--	0.15
Manganese (3.1.1)	--	1.25
Silicon	--	1.00
Phosphorus	--	0.060
Sulfur (3.1.1)	--	0.030
Selenium (3.1.1)	0.18 -	0.35
Chromium	11.50 -	13.50
Nickel	--	0.50
Molybdenum or Zirconium	--	0.60
Copper	--	0.50

3.1.1 Selenium may be absent, but in such case sulfur shall be present in the range of 0.15 - 0.40% and manganese may be as high as 2.5% maximum.

3.1.2 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

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 2.750 In. (69.85 mm) and Under in Diameter or Distance Between Parallel Sides and All Hexagons: Cold finished.

3.2.1.1 Bars 0.500 in. (12.70 mm) and under shall have 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) and all hexagons shall have hardness not higher than 241 HB or equivalent.

3.2.2 Bars, Other Than Hexagons, Over 2.750 In. (69.85 mm) in Diameter or Distance Between Parallel Sides: Hot finished having hardness not higher than 241 HB or equivalent.

3.2.3 Forgings: As ordered.

3.2.4 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties:

3.3.1 Response to Heat Treatment: Product 0.375 in. (9.52 mm) and less in thickness and 0.375 in. (9.52 mm) thick specimens cut from larger bars and forgings, when placed in a furnace which is at $1825^{\circ}\text{F} \pm 10$ ($996.1^{\circ}\text{C} \pm 5.6$), allowed to heat to $1825^{\circ}\text{F} \pm 10$ ($996.1^{\circ}\text{C} \pm 5.6$), held at heat for 30 min. ± 3 , and cooled in still air, shall have hardness not lower than 35 HRC, determined in accordance with ASTM A370.

3.4 Quality: The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and, consistent with the type of steel involved, from internal and external imperfections, detrimental to fabrication or to performance of parts.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, 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).

3.6 Tolerances: Unless otherwise specified, tolerances for bars shall conform to all applicable requirements of AMS 2241.

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 4.4. 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: AMS 2371.
- 4.3.2 Forgings and Forging Stock: As agreed upon by purchaser and vendor.
- 4.4 Reports:
- 4.4.1 The vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition of each heat in the shipment and the results of tests on each size from each heat to determine conformance to the hardness and response to heat treatment requirements. 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.
- 4.4.2 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.
- 4.5 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. 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.

5. PREPARATION FOR DELIVERY:

- 5.1 Identification: The product shall be identified as follows:
- 5.1.1 Bars:
- 5.1.1.1 Each straight bar 0.500 in. (12.70 mm) and over in diameter 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 5610H, 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 less than 0.500 in. (12.70 mm) in diameter or least width of flat surface shall be securely banded and identified by a metal or plastic tag embossed with the purchase order number, AMS 5610H, 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.