



AEROSPACE MATERIAL SPECIFICATION

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

AMS 5880

Issued 4-15-80
Revised

STEEL BARS AND FORGINGS, CORROSION RESISTANT
17Cr - 0.52Mo (0.95 - 1.20C) (SAE 51440C)
Bearing Quality

1. SCOPE:

- 1.1 Form: This specification covers a corrosion-resistant steel in the form of bars, wire, forgings, and forging stock.
- 1.2 Application: Primarily for anti-friction bearing parts requiring resistance to both corrosion and wear with hardness usually not lower than 58 HRC after hardening and tempering.

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 2241 - Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, 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 Steels and Alloys, Wrought Products Except Forgings and Forging Stock
- AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, 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 E45 - Determining the Inclusion Content of Steel
- ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
- ASTM E381 - Rating Macroetched Steel

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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 E353, 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	0.95	1.20
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	16.00	18.00
Molybdenum	0.40	0.65
Nickel	--	0.75
Copper	--	0.50

3.1.1 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: Shall have hardness not higher than 255 HB or equivalent.

3.2.1.1 Bars 2.750 In. (70 mm) and Under in Nominal Diameter or Distance Between Parallel Sides and All Hexagons: Cold finished.

3.2.1.2 Bars, Other Than Hexagons, Over 2.750 In. (70 mm) in Nominal Diameter or Distance Between Parallel Sides: Hot finished.

3.2.2 Wire: Cold finished having tensile strength not higher than 130,000 psi (896 MPa) or equivalent hardness.

3.2.3 Forgings: As ordered.

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 Response to Heat Treatment: Product 0.375 in. (9.50 mm) and under in nominal cross section and 0.375 in. $\pm$ 0.015 (9.50 mm $\pm$ 0.40) thick specimens cut from larger product shall have hardness not lower than 58 HRC or equivalent after being heated to 1925°F $\pm$ 25 (1050°C $\pm$ 15), held at heat for 30 min. $\pm$ 3, quenched in oil, sub-zero cooled to -100°F $\pm$ 20 (-75°C $\pm$ 10), held at temperature for 2 hr $\pm$ 0.25, and warmed in air to room temperature.

3.3.2 Grain Size: Shall be 6 or finer, with occasional grains as large as 4 permissible, determined in accordance with ASTM E112 on hardened specimens by a procedure agreed upon by purchaser and vendor.

3.3.3 Macrostructure:

3.3.3.1 Transverse: Visual examination of transverse sections as in 4.3.4 from bars, wire, billets, and 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 macrostructure standards agreed upon by purchaser and vendor.

3.3.3.2 Longitudinal: Visual examination, with the unaided eye, of longitudinal sections as in 4.3.5 from bars, wire, billets, and forging stock 10 sq. in. (65 cm²) and under in cross-sectional area, polished with 180 grit abrasive and etched in accordance with ASTM E381 in hot hydrochloric acid (1:1) at 150° - 160°F (65° - 71°C) for 25 - 30 min., shall show no streaks of carbide segregation longer than 1/8 in. (3 mm).

3.3.4 Micro-Inclusion Rating: At least one specimen as in 4.3.6 from each ingot tested, as well as two-thirds of the total number of specimens and the average of all specimens shall not exceed the following limits, determined in accordance with ASTM E45, Method A, except that the length of any inclusion shall be not greater than 0.025 in. (0.64 mm).

Type	Inclusion Rating			
	A	B	C	D
Thin	2.0	2.5	2.5	2.0
Heavy	1.5	1.5	2.0	1.5

3.3.5 Microstructure: The product shall be free of excessive carbide segregation. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.3.6 Decarburization:

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

3.3.6.2 Allowable decarburization of bars, wire, and billets ordered for redrawing or forging or to specified microstructural requirements shall be as agreed upon by purchaser and vendor.

3.3.6.3 Decarburization of bars and wire to which 3.3.6.1 or 3.3.6.2 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 0.500, incl	0.010
Over 0.500 to 1.000, incl	0.015
Over 1.000 to 1.500, incl	0.020
Over 1.500 to 2.000, incl	0.025
Over 2.000 to 2.500, incl	0.030
Over 2.500 to 3.000, incl	0.035
Over 3.000 to 4.000, incl	0.045

3.3.6.3 (continued)

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Depth of Decarburization Millimetres
Up to 12.70, incl	0.25
Over 12.70 to 25.40, incl	0.38
Over 25.40 to 38.10, incl	0.51
Over 38.10 to 50.80, incl	0.64
Over 50.80 to 63.50, incl	0.76
Over 63.50 to 76.20, incl	0.89
Over 76.20 to 101.60, incl	1.14

3.3.6.3.1 Limits for depth of decarburization of bars over 4.000 in. (101.60 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.6.4 Decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale or equivalent hardness testing method on hardened but untempered specimens protected during heat treatment to prevent changes in surface carbon content. 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.

3.3.6.4.1 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 Quality:

3.4.1 Steel shall be bearing quality.

3.4.2 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.

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

3.4.4 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, straight bars and wire 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 and wire 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 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.