SAE The Engineering Society For Advancing Mobility Land Sea Air and Space

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5621C

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Superseding AMS 5621B

STEEL BARS AND FORGINGS, CORROSION RESISTANT
13Cr (0.30-0.40C) (SAE 51420)
Annealed UNS S42000

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 parts requiring corrosion resistance and oxidation resistance up to 800°F (425°C) and hardness at room temperature within the range 40 - 50 HRC when heat treated.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications and Aerospace Standards shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 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
MAM 2241 - Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
AMS 2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron 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

2.1.1 (Continued):

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 E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

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

2.3.1 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, Ø determined by wet chemical methods in accordance with ASTM E353 or by spectrochemical or other analytical methods approved by purchaser:

	min	max
Carbon	0.30 -	0.40
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	12.00 -	14.00
Nickel	--	0.50
Molybdenum	--	0.50
Copper	--	0.50
Aluminum	--	0.05
Tin	--	0.05

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: Annealed having hardness not higher than 241 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 shall be cold finished. Ø

3.2.1.2 Bars, other than hexagons, over 2.750 in. (70 mm) in nominal diameter or distance between parallel sides shall be hot finished.

3.2.2 Wire: Cold drawn and annealed having tensile strength not higher than 115,000 psi (795 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 0.500 in. (12.50 mm) and under in nominal thickness and 0.500-in. ± 0.010 (12.50-mm ± 0.25) thick specimens cut from larger bars and forgings shall have hardness not lower than 50 HRC, or equivalent, after being heated to 1825°F ± 25 (995°C ± 15), held at heat for 30 min. ± 3, and cooled in still air. Ø

3.3.2 Decarburization:

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

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

3.3.2.3 Decarburization of bars and wire to which 3.3.2.1 or 3.3.2.2 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 0.375, 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
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

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Depth of Decarburization Millimetres
Up to 9.50, incl	0.25
Over 9.50 to 12.50, incl	0.30
Over 12.50 to 15.50, incl	0.35
Over 15.50 to 25.00, incl	0.42
Over 25.00 to 37.50, incl	0.50
Over 37.50 to 50.00, incl	0.62
Over 50.00 to 62.50, incl	0.75
Over 62.50 to 75.00, incl	0.88
Over 75.00 to 100.00, incl	1.12

3.3.2.3.1 Limits for depth of decarburization of bars over 4.000 in. (100.00 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.2.4 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.

3.3.2.4.1 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the limits of Table I by more than 0.005 in. (0.12 mm) and the width is 0.065 in. (1.65 mm) or less.

3.4 Quality:

3.4.1 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.

3.4.1.1 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.

3.4.1.2 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 imperfections exposed to the machined surfaces. Standard machining allowance shall be in accordance with AS 1182.

3.4.1.3 Forgings shall have substantially uniform macrostructure. Standards for Ø acceptance shall be as agreed upon by purchaser and vendor.

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

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 (2 - 6 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.6 Tolerances: Bars and wire shall conform to all applicable requirements of AMS 2241 or MAM 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 any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

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

4.2.2 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 prior to or on the first-article shipment of a forging to a purchaser, when a change in material, processing, or both requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, preproduction forgings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars and Wire: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374.

4.4 Approval: When specified, approval and control of forgings shall be in accordance with AMS 2375.

4.5 Reports: