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

AEROSPACE MATERIAL SPECIFICATION

AMS 5614A
Superseding AMS 5614

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UNS S41025

STEEL BARS AND FORGINGS, CORROSION AND MODERATE HEAT RESISTANT 12Cr - 0.50Mo

1. SCOPE:

1.1 Form: This specification covers a corrosion and moderate heat resistant steel in the form of bars, wire, forgings, and forging stock.

1.2 Application: Primarily for parts, such as compressor blades and vanes, requiring oxidation resistance up to 1000°F (540°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., 400 Commonwealth Drive, Warrendale, PA 15096.

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 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

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM E23 - Notched Bar Impact Testing of Metallic Materials
ASTM E340 - Macroetching Metals and Alloys
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, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

Printed in U.S.A.

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 approved analytical methods:

	min	max
Carbon	0.07	0.12
Manganese	0.30	0.60
Silicon	--	0.35
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	11.50	12.50
Molybdenum	0.40	0.60
Nickel	--	0.60
Copper	--	0.50
Aluminum	--	0.05
Tin	--	0.05
Nitrogen (3.3.1)	--	0.08

3.1.1 Determination not required for routine acceptance.

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: Hot rolled, annealed, and descaled or hot rolled, annealed, and ground having a hardness not higher than 223 HB or equivalent.

3.2.2 Wire: Cold drawn and annealed having tensile strength not higher than 115 000 psi (793 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; tensile and hardness testing shall be performed in accordance with ASTM A370:

3.3.1 Macrostructure: Visual examination of transverse sections from bars, wire, billets, and forging stock, etched in accordance with ASTM E340 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 imperfections, such as pipe, porosity, segregation, and inclusions, detrimental to fabrication or to performance of parts. Macrostructure standards shall be as agreed upon by purchaser and vendor.

3.3.2 Response to Heat Treatment: Product 0.375 in. (9.52 mm) and under in nominal thickness and specimens 0.375 in. ± 0.010 (9.52 mm ± 0.25) thick cut from larger product shall have hardness of 217 - 248 HB or equivalent after being hardened by heating to 1750°F ± 10 (955°C ± 5), holding at heat for 25 - 30 min., and cooling in air and tempered by heating to a temperature not lower than 1100°F (595°C), holding at heat for 60 min. ± 5, and cooling in air.

3.3.3 Tensile Properties: Tensile test specimens, heat treated as in 3.3.2, shall have the following properties:

Tensile Strength, min	100,000 psi (680 MPa)
Yield Strength at 0.2% Offset, min	80,000 psi (552 MPa)
Elongation in 4D, min	21%
Reduction of Area, min	60%

3.3.4 Impact Properties: Izod test specimens conforming to ASTM E23, Type D, prepared from product heat treated as in 3.3.2, shall have an impact value of not less than 50 ft-lb (68 J).

3.4 Quality: 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.

3.5 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 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 perform such confirmatory testing as he deems 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 lot.

4.2.2 Preproduction Tests: Tests of forgings to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed on the first-article shipment of a forging to a purchaser, when a change in material or processing requires re-approval, or when purchaser deems confirmatory testing is 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:

4.5.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat and the results of tests on each size from each heat to determine conformance to the other technical requirements of this specification. 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.