NOTICE OF
ADOPTION

ADOPTION NOTICE
20 December 1991
AMS 5719B
1 July 1990
SUPERSEDING
AMS 5719A
3 August 1987

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Title of Document: Steel Bars, Wire, Forgings, Tubing, Rings, and Extrusions, Corrosion Resistant
11.8Cr - 2.5Ni - 1.8Mo - 0.33V (0.08 - 0.15C)
Annealed, Consumable Electrode Vacuum Melted

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The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-5719 REV B

Issued 1970-11-01
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Superseding AMS-5719A

Submitted for recognition as an American National Standard

STEEL BARS, WIRE, FORGINGS, TUBING, RINGS, AND EXTRUSIONS, CORROSION RESISTANT 11.8Cr - 2.5Ni - 1.8Mo - 0.33V (0.08 - 0.15C) Annealed, Consumable Electrode Vacuum Melted

UNS S64152

1. SCOPE:

1.1 Form: This specification covers a premium aircraft-quality corrosion-resistant steel in the form of bars, wire, forgings, mechanical tubing, flash welded rings, extrusions, and stock for forging, flash welded rings, or extruding.

1.2 Application: Primarily for parts, such as compressor wheels and structural members, requiring high strength and oxidation resistance up to 800°F (427°C).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the latest issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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-2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing
MAM-2243 - Tolerances, Metric, Corrosion and Heat Resistant Steel Tubing
AMS-2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS-2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM-2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
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-2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys
AMS-2808 - Identification, Forgings
AMS-7493 - Rings, Flash Welded, Non-Austenitic Corrosion Resistant Steels

2.1.2 Aerospace Standards:

AS1182 - Standard Machining Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Products

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 370 - Mechanical Testing of Steel Products
ASTM A 604 - Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets
ASTM E 112 - Determining Average Grain Size
ASTM E 292 - Conducting Time-For-Rupture Notch Tensile Tests of Materials
ASTM E 353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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 E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	0.08	0.15
Manganese	0.50	0.90
Silicon	--	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	11.00	12.50
Nickel	2.00	3.00
Molybdenum	1.50	2.00
Vanadium	0.25	0.40
Nitrogen	0.01	0.05
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:

3.2.1 Bars:

3.2.1.1 Rounds: Annealed and centerless ground, turned, or polished.

3.2.1.2 Hexagons: Annealed and cold finished.

3.2.1.3 Squares and Rectangles: Annealed and descaled.

3.2.2 Wire: Cold drawn, annealed, and cold finished.

3.2.3 Forgings, Flash Welded Rings, and Extrusions: Annealed and descaled.

3.2.3.1 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS-7493.

3.2.4 Mechanical Tubing: Cold finished and annealed.

3.2.5 Stock for Forging, Flash Welded Rings, or Extruding: As ordered by the forging, flash welded ring, or extrusion manufacturer.

3.3 Heat Treatment: Bars, wire, forgings, flash welded rings, extrusions, and mechanical tubing shall be annealed by heating to 1275°F ± 20 (691°C ± 11), holding at heat for not less than 6 hours, and cooling in air.

3.4 Properties: The product shall conform to the following requirements; tensile, hardness, and impact testing shall be performed in accordance with ASTM A 370:

3.4.1 The Product:

3.4.1.1 Macrostructure: Visual examination of transverse sections as in 4.3.3 Ø from bars, billets, tube rounds or tubes, and stock for forging, flash welded rings, or extruding, etched in accordance with ASTM A 604, shall show no pipe or cracks. Except as specified in 3.4.1.1.1, porosity, segregation, inclusions, and other imperfections for product 36 square inches (232 cm^2) and under in nominal cross-sectional area shall be no worse than the following macrographs of ASTM A 604; macrostructure standards for product over 36 square inches (232 cm^2) in cross-sectional area shall be as agreed upon by purchaser and vendor:

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

3.4.1.1.1 If tubes are produced directly from ingots or large blooms, transverse sections may be taken from tubes rather than tube rounds. Macrostructure standards for such tubes shall be as agreed upon by purchaser and vendor.

3.4.2 Bars, Wire, Forgings, Mechanical Tubing, Flash Welded Rings, and Extrusions:

3.4.2.1 As Annealed:

3.4.2.1.1 Bars, Forgings, Mechanical Tubing, Flash Welded Rings, and Extrusions: Shall have hardness not higher than 311 HB, or equivalent.

3.4.2.1.2 Wire: Shall have tensile strength not higher than 155,000 psi Ø (1069 MPa).

3.4.2.2 After Hardening and Double Tempering: Product 7.00 inches (177.8 mm) and under in nominal diameter or least distance between parallel sides shall have the following properties after being hardened by heating to 1925°F ± 25 (1052°C ± 14), holding at heat for not less than 30 minutes, and quenching in oil and double tempered by heating to a temperature within the range 1040° - 1075°F (560° - 579°C), holding at the selected temperature within ±15°F (±8°C) for not less than 60 minutes, cooling in air to room temperature, reheating to a temperature within the range 1000° - 1040°F (538° - 560°C), holding at the selected temperature within ±15°F (±8°C) for not less than 3 hours, and cooling in air; property requirements for product over 7.00 inches (177.8 mm) in nominal diameter or least distance between parallel sides shall be as agreed upon by purchaser and vendor:

3.4.2.2.1 Tensile Properties:

3.4.2.2.1.1 Smooth Bar: Shall be as follows; determined in either the longitudinal or transverse direction except that testing in the transverse direction applies only to product from which a tensile specimen not less than 2.50 inches (63.5 mm) in length can be obtained. Testing in the longitudinal direction is not required on product tested in the transverse direction.

Tensile Strength, minimum	155,000 psi (1069 MPa)
Yield Strength at 0.2% Offset, minimum	130,000 psi (896 MPa)
Elongation, minimum	
in 4D	12%
in 5D	9%
Reduction of Area, minimum	30%

3.4.2.2.1.2 Notched Bar: Shall be not less than 1.4 times the smooth-bar Ø tensile strength, determined on specimens machined to the dimensions shown in ASTM E 292.

3.4.2.2.2 Hardness: Should be 341 - 375 HB, or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.2.1.1 are met.

3.4.2.2.3 Charpy Impact Value: Shall be not less than 30 foot-pounds (41 J), Ø determined on the V-notched specimen at room temperature.

3.4.2.2.4 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E 112.

3.4.3 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 3.3 and 3.4.2.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.2.2.1, 3.4.2.2.2, and 3.4.2.2.4. If specimens taken from the stock after heat treatment as in 3.3 and 3.4.2.2 conform to the requirements of 3.4.2.2.1, 3.4.2.2.2, and 3.4.2.2.4, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4.4 Stock for Flash Welded Rings or Extruding: A sample of stock heat treated as in 3.3 and 3.4.2.2 shall conform to the requirements of 3.4.2.2.1, 3.4.2.2.2, and 3.4.2.2.4.

3.5 Quality:

3.5.1 Steel shall be premium aircraft-quality conforming to AMS-2300 or MAM-2300; it shall be multiple melted using consumable electrode vacuum practice in the remelt cycle.

3.5.2 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.

3.5.2.1 Bars, mechanical tubing, and flash welded rings ordered ground, turned, or polished shall be free from seams, laps, tears, and cracks open to the ground, turned, or polished surfaces.

3.5.2.2 Product ordered to surface conditions other than ground, turned, or polished shall, after removal of the standard machining allowance in accordance with AS1182, be free from seams, laps, tears, cracks, and other defects exposed to the machined 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 re-entrant grain flow.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars, wire, mechanical tubing, and extrusions will be acceptable in mill lengths of 6 - 20 feet (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).

3.7 Tolerances: Shall conform to all applicable requirements of the following:

3.7.1 Bars and Wire: AMS-2241 or MAM-2241.

3.7.2 Mechanical Tubing: AMS-2243 or MAM-2243.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all Ø samples for vendor's tests and shall be responsible for performing all required tests. 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 for the following requirements are acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1.1 Composition (2.1), macrostructure (3.4.1.1), and frequency/severity cleanliness rating (3.5.1) of each heat.

4.2.1.2 Hardness (3.4.2.1.1) of each lot of bars, forgings, mechanical tubing, flash welded rings, and extrusions as annealed.

4.2.1.3 Tensile strength (3.4.2.1.2) of each lot of wire as annealed.

4.2.1.4 Tensile properties (3.4.2.2.1), hardness (3.4.2.2.2), and grain size (3.4.2.2.4) of each lot of bars, wire, forgings, mechanical tubing, flash welded rings, and extrusions after hardening and double tempering as in 3.4.2.2.

4.2.1.5 Tolerances (3.7) of bars, wire, and mechanical tubing.

4.2.2 Periodic Tests: Tests for the following requirements are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser:

4.2.2.1 Charpy impact value (3.4.2.2.3) of each lot of bars, wire, forgings, mechanical tubing, flash welded rings, and extrusions after hardening and double tempering as in 3.4.2.2.

4.2.2.2 Ability of forging stock (3.4.3) and of stock for flash welded rings or extruding (3.4.4) to develop required properties.

4.3 Sampling and Testing: Shall be in accordance with the following; a heat Ø shall be the consumable electrode remelted ingots produced from steel originally melted as a single furnace charge.

4.3.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, Extrusions, and Stock for Flash Welded Rings or Extruding: AMS-2371.

4.3.2 Forgings and Forging Stock: AMS-2374.

4.3.3 Samples for macrostructure rating (3.4.1.1) shall be full cross-sectional specimens obtained from the finished billet or suitable rerolled product representing the top and bottom of at least the first, middle, and last usable ingot of each heat.

4.4 Reports:

4.4.1 The vendor of bars, wire, forgings, mechanical tubing, flash welded rings, and extrusions shall furnish with each shipment a report showing the results of tests for chemical composition, macrostructure, and frequency-severity cleanliness rating of each heat and the results of tests to determine conformance to the other acceptance test requirements. This report shall include the purchase order number, lot number, AMS-5719B, size, and quantity. 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 stock for forging, flash welded rings, or extruding shall Ø furnish with each shipment a report showing the results of tests for chemical composition and frequency-severity cleanliness rating of each heat. This report shall include the purchase order number, heat number, AMS-5719B, size, and quantity.

4.5 Resampling and Retesting: Shall be in accordance with the following:

4.5.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, Extrusions, and Stock for Flash Welded Rings or Extruding: AMS-2371.

4.5.2 Forgings and Forging Stock: AMS-2374.