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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5718A

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Superseding AMS 5718

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

UNS S64152

1. SCOPE:

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

1.2 Application: Primarily for parts, such as compressor wheels and structural members, requiring high strength and oxidation resistance up to 800°F (425°C).

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 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 2303 - Aircraft Quality Steel Cleanliness, Martensitic Corrosion Resistant Steels, Magnetic Particle Inspection Procedure
MAM 2303 - Aircraft Quality Steel Cleanliness, Martensitic Corrosion Resistant Steels, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
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
AMS 7493 - Rings, Flash Welded, Non-Austenitic Corrosion Resistant Steels

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 E112 - Determining Average Grain Size
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E381 - Macroetch Testing, Inspection, and Rating Steel Products, Comprising Bars, Billets, Blooms, and Forgings

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 spectrographic or other analytical methods approved by 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 Bars Other than Rounds or Hexagons: Annealed and descaled.

3.2.2 Wire: 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, they shall be manufactured in accordance with AMS 7493.

3.2.4 Mechanical Tubing: Cold finished and annealed.

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

3.3 Heat Treatment: Bars, wire, forgings, flash welded rings, extrusions, and mechanical tubing shall be annealed by heating to 1275°F ± 20 (690°C ± 10), holding at heat for not less than 6 hr, and cooling in air.

3.4 Properties: The product shall conform to the following requirements; tensile and hardness testing shall be performed in accordance with ASTM A370:

3.4.1 Macrostructure: Visual examination of transverse sections as in 4.3.3 from bars, billets, tube rounds or tubes, and stock for forging or flash welded rings, etched in accordance with ASTM E381 in hot hydrochloric acid at 160° - 180°F (70° - 80°C) for sufficient time to develop a well-defined macrostructure, shall show no pipe or cracks. Except as specified in 3.4.1.1, porosity, segregation, inclusions, and other imperfections shall be no worse than standards agreed upon by purchaser and vendor.

3.4.1.1 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 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 E112.

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

3.4.3.1 As Annealed:

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

3.4.3.1.2 Wire: Shall have tensile strength not higher than 155,000 psi (1070 MPa).

3.4.3.2 After Hardening and Tempering: Specimens taken from bars, wire, extrusions, and tubing, from forgings with axis in the longitudinal direction, and from parent metal of flash welded rings shall have the following properties after being hardened by heating to 1925°F ± 25 (1050°C ± 15), holding at heat for not less than 30 min., and cooling as required to room temperature and tempered by heating to 1200°F ± 25 (650°C ± 15), holding at heat for not less than 2 hr, and cooling in air to room temperature:

3.4.3.2.1 Tensile Properties:

Tensile Strength, min	135,000 psi (930 MPa)
Yield Strength at 0.2% Offset, min	110,000 psi (760 MPa)
Elongation in 4D, min	17%
Reduction of Area, min	30%

3.4.3.2.2 Hardness: Should be 286 - 331 HB, or equivalent, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.3.2.1 are met.

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3.4.4 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 3.3 and 3.4.3.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.3.2.1 and 3.4.3.2.2. If specimens taken from the stock after heat treatment as in 3.3 and 3.4.3.2 conform to the requirements of 3.4.3.2.1 and 3.4.3.2.2, the tests shall be accepted as equivalent to tests of the forged coupon.

3.4.5 Stock for Flash Welded Rings: Specimens taken from the stock after heat treatment as in 3.3 and 3.4.3.2 shall conform to the requirements of 3.4.3.2.1 and 3.4.3.2.2.

3.5 Quality:

3.5.1 Steel shall be aircraft quality conforming to AMS 2303 or MAM 2303.

3.5.2 Ø 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, 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, 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.

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

3.6 Ø Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars, wire, and mechanical tubing 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).

3.7 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 Ø 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 the following requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Composition (3.1), macrostructure (3.4.1), and grain size (3.4.2) of each heat.

4.2.1.2 Tensile properties (3.4.3.2.1) and hardness (3.4.3.2.2) of each lot of bars, wire, forgings, mechanical tubing, extrusions, and flash welded rings after hardening and tempering.

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

4.2.2 Periodic Tests: Tests of forging stock (3.4.4) and of stock for flash welded rings (3.4.5) to demonstrate ability to develop required properties are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 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.

4.2.3.1 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, Wire, Mechanical Tubing, Extrusions, Flash Welded Rings, and Stock for Flash Welded Rings: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374 and as follows:

4.3.2.1 Samples for macrostructure (3.4.1) testing 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.

4.3.2.2 Specimens for tensile tests of forgings shall be cut from any plane perpendicular to the axis of the forging with axis of specimen in the selected plane perpendicular to a radius. When size and shape permit, additional specimens shall be cut with the axis of specimen approximately parallel to the axis of the forging. Size, location, and number of specimens shall be as agreed upon by purchaser and vendor.