



AEROSPACE MATERIAL SPECIFICATION

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

AMS 5764 A
Superseding AMS 5764

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STEEL BARS, FORGINGS, EXTRUSIONS, AND RINGS, CORROSION RESISTANT
5Mn - 22Cr - 12.5Ni - 2.2Mo - 0.20Cb - 0.30N - 0.20V

1. SCOPE:

- 1.1 **Form:** This specification covers a corrosion resistant steel in the form of bars, wire, forgings, extrusions, flash welded rings, and stock for forging, extruding, or flash welded rings.
- 1.2 **Application:** Primarily for parts requiring excellent corrosion resistance and high strength at temperatures from -423° to $+1100^{\circ}$ F (-253° to $+593^{\circ}$ C). Can also be used for welded parts without subsequent heat treatment.

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 2375 - Approval and Control of Critical Forgings
- AMS 2808 - Identification, Forgings
- AMS 7490 - Rings, Flash Welded, Corrosion and Heat Resistant Austenitic Steels and Austenitic-Type Alloys

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

- ASTM A262 - Detecting Susceptibility to Intergranular Attack in Stainless Steels
- 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 **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

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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	--	0.06
Manganese	4.00 -	6.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	20.50 -	23.50
Nickel	11.50 -	13.50
Molybdenum	1.50 -	3.00
Columbium	0.10 -	0.30
Nitrogen	0.20 -	0.40
Vanadium	0.10 -	0.30
Titanium (3.1.1)	--	0.02
Aluminum (3.1.1)	--	0.02
Zirconium (3.1.1)	--	0.02

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:

3.2.1 Bars:

3.2.1.1 Rounds: Centerless ground or turned after solution heat treatment.

3.2.1.2 Hexagons: Cold drawn after solution heat treating and descaling.

3.2.1.3 Squares and Flats: Hot finished, solution heat treated, and descaled.

3.2.2 Wire: Cold drawn or centerless ground after solution heat treatment.

3.2.3 Forgings and Flash Welded Rings: Solution heat treated 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 7490.

3.2.4 Extrusions: Solution heat treated, straightened, and descaled.

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

3.3 Heat Treatment: The product shall be solution heat treated by heating to $1950^{\circ}\text{F} \pm 25$ ($1065.6^{\circ}\text{C} \pm 14$), holding at heat for a time commensurate with section thickness, and cooling at a rate equivalent to air cool or faster.

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

3.4.1 Bars, Wire, Forgings, Extrusions, and Flash Welded Rings:

3.4.1.1 Tensile Properties: Shall be as follows:

Tensile Strength, min	100,000 psi (690 MPa)
Yield Strength at 0.2% Offset, min	55,000 psi (379 MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	35%
Reduction of Area (round specimens) min	55%

3.4.1.2 Hardness: Should be not lower than 20 HRC or equivalent but the product shall not be rejected on the basis of hardness if the tensile properties are met.

3.4.1.3 Embrittlement: The product, after sensitizing treatment, shall pass the copper/copper sulfate/ \emptyset sulfuric acid test performed in accordance with ASTM A262, Practice E, without evidence of intergranular surface attack. After exposure, specimens shall not crack when bent 180 deg (3.14 rad) around a diameter equal to the nominal thickness or diameter of the specimen.

3.4.2 Stock for Forging, Extruding, or Flash Welded Rings: When a sample of stock is forged to a test coupon and heat treated as in 3.3, specimen taken from the heat treated coupon shall conform to the requirements of 3.4.1.1 and 3.4.1.2. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1 and 3.4.1.2, the tests shall be accepted as equivalent to tests of the forged coupon.

3.5 Quality: The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

3.6 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).

3.7 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 the specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following are classified as acceptance or routine control tests:

4.2.1.1 Tests of the product to determine conformance to composition (3.1) requirements.

4.2.1.2 Tests of bars, wire, forgings, extrusions, and flash welded rings to determine conformance to tensile property (3.4.1.1) and hardness (3.4.1.2) requirements.

4.2.1.3 Tests of bars and wire to determine conformance to tolerance (3.7) requirements.

4.2.2 Qualification Tests: The following are classified as qualification or periodic control tests:

4.2.2.1 Tests of bars, wire, forgings, extrusions, and flash welded rings to determine conformance to embrittlement (3.4.1.3) requirements.

4.2.2.2 Tests of stock for forging, extruding, or flash welded rings to demonstrate ability to develop required properties (3.4.2).

4.2.3 For direct U. S. Military procurement, qualification test material and supporting test data shall be submitted to the cognizant qualification agency as directed by the request for procurement, the procuring activity, or the contracting officer.

4.3 Sampling: Shall be in accordance with the following:

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

4.3.2 Forgings and Forging Stock: As agreed upon by purchaser and vendor.

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 in the shipment and for tensile properties and hardness of each size from each heat and stating that the product conforms 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.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars and Wire:

5.1.1.1 Each straight bar over 0.500 in. (12.70 mm) in nominal diameter or least width of flat surface shall be marked in a row of characters recurring at intervals not greater than 3 ft (914 mm) with AMS 5764A, heat number, and manufacturer's identification. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

5.1.1.2 Straight bars and wire 0.500 in. (12.70 mm) and under in nominal diameter or least width of flat surface shall be securely bundled and identified by a durable tag marked with the purchase order number, AMS 5764A, heat number, nominal size, and manufacturer's identification and attached to each bundle or shall be boxed and the box marked with the same information.