Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 5639C
Superseding AMS 5639B
Issued 6-15-53
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STEEL BARS, FORGINGS, TUBING, AND RINGS, CORROSION RESISTANT
19Cr - 9.5Ni (SAE 30304)

1. SCOPE:

1.1 Form: This specification covers a corrosion-resistant steel in the form of bars, wire, forgings, mechanical tubing, flash welded rings, and stock for forging or flash welded rings. Welding, brazing, or other exposure to temperatures over 800 F (427 C) during fabrication may impair corrosion resistance.

1.2 Application: Primarily for parts requiring corrosion and heat 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 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., Two Pennsylvania Plaza, New York, New York 10001.

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 2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing
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, Pennsylvania 19103.

ASTM A370 - Mechanical Testing of Steel Products
ASTM A393 - Conducting Acidified Copper Sulfate Test for Intergranular Attack in Austenitic Stainless Steel
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, Pennsylvania 19120.

2.3.1 Federal Standards:

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

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	--	0.08
Manganese	--	2.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	18.00	20.00
Nickel	8.00	12.00
Molybdenum	--	0.75
Copper	--	0.75

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

3.2 Condition:

3.2.1 Bars, Wire, Forgings, Mechanical Tubing and Flash Welded Rings: Solution heat treated free from continuous carbide network.

3.2.1.1 Bars and Wire: All hexagons, other bars 2.75 in. (69.85 mm) and under in diameter or distance between parallel sides, and wire shall be cold finished.

3.2.1.2 Mechanical Tubing: Shall be cold finished.

3.2.1.3 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.

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

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

3.3.1 Tensile Properties: Wire shall have tensile strength not higher than 125,000 psi (862 MPa) or Ø equivalent.

3.3.2 Hardness:

3.3.2.1 Bars: Shall be as follows, or equivalent, determined approximately midway between outer surface and center:

Nominal Diameter or Distance Between Parallel Sides		
Inches	(Millimeters)	Brinell Hardness
Up to 0.75, incl	(Up to 19.05, incl)	170 - 255
Over 0.75	(Over 19.05)	140 - 241

3.3.2.2 Mechanical Tubing: Shall be not higher than 90 HRB or equivalent, determined approximately midway between outer and inner surfaces.

3.3.2.3 Forgings and Flash Welded Rings: Shall be not higher than 187 HB or equivalent.

3.3.3 Embrittlement: The product, as received, shall be capable of being exposed to acidified copper sulfate in accordance with ASTM A393 without evidence of intercrystalline surface attack. After exposure, specimens shall not crack when bent 180 deg (3.14 rad) around a diameter equal to the thickness or diameter of the specimen.

3.4 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.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, bars, straight wire, and tubing 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 shall conform to all applicable requirements of the following:

3.6.1 Bars and Wire: AMS 2241.

3.6.2 Mechanical Tubing: AMS 2243.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor 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 assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Routine Control Tests: Tests to determine conformance to composition (3.1), condition (3.2), tensile property (3.3.1), hardness (3.3.2), and tolerance (3.6) requirements are classified as routine control tests.

4.2.2 Periodic Control Tests: Tests to determine conformance to embrittlement (3.3.3) requirements are classified as qualification and/or periodic control tests.

4.3 Sampling: Bars, wire, mechanical tubing, flash welded rings, and stock for flash welded rings shall be sampled in accordance with AMS 2371. Forgings and forging stock shall be sampled as agreed upon by purchaser and vendor.

4.4 Approval: When specified, approval and control of critical 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 of the results of tests for chemical composition of each heat in the shipment and the results of tests on each size from each heat to determine conformance to the tensile property and hardness requirements. 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, Wire, and Tubing:

5.1.1.1 Each straight bar and tube 0.500 in. (12.70 mm) and over in OD 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 5639C, 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, wire, and tubes less than 0.500 in. (12.70 mm) in OD or least width of flat surface shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 5639C, 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.

5.1.1.3 Coiled bars and wire shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 5639C, heat number, nominal size, and manufacturer's identification and attached to each coil or shall be boxed and the box marked with the same information.

5.1.2 Forgings: In accordance with AMS 2808.

5.1.3 Flash Welded Rings and Stock for Forging or Flash Welded Rings: As agreed upon by purchaser and vendor.

5.2 Packaging: The product shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate where technical changes have been made in this specification over the previous issue.