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

AEROSPACE MATERIAL SPECIFICATION

AMS 5656A
Superseding AMS 5656

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UNS S21904

STEEL BARS, FORGINGS, AND RINGS, CORROSION RESISTANT
9.0Mn - 20Cr - 6.5Ni - 0.27N

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 high strength and corrosion resistance from -425° F (-255° C) up to 1100° F (595° C) and where parts may require welding during fabrication.

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
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 A370 - Mechanical Testing of Steel Products
ASTM A708 - Detection of Susceptibility to Intergranular Corrosion in Severely Sensitized 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, 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

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	--	0.04
Manganese	8.00	10.00
Silicon	--	1.00
Phosphorus	--	0.060
Sulfur	--	0.030
Chromium	19.00	21.50
Nickel	5.50	7.50
Nitrogen	0.15	0.40

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: Hot rolled, solution heat treated, and descaled.

3.2.1.1 Round bars shall be ground or turned.

3.2.2 Wire: Cold finished and solution heat treated.

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

3.3 Heat Treatment: Bars, wire, forgings, extrusions, and flash welded rings shall be solution heat treated by heating to 1950° F ± 25 (1065° C ± 15), 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; tensile and hardness 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	90,000 psi (621 MPa)
Yield Strength at 0.2% Offset, min	50,000 psi (345 MPa)
Elongation in 4D, min	40%

3.4.1.2 Hardness: Shall be not higher than 100 HRB or equivalent.

3.4.1.3 Embrittlement: The product, after being sensitized by heating in air to 1250°F ± 10 (675°C ± 5), holding at heat for 60 min. ± 5, and cooling in air, shall show no evidence of intercrystalline surface attack when immersed in acidified copper sulfate solution in accordance with ASTM A708. After immersion, specimens shall withstand, without cracking, bending in accordance with ASTM A708.

3.4.2 Stock for Forging, Extruding, or Flash Welded Rings: Shall have properties as agreed upon by purchaser and vendor.

3.5 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.

3.6 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 this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The following are classified as acceptance 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 Periodic Tests: Tests of bars, wire, forgings, extrusions, and flash welded rings to determine conformance to embrittlement (3.4.1.3) requirements are classified as periodic tests.

4.2.3 Preproduction Tests: Tests of forgings to determine conformance to all technical requirements of this specification are classified as preproduction tests.

4.2.3.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, preproduction test 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, Extrusions, Flash Welded Rings, and Stock for Extruding or Flash Welded Rings: AMS 2371.

4.3.1.1 Specimens for tensile tests of flash welded rings shall be cut from parent metal not including the weld-heat-affected zone.

ø 4.3.2 Forgings and Forging Stock: AMS 2374.

ø 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 for tensile property and hardness requirements of each size from each heat. 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 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: Shall be in accordance with the following:

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

ø 4.6.2 Forgings and Forging Stock: AMS 2374.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

ø 5.1.1 Bars, Wire, and Extrusions: In accordance with AMS 2806.

5.1.2 Forgings: In accordance with AMS 2808.

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

5.2 Packaging:

5.2.1 The product shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.2.2 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-163, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 will be acceptable if it meets the requirements of Level C.

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.