



AEROSPACE MATERIAL

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

SPECIFICATION

AMS 5772

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Revised

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
Cobalt Base - 22Cr - 22Ni - 14.5W - 0.07La

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant cobalt base alloy in the form of bars, forgings, flash welded rings, and stock for forging or flash welded rings.

1.2 Application: Primarily for parts requiring high strength up to 1800 F (982 C) and oxidation resistance up to 2000 F (1093 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 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys

AMS 2261 - Tolerances, Nickel, Nickel Base, and Cobalt Base Alloy Bars and Wire

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 E8 - Tension Testing of Metallic Materials

ASTM E10 - Brinell Hardness of Metallic Materials

ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM E139 - Conducting Creep and Time-for-Rupture Tension Tests of Materials

ASTM E354 - Chemical Analysis of High Temperature, Electrical, Magnetic, and Other
Similar Iron, Nickel, and Cobalt-Base Alloys

2.3 Government Publications: Available from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

2.3.1 Federal Standards:

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

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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 E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods.

	min	max
Carbon	0.05	0.15
Manganese	--	1.25
Silicon	0.20	0.50
Phosphorus	--	0.020
Sulfur	--	0.015
Chromium	20.00	24.00
Nickel	20.00	24.00
Tungsten	13.00	16.00
Lanthanum	0.03	0.12
Boron	--	0.015
Iron	--	3.00
Cobalt	remainder	

- 3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248; check analysis limits for lanthanum shall be 0.00 under min or 0.01 over maximum.

- 3.2 Condition: The product shall be supplied in the following condition:

- 3.2.1 Bars, Forgings, and Flash Welded Rings: Solution heat treated and descaled.

- 3.2.1.1 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.

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

- 3.3 Heat Treatment: Bars, forgings, and flash welded rings shall be solution heat treated by heating to $2150\text{ F} \pm 25$ (1176.7 ± 14), holding at heat for not less than 15 min., and cooling at a rate which will produce material meeting the requirements of 3.4.1.1, 3.4.1.2, and 3.4.1.3.

- 3.3.1 Any thermal treatment following solution heat treatment as in 3.3 shall not involve use of temperatures higher than $2050\text{ F} \pm 25$ ($1120.6\text{ C} \pm 14$).

- 3.4 Properties:

- 3.4.1 Bars, Forgings, and Flash Welded Rings:

- 3.4.1.1 Tensile Properties: Specimens taken in the longitudinal direction from bars, in the circumferential direction from parent metal of flash welded rings, and from forgings in locations agreed upon by purchaser and vendor shall conform to the following, determined in accordance with ASTM E8:

Tensile Strength, min	125,000 psi (862 MN/m ²)
Yield Strength at 0.2% Offset, min	55,000 psi (379 MN/m ²)
Elongation in 2 in. (50.8 mm) or 4D, min	45%

- 3.4.1.2 Hardness: Shall be as follows, determined in accordance with ASTM E10:

- 3.4.1.2.1 Bars: Not higher than 302 HB or equivalent, determined approximately midway between center and surface.

- 3.4.1.2.2 Forgings and Flash Welded Rings: Not higher than 293 HB or equivalent.
- 3.4.1.3 Stress-Rupture Test at 1700 F (926.7 C): A tensile test specimen, maintained at $1700\text{ F} \pm 3$ ($926.7\text{ C} \pm 1.7$) while a load sufficient to produce an initial axial stress of 13,000 psi (90 MN/m^2) is applied continuously to specimens from bars and flash welded rings and of 12,000 psi (83 MN/m^2) is similarly applied to specimens from forgings, shall not rupture in less than 23 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 15% in 4D. Test shall be conducted in accordance with ASTM E139.
- 3.4.1.3.1 The test of 3.4.1.3 may be conducted using a load higher than required to produce the applicable initial axial stress specified in 3.4.1.3 but load shall not be changed while test is in process. Time to rupture and elongation requirements shall be as specified in 3.4.1.3.
- 3.4.1.3.2 When permitted by purchaser, the test of 3.4.1.3 may be conducted using incremental loading. In such case, the load required to produce the applicable initial axial stress specified in 3.4.1.3 shall be used to rupture or for 48 hr, whichever occurs first. After the 48 hr and at intervals of 8 - 16 hr, preferably 8 - 10 hr, thereafter, the stress shall be increased in increments of 2000 psi (14 MN/m^2). Time to rupture and elongation requirements shall be as specified in 3.4.1.3.
- 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, bars will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any order shall be supplied in lengths shorter than 10 ft (3m).
- 3.7 Tolerances: Unless otherwise specified, tolerances for bars shall conform to all applicable requirements of AMS 2261.
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 assure that material conforms to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as routine control tests.
- 4.3 Sampling: Bars, 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, hardness, and stress-rupture requirements of this specification. This report shall include the purchase order number, heat number, material specification number, size, and quantity from each heat. If forgings are supplied, the part number and size of stock used to make the forgings shall also be included.