SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York, N.Y. 10017

AEROSPACE MATERIAL SPECIFICATIONS

AMS 5634

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Revised

ALLOY BARS AND FORGINGS, CORROSION AND HEAT RESISTANT
Iron Base - 13.3Cr - 38Ni - 5.5Mo - 0.85Cb - 2.5Ti - 1.6Al
Solution and Precipitation Heat Treated

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. FORM: Bars, forgings, and forging stock.

3. APPLICATION: Primarily for parts, such as turbine discs, shafts, spacers, dowels, and fittings requiring high strength up to 1400 F (760 C) and oxidation resistance up to 1600 F (871 C).

4. COMPOSITION:

	min	max
Carbon	0.02	0.08
Manganese	--	0.25
Silicon	--	0.25
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	12.50	14.00
Nickel	36.50	39.50
Molybdenum	5.00	6.00
Columbium	0.60	1.10
Titanium	2.30	2.70
Aluminum	1.45	1.75
Boron	0.003	0.015
Iron	remainder	

4.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2248. Check analysis limits for nickel shall be 0.25 under min or over max and for molybdenum shall be 0.10 under min or over maximum.

5. CONDITION:

5.1 Bars and Forgings: Solution and precipitation heat treated as in 6.1.1.

5.1.1 Bars 2.75 in. and less in diameter or distance between parallel sides shall be cold finished.

5.1.2 Forgings shall be descaled, unless otherwise specified.

5.2 Forging Stock: As ordered by the forging manufacturer.

6. TECHNICAL REQUIREMENTS:

6.1 Bars and Forgings:

6.1.1 Heat Treatment: The product shall be solution treated by heating to 1875 F ± 25 (1023.9 C ± 14), holding at heat for 1 hr, and quenching in oil or water and then shall be precipitation heat treated by heating to 1450 F ± 25 (787.8 C ± 14), holding at heat for 16 hr, air cooling, reheating to 1200 F ± 25 (648.9 C ± 14), holding at heat for 16 hr, and air cooling. Furnace cooling from 1450 F (787.8 C) to 1200 F (648.9 C) may be substituted for air cooling and subsequent reheating.

6.1.2 Tensile Properties at Room Temperature:

Tensile Strength, psi	183,000 min
Yield Strength at 0.2% Offset or at 0.0128 in. in 2 in. Extension Under Load (E = 28,900,000) psi	127,000 min
Elongation, % in 2 in. or 4D	11 min
Reduction of Area, %	15 min

6.1.3 Tensile Properties at 1200 F (648.9 C): Test specimens shall be heated to 1200 F ± 10 (648.9 C ± 5.6), held at heat for 30 min. before testing, and tested at 1200 F ± 10 (648.9 C ± 5.6) at a strain rate of 0.003 - 0.007 in. per in. per min. to the yield strength and at a rate of 0.03 - 0.07 in. per in. per min. above the yield strength.

Tensile Strength, psi	155,000 min
Yield Strength at 0.2% Offset or at 0.0152 in. in 2 in. Extension Under Load (E = 22,700,000), psi	127,000 min
Elongation, % in 2 in. or 4D	11 min
Reduction of Area, %	15 min

6.1.4 Hardness: Shall be Brinell 320 - 403 or equivalent.

6.1.5 Stress-Rupture Test at 1400 F (760 C): A combination smooth and notched test specimen machined to the dimensions shown in Fig. 1 and Table I, maintained at 1400 F ± 3 (760 C ± 1.7) while an axial stress of 55,000 psi is applied continuously, shall not rupture in less than 25 hours. The test shall be continued to rupture, with fracture occurring in the smooth section. Tests shall be conducted in accordance with the issue of ASTM E139 specified in the latest issue of AMS 2350.

6.1.5.1 As an alternate procedure, separate smooth and notched test specimens, machined from adjacent sections of the same piece, with gage sections conforming to the respective dimensions of Table I may be tested individually under the above conditions. The smooth specimen shall not rupture in less than 25 hours. The notched specimen shall not rupture in less time than the companion smooth specimen but need not be tested to rupture.

6.2 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 6.1.1, specimens taken from the heat treated coupon shall conform to the requirements of 6.1.2, 6.1.3, 6.1.4, and 6.1.5. If specimens taken from the stock after heat treatment as in 6.1.1 conform to the requirements of 6.1.2, 6.1.3, 6.1.4, and 6.1.5, the tests shall be accepted as equivalent to tests of the forged coupon.

7. QUALITY: Material shall be produced by multiple melting using consumable electrode practice in the remelt cycle, unless otherwise permitted. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used. 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, appearance, or performance of parts.

8. TOLERANCES: Unless otherwise specified, tolerances for bars shall conform to all applicable requirements of the latest issue of AMS 2241.

9. REPORTS:

9.1 Unless otherwise specified, 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 technical 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.

9.2 Unless otherwise specified, 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, 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.

10. IDENTIFICATION:

10.1 Bars: Individual pieces or bundles shall have attached a metal or plastic tag embossed with the purchase order number, AMS 5634, nominal size, and heat number, or shall be boxed and the box marked with the same information. In addition to the above identification, flats 2 x 1 in. and larger and other bars 1 in. and over in diameter or distance between parallel sides shall be stamped with the heat number within 2 in. of one end.

10.2 Forgings: Shall be identified in accordance with the latest issue of AMS 2808.

10.3 Forging Stock: Shall be identified as agreed upon by purchaser and vendor.

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