AEROSPACE
MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

AMS 5709

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Revised

ALLOY BARS AND FORGINGS, CORROSION AND HEAT RESISTANT
Nickel Base - 19.5Cr - 13.5Co - 4.3Mo - 3.0Ti - 1.4Al
Solution, Stabilization, and Precipitation Heat Treated. 1975 F (1079.4 C) Treatment
Consumable Electrode or Vacuum Induction Melted

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 pins, nuts, and turbine blades or buckets, requiring high strength up to 1500 F (815 C) and oxidation resistance up to 1750 F (955 C).

4. COMPOSITION:

Carbon	0.04 - 0.10
Manganese	0.10 max
Silicon	0.15 max
Phosphorus	0.015 max
Sulfur	0.015 max
Chromium	18.00 - 21.00
Cobalt	12.00 - 15.00
Molybdenum	3.50 - 5.00
Titanium	2.75 - 3.25
Aluminum	1.20 - 1.60
Zirconium	0.02 - 0.08
Boron	0.003 - 0.010
Iron	2.00 max
Copper	0.10 max
Nickel	remainder

4.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2269; check analysis limits for zirconium shall be 0.01 under min or over maximum.

5. CONDITION: Unless otherwise specified, material shall be supplied in the following condition:

5.1 Bars and Forgings: Solution, stabilization, and precipitation heat treated, and descaled.

5.1.1 Bars shall be hot rolled or extruded; round bars shall be ground or turned.

5.2 Forging Stock: As ordered by the forging manufacturer.

6. TECHNICAL REQUIREMENTS:

6.1 Bars and Forgings:

6.1.1 Heat Treatment: Unless otherwise specified, the product shall be heat treated as follows:

Printed in U. S. A.

6.1.1.1 Solution Heat Treatment: Heat to 1975 F ± 25 (1079.4 C ± 14), hold at heat for approximately 4 hr, and cool at a rate equivalent to air cool or faster.

6.1.1.2 Stabilization Heat Treatment: Heat to 1550 F ± 15 (843.3 C ± 8.3), hold at heat for 4 hr, except that blade or bucket forgings shall be held at heat for 24 hr, and cool in air.

6.1.1.3 Precipitation Heat Treatment: Heat to 1400 F ± 15 (760 C ± 8.3), hold at heat for approximately 16 hr, and cool in air.

6.1.2 Hardness: Shall be Rockwell C 32 - 42 or equivalent.

6.1.3 Grain Size: Shall be substantially uniform without pronounced segregation of fine and coarse grain areas, in accordance with standards agreed upon by purchaser and vendor. Clusters of large germinated grains will be cause for rejection.

6.1.4 Stress-Rupture Test at 1500 F (815.6 C): A tensile test specimen, maintained at 1500 F ± 5 (815.6 C ± 2.8) while an axial stress of 47,500 psi is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture. Elongation after rupture, measured at room temperature, shall be not less than 8% in 4D.

6.1.4.1 The test of 6.1.4 may be conducted at a stress higher than 47,500 psi but stress shall not be changed while test is in process, unless otherwise specified or allowed. Time to rupture and elongation requirements shall be as specified in 6.1.4.

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, and 6.1.4. 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, and 6.1.4, the test shall be accepted as equivalent to tests of the forged coupon.

7. QUALITY: Material shall be produced by multiple melting using consumable electrode process in the remelt cycle or shall be induction melted under vacuum, unless otherwise permitted. 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. Forgings shall have substantially uniform macrostructure and grainflow.

8. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2261.

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, material specification number, heat 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.