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

AEROSPACE MATERIAL SPECIFICATIONS

AMS 5664A
Superseding AMS 5664
Issued 9-1-65
Revised 11-1-67

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
Nickel Base - 19Cr - 3.1Mo - 5.1(Cb + Ta) - 0.90Ti - 0.50Al
Consumable Electrode or Vacuum Induction Melted
1950 F (1065.6 C) Solution Treated

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

2. FORM: Bars, forgings, flash welded rings, and stock for forgings and flash welded rings.

3. APPLICATION: Primarily for rotating and structural parts such as impellers, flanges, and fasteners requiring high strength at cryogenic temperatures and for short time use up to 1000 F (538 C) and oxidation resistance up to 1800 F (982 C).

4. COMPOSITION:

	min	max
Carbon	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.015
Ø Chromium	17.00	21.00
Nickel	50.00	55.00
Cobalt	--	1.00
Molybdenum	2.80	3.30
Columbium + Tantalum	4.75	5.50
Titanium	0.65	1.15
Aluminum	0.20	0.80
Boron	--	0.006
Copper	--	0.30
Iron	remainder	

4.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2269.

5. CONDITION: Unless otherwise ordered, the product shall be supplied in the following condition:

5.1 Bars, Forgings, and Flash Welded Rings: Solution heat treated as in 6.1.1.

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

5.1.2 Forgings shall be rough machined or descaled.

5.1.3 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 the latest issue of AMS 7490, unless otherwise specified.

5.2 Stock for Forgings and Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.

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6. TECHNICAL REQUIREMENTS:

6.1 Bars, Forgings, and Flash Welded Rings: Unless otherwise specified, the product shall be solution heat treated to conform to the requirements of 6.1.2 and 6.1.3 and to be capable of meeting the requirements of 6.1.4. No specific heat treating instructions are specified but it is recommended that the product be solution heat treated by heating in a suitable protective atmosphere to 1950 F ± 25 (1065.6 C ± 14) but in no case lower than 1900 F (1038 C), holding at heat for not more than 2 hr, and cooling at a rate equivalent to air cool or faster.

6.1.2 Hardness: Shall be not higher than Brinell 248 or equivalent.

6.1.3 Grain Size: Shall average 3 or finer, as determined by comparison of a polished and etched specimen with the chart in the issue of ASTM E112 listed in the latest issue of AMS 2350; 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. In case of disagreement on grain size by the comparison method, the intercept (Heyn) procedure shall be used.

6.1.4 Properties After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1400 F ± 15 (760 C ± 8.3), holding at heat for 10 hr, furnace cooling to 1200 F ± 15 (648.9 C ± 8.3), holding at 1200 F ± 15 (648.9 C ± 8.3) until a Ø total precipitation heat treatment time of 20 hr has been reached, and cooled. The product shall also be capable of meeting the following requirements after being re-solution heat treated by heating to 1950 F ± 25 (1065.6 C ± 14) in a suitable protective atmosphere, holding at heat for 1 - 2 hr, and cooling at a rate equivalent to air cool or faster and then being precipitation heat treated as above.

6.1.4.1 Tensile Properties:

6.1.4.1.1 Bars: Specimens shall be taken with the axis in the short transverse direction. If the short transverse direction is less than 2-1/2 in., specimens shall be taken with the axis in the long transverse direction. If both transverse directions are less than 2-1/2 in., specimens shall be taken with the axis in the longitudinal direction.

Tensile Strength, psi	180,000 min
Yield Strength at 0.2% Offset or at 0.0141 in. in 2 in. Extension Under Load (E = 29,600,000), psi	150,000 min
Elongation, % in 2 in. or 4D	10 min
Reduction of Area (round specimens), %	12 min

6.1.4.1.2 Forgings and Flash Welded Rings: Specimens from forgings shall be taken with the axis in the transverse direction. If the forging is less than 2-1/2 in. in the transverse direction, specimens Ø shall be taken with the axis in the longitudinal direction. Specimens from flash welded rings shall be taken with the axis in the circumferential direction.

Tensile Strength, psi	180,000 min
Yield Strength at 0.2% Offset or at 0.0141 in. in 2 in. Extension Under Load (E = 29,600,000), psi	150,000 min
Elongation, % in 2 in. or 4D	12 min
Reduction of Area (round specimens), %	15 min

6.1.4.2 Hardness: Shall be not lower than Brinell 341 or equivalent.

6.2 Stock for Forgings or Flash Welded Rings: When a sample of stock is forged to a test coupon and solution and precipitation heat treated as in 6.1.1 and 6.1.4, specimens taken from the heat treated coupon shall conform to the requirements of 6.1.4.1 and 6.1.4.2. If specimens taken from the stock after heat treatment as in 6.1.1 and 6.1.4 conform to the requirements of 6.1.4.1 and 6.1.4.2, the tests shall be accepted as equivalent to tests of the forged coupon.