Society of Automotive Engineers, Inc.
485 LEXINGTON AVENUE, NEW YORK, N.Y. 10017

AEROSPACE MATERIAL SPECIFICATION

AMS 5671A
Superseding AMS 5671
Issued 9-1-65
Revised 5-1-68

ALLOY BARS, FORGINGS, AND RINGS, CORROSION AND HEAT RESISTANT
Nickel Base - 15.5Cr - 0.95(Cb + Ta) - 2.5Ti - 0.70Al - 7.0Fe
Consumable Electrode or Vacuum Induction Melted

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

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

3. APPLICATION: Primarily for parts, such as flanges, cases, and turbine rotors, requiring high strength at temperatures in the range of 800 - 1100 F (427 - 593 C), particularly where welding is involved.

4. COMPOSITION:

	min	max
Carbon	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus (1)	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel + Cobalt	70.00	--
Cobalt (1)	--	1.00
Columbium + Tantalum	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Copper	--	0.50

(1) Determination not required for routine acceptance.

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

5. CONDITION:

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

5.1.1 Bars shall be hot finished; round bars shall be ground or turned except that bars under 0.5 in. in diameter, when so ordered, shall be cold drawn.

5.1.2 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. During manufacture of flash welded rings, the stock shall not be heated to a temperature higher than 1825 F (996 C), unless otherwise agreed upon by purchaser and vendor.

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

6. TECHNICAL REQUIREMENTS:

6.1 Forgings and Flash Welded Rings:

6.1.1 Heat Treatment: The product shall be solution heat treated by heating to 1800 F ± 25 (982.2 C ± 14), holding at heat for 1 hr, and cooling at a rate equivalent to air cool or faster.

6.1.2 Hardness: Shall be not higher than Brinell 320 or equivalent.

6.1.3 Properties After Precipitation Heat Treatment: The product shall conform to the following requirements after being precipitation heat treated by heating to 1350 F ± 15 (732.2 C ± 8.3), holding at heat for 8 hr, cooling at a rate of 100 F degrees ± 15 (55.6 C degrees ± 8.3) per hr to 1150 F ± 15 (621.1 C ± 8.3), holding at 1150 F ± 15 (621.1 C ± 8.3) for 8 hr, and air cooling.

Note. Instead of the 100 F degrees (55.6 C degrees) per hr cooling rate to 1150 F ± 15 (621.1 C ± 8.3), material may be furnace cooled at any rate provided the time at 1150 F ± 15 (621.1 C ± 8.3) is adjusted to give a total precipitation heat treatment time of 18 hours.

6.1.3.1 Tensile Properties:

6.1.3.1.1 Ø Bars Under 2.50 In. in Diameter or Thickness, Forgings Under 2.50 In. in Thickness, and Flash Welded Rings Under 2.50 In. in Radial Thickness:

Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 31,000,000) psi, min	Extension Under Load in. in 2 in.	Elongation % in 2 in. or 4D, min	Reduction of Area (round specimens) %, min
Longitudinal	170,000	115,000	0.0114	18	18
Transverse	165,000	110,000	0.0111	15	15

6.1.3.1.2 Ø Bars 2.50 to 4.00 In., Excl, in Diameter or Thickness, Forgings 2.50 to 4.00 In., Excl, in Thickness, and Flash Welded Rings 2.50 to 4.00 In., Excl, in Radial Thickness:

Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 31,000,000) psi, min	Extension Under Load in. in 2 in.	Elongation % in 2 in. or 4D, min	Reduction of Area %, min
Longitudinal	170,000	115,000	0.0114	15	15
Transverse	160,000	105,000	0.0108	12	12

6.1.3.1.3 Ø Properties of bars 4.00 in. and over in diameter or thickness, forgings 4.00 in. and over in thickness, and flash welded rings 4.00 in. and over in radial thickness shall be as agreed upon by purchaser and vendor.

6.1.3.1.4 Longitudinal property requirements of 6.1.3.1.1 and 6.1.3.1.2 apply to specimens taken with the axis approximately parallel to the grainflow, and to specimens taken in the radial direction and in the tangential direction at the rim of disc forgings. All other specimens shall be considered to be in the transverse direction.

6.1.3.1.5 Transverse test requirements of 6.1.3.1.1 and 6.1.3.1.2 apply to material having a cross-section dimension sufficiently large to yield tensile test specimens not less than 2-1/2 in. long.

6.1.3.1.6 Specific locations of specimens shall be as agreed upon by purchaser and vendor.

6.1.3.2 Hardness: Rockwell C 32 - 42 or equivalent.

6.2 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 6.1.1 and 6.1.3, specimens taken from the heat treated coupon shall conform to the transverse requirements of 6.1.3.1.1 or 6.1.3.1.2, as applicable, and the requirements of 6.1.3.2 and shall be capable of meeting the longitudinal requirements of 6.1.3.1.1 or 6.1.3.1.2, as applicable. If specimens taken from the stock after heat treatment as in 6.1.1 and 6.1.3 conform to the transverse requirements of 6.1.3.1.1 or 6.1.3.1.2, as applicable, and the requirements of 6.1.3.2 and are capable of meeting the longitudinal requirements of 6.1.3.1.1 or 6.1.3.1.2, as applicable, the tests shall be accepted as equivalent to tests of the forged coupon. If the forged coupon. If the forged coupon or the stock is of such size that transverse tensile test specimens cannot be obtained, tests shall be run in the longitudinal direction.

6.3 Stock for Flash Welded Rings: A sample of stock heat treated as in 6.1.1 and 6.1.3 shall conform to the transverse requirements of 6.1.3.1.1 or 6.1.3.1.2, as applicable, and the requirements of 6.1.3.2 and shall be capable of meeting the longitudinal requirements of 6.1.3.1.1 or 6.1.3.1.2, as applicable. If the stock is less than 2-1/2 in. in diameter or width, tests shall be run in the longitudinal direction.

7. QUALITY: Material shall be produced by multiple melting using consumable electrode practice in the remelt cycle or shall be induction melted under vacuum, 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 or to performance of parts.

8. REPORTS:

8.1 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 and its revision letter, 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.

8.2 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 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.

9. IDENTIFICATION: Unless otherwise specified, the product shall be identified as follows:

9.1 Bars:

9.1.1 Each straight bar 0.500 in. and over in diameter or least width of flat surface shall be marked in a row of characters recurring at intervals not greater than 3 ft with AMS 5671A, heat number, and manufacturer's identification. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

9.1.2 Straight bars less than 0.500 in. in diameter or least width of flat surface shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 5671A, heat number, nominal size, and manufacturer's identification and attached to each bundle or shall be boxed and the box marked with the same information.