

# AERONAUTICAL MATERIAL SPECIFICATIONS

AMS 5746

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

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Revised

ALLOY, CORROSION AND HEAT RESISTANT  
15Cr - 45Ni - 4W - 4Mo - 3Ti - 1Al  
Consumable Electrode Vacuum Melted

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. FORM: Bars, forgings, forging stock, and heading stock.
3. APPLICATION: Primarily for parts such as turbine rotors, shafts, buckets or blades, bolts, dowels, and fittings requiring high strength up to 1600 F and oxidation resistance up to 1800 F.
4. COMPOSITION:

Carbon	0.08	max
Manganese	0.75	max
Silicon	0.75	max
Phosphorus	0.040	max
Sulfur	0.040	max
Chromium	14.00	- 16.00
Nickel	42.00	- 48.00
Molybdenum	3.00	- 4.50
Tungsten	3.00	- 4.50
Titanium	2.70	- 3.30
Aluminum	0.75	- 1.30
Boron	0.008	- 0.016
Iron		remainder

- 4.1 Check Analysis: Composition variations shall conform to the requirements of the latest issue of AMS 2248.
5. CONDITION:
  - 5.1 Bars and Forgings: Solution and precipitation heat treated, unless otherwise specified.
  - 5.2 Stock for Forging or Heading: As ordered by the forging or heading manufacturer.
6. TECHNICAL REQUIREMENTS:
  - 6.1 Bars and Forgings:
    - 6.1.1 Heat Treatment: The product shall be solution heat treated by heating to 1900 F  $\pm$  25, holding at heat for 1 hr, and quenching in oil, and shall then be precipitation heat treated by heating to 1550 F  $\pm$  25, holding at heat for 6 hr, air cooling, heating to 1300 F  $\pm$  25, holding at heat for 16 hr, and air cooling.

6.1.2 Tensile Properties: Tensile test specimens taken from bars and forgings and tested at room temperature shall conform to the following requirements:

6.1.2.1 Bars:

Tensile Strength, psi	190,000 min
Yield Strength at 0.2% Offset or at 0.0123 in. in 2 in. Extension Under Load ( $E = 30,000,000$ ), psi	125,000 min
Elongation, % in 4D 3/4 in. and under in diameter, or equivalent cross- section	12 min
Over 3/4 in. diameter or equivalent cross-section	10 min
Reduction of Area, % Up to 3/4 in. Rd, incl., or equivalent cross-section	15 min
Over 3/4 in. Rd, or equivalent cross-section	12 min

6.1.2.2 Forgings:

Tensile Strength, psi	170,000 min
Yield Strength at 0.2% Offset or at 0.0123 in. in 2 in. Extension Under Load ( $E = 30,000,000$ ), psi	125,000 min
Elongation, % in 4D	8 min
Reduction of Area, %	10 min

6.1.2.3 When a dispute occurs between purchaser and vendor over the yield strength value, yield strength determined by the offset method shall apply.

6.1.3 Hardness: Shall be Brinell 340 - 418 or equivalent.

6.1.4 Stress-Rupture Test at 1200 F: A combination smooth and notched test specimen machined from bars and forgings to the dimensions shown in Figure 1 and Table I, maintained at 1200 F  $\pm 3$  while an axial stress of 90,000 psi is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture, either maintaining the same stress or increasing the stress in 5000 psi increments after 48 hr and at intervals of not less than 8 hr thereafter. Rupture shall occur in the smooth section and elongation of this section after rupture, measured at room temperature, shall be not less than 5% in 4D if the specimen ruptures in 48 hr or less, and not less than 3% in 4D if the specimen ruptures in more than 48 hours.

6.1.4.1 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, including increase of stress after 48 hours. The smooth specimen shall not rupture in less than 23 hr and elongation after rupture, measured at room temperature, shall be as specified above. The notched specimen need not be tested to rupture but shall not rupture in less time than the companion smooth specimen.

6.2 Stock for Forging or Heading: When a sample of stock is forged to a test coupon as agreed upon by purchaser and vendor and heat treated as in 6.1.1, specimens taken from the heat treated coupon shall conform to the requirements of 6.1.2.2, 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 6.1.2.2, 6.1.3, and 6.1.4, the tests shall be accepted as equivalent to tests of the forged coupon.

7. QUALITY: Material shall be multiple melted using vacuum consumable electrode practice in the remelt cycle, unless otherwise specified. 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. TOLERANCES: Unless otherwise specified, tolerances shall conform to the following:
  - 8.1 Bars: The latest issue of AMS 2241 as applicable and as specified below:
    - 8.1.1 All hexagons, and other bars 2.75 in. and less in diameter or distance between parallel sides, Table I.
    - 8.1.2 Bars, other than hexagons, over 2.75 in. in diameter or distance between parallel sides, Table II.
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 5746, 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 Stock for Forging or Heading: 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.