

AEROSPACE MATERIAL SPECIFICATIONS

AMS 5733C

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

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STEEL BARS AND FORGINGS, CORROSION AND HEAT RESISTANT
13.5Cr - 26Ni - 3Mo - 1.8Ti

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, forging stock, and heading stock.
3. APPLICATION: Primarily for parts and assemblies, such as bolts, dowels, fittings, turbine discs, and turbine nozzle assemblies, requiring high strength up to 1250 F (675 C).

4. COMPOSITION:

Carbon	0.08	max
Manganese	0.60	- 1.50
Silicon	0.40	- 1.00
Phosphorus	0.040	max
Sulfur	0.030	max
Chromium	12.00	- 15.00
Nickel	24.00	- 28.00
Molybdenum	2.50	- 3.50
Titanium	1.55	- 2.00
Copper	0.50	max
Aluminum	0.35	max
Boron	0.0010	- 0.010

- 4.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2248.

5. CONDITION:

- 5.1 Bars and Forgings: Solution and precipitation heat treated.

5.1.1 Bars 1.25 in. and under in diameter or distance between parallel sides shall be cold drawn with not less than 15% reduction of cross-sectional area.

5.1.2 Bars over 1.25 in. in diameter or distance between parallel sides shall be cold drawn with not less than 15% reduction of cross-sectional area or shall be hot rolled with finishing temperature not higher than 1800 F (982 C).

- 5.2 Stock for Forging or Heading: As ordered by the forging or heading manufacturer.

6. TECHNICAL REQUIREMENTS:

- 6.1 Bars and Forgings:

Section 8.3 of the SAE Technical Board rules provides that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no commitment to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 6.1.1 Heat Treatment: The product shall be solution heat treated by heating to not lower than 1750 F (954 C) but not higher than 1900 F (1038 C), holding at heat for not less than 1 hr, and quenching in oil or water. It shall then be precipitation heat treated by heating to not lower than 1250 F (676 C) but not higher than 1400 F (760 C), holding at heat for not less than 5 hr, cooling slowly in not less than 5 hr to 1200 F \pm 15 (648.9 C \pm 8.3), holding at 1200 F \pm 15 (648.9 C \pm 8.3) for not less than 20 hr, and cooling in air.
- 6.1.2 Tensile Properties: Tensile test specimens cut from the product and tested at room temperature shall conform to the following requirements:
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|---|--|-------------|
| | Tensile Strength, psi | 130,000 min |
| ∅ | Yield Strength at 0.2% Offset or at 0.0098 in. in 2 in. Extension Under Load (E = 29,100,000), psi | 85,000 min |
| | Elongation, % in 4D | 15 min |
| | Reduction of Area, % | 18 min |
- 6.1.2.1 Large Disc Forgings: When tensile test specimens are machined from approximately the center of large disc forgings (over 50 sq in. cross sectional area), the elongation may be as low as 10% and the reduction of area as low as 12%. Specimens shall be cut with axis of specimens in any plane perpendicular to the axis of the forging and perpendicular to a radius in the selected plane.
- 6.1.2.2 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 248 - 321 or equivalent.
- 6.1.4 Stress-Rupture Test at 1200 F (648.9 C): A combination smooth and notched test specimen machined to the dimensions shown in Figure 1 and Table I, maintained at 1200 F \pm 3 (648.9 C \pm 1.7) while an axial stress of 60,000 psi is applied continuously, shall not rupture in less than 15 hr. 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 hr.
- 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 hr. The smooth specimen shall not rupture in less than 15 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 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 tests shall be accepted as equivalent to tests of the forged coupon.

7. QUALITY: Material 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 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 tag stamped with the purchase order number, AMS 5733C, 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.