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

AEROSPACE MATERIAL SPECIFICATIONS

AMS 5736E
Superseding AMS 5736D
Issued 3-1-55
Revised 5-1-68

STEEL BARS, FORGINGS, TUBING, AND RINGS, CORROSION AND HEAT RESISTANT
15Cr - 26Ni - 1.3Mo - 2.1Ti - 0.30V
1800 F (982.2 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, mechanical tubing, flash welded rings, and stock for forgings, flash welded rings, or heading.

3. APPLICATION: Primarily for parts, such as turbine rotors, shafts, buckets or blades, bolts, dowels, and fittings, requiring high strength up to 1300 F (704 C) and oxidation resistance up to 1500 F (816 C), including those which are welded and then heat treated to develop required properties.

4. COMPOSITION:

	min	max
Carbon	--	0.08
Manganese	--	2.00
Silicon	--	1.00
Ø Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	13.50	- 16.00
Nickel	24.00	- 27.00
Molybdenum	1.00	- 1.50
Titanium	1.90	2.30
Boron	0.0030	- 0.010
Vanadium	0.10	- 0.50
Aluminum	--	0.35

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

5. CONDITION:

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

5.1.1 Bars 2.75 in. and less in diameter or distance between parallel sides shall be cold finished.

5.1.2 Forgings shall be descaled, unless otherwise specified.

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 Mechanical Tubing: Cold finished and solution heat treated, unless otherwise specified.

5.3 Stock for Forging, Flash Welded Rings, or Heading: As ordered by the forging, flash welded ring, or heading manufacturer.

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6. TECHNICAL REQUIREMENTS:

6.1 Bars, Forgings, Mechanical Tubing, 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 quenching in oil or water.

6.1.2 Hardness:

6.1.2.1 Bars and Mechanical Tubing: Shall have hardness not higher than Brinell 201 or equivalent when taken approximately midway between outer surface and center or inner surface as applicable.

6.1.2.2 Forgings and Flash Welded Rings: Shall have hardness not higher than Brinell 201 or equivalent.

6.1.3 Properties After Precipitation Heat Treatment: Specimens taken from bars, forgings, and mechanical tubing and from parent metal of flash welded rings shall conform to the following requirements after heating to 1325 F ± 15 (718.3 C ± 8.3), holding at heat for 16 hr, and air cooling. When agreed upon by purchaser and vendor and if material fails to meet these requirements after heating as above, separate specimens may be heated to a temperature not lower than 1300 F (704 C) but not higher than 1400 F (760 C), held at heat for 16 hr, and cooled in air. If such specimens meet the following requirements, material will be considered acceptable.

6.1.3.1 Tensile Properties:

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 2 in. or 4D	15 min
Reduction of Area, %	18 min

6.1.3.1.1 When tensile test specimens are machined, tangentially, 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 machined in other directions from this location are not required.

6.1.3.1.2 Reduction of area requirement does not apply to mechanical tubing from which a solid round test specimen cannot be cut.

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

6.1.3.2 Hardness: Brinell 248 - 341 or equivalent.

6.1.3.3 Stress-Rupture Test at 1200 F (648.9 C): A combination smooth and notched test specimen machined from bars, forgings, and mechanical tubing and from parent metal of flash welded rings to the dimensions shown in Fig. 1 and Table I, maintained at 1200 F ± 3 (648.9 C ± 1.7) while an axial stress of 65,000 psi is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture. 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. Tests shall be conducted in accordance with the issue of ASTM E139 specified in the latest issue of AMS 2350.

6.1.3.3.1 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. 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.

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6.1.3.3.2 The tests of 6.1.3.3 and 6.1.3.3.1 may be conducted at a stress higher than 65,000 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 6.1.3.3 and 6.1.3.3.1.

6.1.3.3.3 For mechanical tubing from which a solid round test specimen cannot be cut, a full section of tubing shall be tested and shall meet the smooth bar requirements of 6.1.3.3.1.

6.2 Stock for Forging, Flash Welded Rings, or Heading: 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 requirements of 6.1.3.1, 6.1.3.2, and 6.1.3.3. If specimens taken from the stock after heat treatment as in 6.1.1 and 6.1.3 conform to the requirements of 6.1.3.1, 6.1.3.2, and 6.1.3.3, 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 following:

8.1 Bars: The latest issue of AMS 2241.

8.2 Tubing: The latest issue of AMS 2243.

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 and its revision letter, size, quantity from each heat, and precipitation heat treatment temperature used. 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 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.

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

10.1 Bars and Tubing:

10.1.1 Each straight bar and tube 0.500 in. and over in OD or least width of flat surface shall be marked in a row of characters recurring at intervals not greater than 3 ft with AMS 5736E, 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.

10.1.2 Straight bars and tubes less than 0.500 in. in OD 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 5736E, 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.

10.1.3 Coiled bars shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 5736E, heat number, nominal size, and manufacturer's identification and attached to each coil or shall be boxed and the box marked with the same information.

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10.2 Forgings: Shall be identified in accordance with the latest issue of AMS 2808.

10.3 Flash Welded Rings: Shall be identified as agreed upon by purchaser and vendor.

10.4 Stock for Forgings or Flash Welded Rings: 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.

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