Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 5719

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Revised

STEEL BARS, FORGINGS, TUBING, AND RINGS, CORROSION RESISTANT
11.8Cr - 2.5Ni - 1.8Mo - 0.33V (0.08 - 0.15C)
Premium Quality, Vacuum Consumable Electrode Melted

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

2. FORM: Bars, wire, forgings, flash welded rings, extrusions, mechanical tubing, and stock for forging and flash welded rings.

3. APPLICATION: Primarily for parts and assemblies, such as compressor wheels and structural members, requiring high strength and oxidation resistance up to 800 F (427 C).

4. COMPOSITION:

	min	max
Carbon	0.08	0.15
Manganese	0.50	0.90
Silicon	--	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	11.00	12.50
Nickel	2.00	3.00
Molybdenum	1.50	2.00
Vanadium	0.25	0.40
Nitrogen	0.01	0.05
Copper	--	0.50

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

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

5.1 Bars:

5.1.1 Rounds: Centerless ground, turned, or polished after annealing as in 6.1.1.

5.1.2 Hexagons: Cold finished after annealing as in 6.1.1.

5.1.3 Squares and Flats: Annealed as in 6.1.1 and descaled.

5.2 Wire: Annealed as in 6.1.1 and cold finished.

5.3 Forgings, Flash Welded Rings, and Extrusions: Annealed as in 6.1.1 and descaled.

5.3.1 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 7493.

5.4 Mechanical Tubing: Cold finished and annealed as in 6.1.1.

5.5 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.

6. TECHNICAL REQUIREMENTS: When ASTM methods are specified for determining conformance to the following requirements, tests shall be conducted in accordance with the issue of the ASTM method listed in the latest issue of AMS 2350.

6.1 Bars, Wire, Forgings, Flash Welded Rings, Extrusions, and Mechanical Tubing:

6.1.1 Annealing: The product shall be annealed by heating to 1275 F ± 20 (690.6 C ± 11.1) holding at heat for not less than 6 hr, and cooling in air.

6.1.2 Properties As Annealed: Tests shall be performed in accordance with ASTM A370.

6.1.2.1 Bars, Forgings, Flash Welded Rings, Extrusions, and Mechanical Tubing: Shall have hardness not higher than Brinell 311 or equivalent.

6.1.2.2 Wire: Shall have tensile strength not higher than 155,000 psi.

6.1.3 Properties After Hardening and Tempering: Test specimens taken from bars, wire, extrusions, and tubing, from forgings with axis approximately parallel to the forging flow lines, and from parent metal of flash welded rings shall conform to the following requirements after being hardened by heating to 1925 F ± 25 (1051.7 C ± 14), holding at heat for not less than 30 min., and quenching in oil and double tempered by heating within the range 1000 - 1050 F (537.8 - 565.6 C), holding at the selected temperature within ±15 F (±8.3 C) for not less than 3 hr, cooling in air to room temperature, reheating within the range 960 - 1000 F (515.6 - 537.8 C), holding at the selected temperature within ±15 F (±8.3 C) for not less than 3 hr, and cooling in air.

6.1.3.1 Smooth-Bar Tensile Properties: These properties apply when the rate of strain is maintained at 0.003 - 0.007 in. per in. per min. through the yield strength and then is increased so as to produce failure in approximately one additional minute. When a dispute occurs between purchaser and vendor over the yield strength values, a referee test shall be performed on a test machine having a strain-rate pacer, using a rate of 0.005 in. per in. per min. through the yield strength and a maximum crosshead speed of 0.10 in. per min. above the yield strength; for such referee tests, yield strength shall be determined by the offset method. Tests shall be conducted in accordance with ASTM A370.

Tensile Strength, psi	155,000 min
Yield Strength at 0.2% Offset or at 0.0130 in. in 2 in. Extension Under Load (E = 29,000,000), psi	130,000 min
Elongation, % in 2 in. or 4D	12 min
Reduction of Area (round specimens), %	30 min

6.1.3.2 Notched-Bar Tensile Properties: Test specimens, machined to the dimensions shown in Fig. 1 and Table I, shall have a notched-bar tensile strength not less than 1.4 times the smooth-bar tensile strength.

6.1.3.3 Hardness: Brinell 341 - 388 or equivalent, determined in accordance with ASTM E10.

6.1.3.4 Izod Impact Value: Not less than 30 ft-lb at room temperature, determined in accordance with ASTM A370.

6.1.3.5 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

6.1.4 Other Tempering Heat Treatment: Properties after tempering at temperatures other than that specified in 6.1.3 shall be as agreed upon by purchaser and vendor.

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 requirements of 6.1.3.1, 6.1.3.2, 6.1.3.3, and 6.1.3.4. 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, 6.1.3.3, and 6.1.3.4, the tests shall be accepted as equivalent to tests of the forged coupon.

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 requirements of 6.1.3.1, 6.1.3.2, 6.1.3.3, 6.1.3.4, and 6.1.3.5.

6.4 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, acceptance of the product may be based on the testing of three additional specimens for each original nonconforming specimen, all of which additional specimens shall conform to specified requirements. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the material represented and no additional testing shall be permitted. Results of all tests shall be reported.

7. QUALITY: Steel shall be premium quality and shall conform to the latest issue of AMS 2300; it shall be multiple melted using vacuum consumable electrode practice in the remelt cycle, unless otherwise permitted. 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.

7.1 Macrostructure: Full cross-sectional specimens representing the top and bottom of the first, middle, and last usable ingots in a heat shall be obtained from the finished billet or a suitable rerolled product and shall be macroetched in hot hydrochloric acid (1:1) at 160 - 180 F (71.1 - 82.2 C) for sufficient time to develop a well defined macrostructure. The macroetched specimen, when examined visually, shall show no injurious imperfections such as pipe, porosity, blow-holes, segregation, and inclusions detrimental to fabrication or performance of parts. Macrostructure shall be equal to or better than standards agreed upon by purchaser and vendor.

7.2 Surface Requirements for Bars and Tubing:

7.2.1 Bars and tubing ordered ground, turned, or polished shall be free from seams, laps, tears, and cracks open to the ground, turned, or polished surfaces.

7.2.2 Product ordered to surface conditions other than ground, turned, or polished shall, after removal of the standard machining allowance, be free from seams, laps, tears, cracks, and other defects exposed to the machined surfaces. Standard machining allowance shall be in accordance with values shown in the latest issue of AMS 2300.

7.3 Sampling: Bars, wire, and mechanical tubing shall be sampled in accordance with the latest issue of AMS 2371 and as specified herein. Forgings, extrusions, flash welded rings, and stock for forging or flash welded rings shall be sampled as agreed upon by purchaser and vendor.

8. TOLERANCES: Shall conform to all applicable requirements of the following, unless otherwise specified:

8.1 Bars and Wire: The latest issue of AMS 2241. Tolerances for sizes not covered by AMS 2241 shall be as agreed upon by purchaser and vendor.

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, grain size, and AMS 2300 frequency-severity rating of each heat in the shipment and for tensile properties and impact values of each size from each heat in the shipment. A heat shall be the consumable electrode remelted ingots produced from steel originally melted in a single furnace charge. 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: The product shall be identified as follows:

10.1 Bars, Wire, 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 5719, 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, wire, 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 5719, 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 and wire shall be securely bundled and identified by a metal or plastic tag embossed with the purchase order number, AMS 5719, 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.

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

10.3 Extrusions, Flash Welded Rings, and Stock for Forging or Flash Welded Rings: Shall be identified as agreed upon by purchaser and vendor.

11. APPROVAL: When specified, approval of critical forgings shall be in accordance with the latest issue of AMS 2375.

12. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.