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

AEROSPACE MATERIAL SPECIFICATION

AMS 6526

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Revised

STEEL BARS, FORGINGS, AND TUBING
1.0Cr - 7.5Ni - 4.5Co - 1.0Mo - 0.09V (0.29-0.34 C)
Premium Quality, Consumable Electrode Melted, Annealed

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

2. FORM: Bars, forgings, mechanical tubing, and forging stock.

3. APPLICATION: Primarily for heat treated parts, such as pressure vessels, requiring through hardening to high strength levels and when such parts may require welding.

4. COMPOSITION:

	min	max
Carbon	0.29	0.34
Manganese	0.10	0.35
Silicon	--	0.10
Phosphorus	--	0.010
Sulfur	--	0.010
Chromium	0.90	1.10
Nickel	7.00	8.00
Cobalt	4.25	4.75
Molybdenum	0.90	1.10
Vanadium	0.06	0.12

4.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2259, paragraph titled "Low Alloy Steels"; check analysis limits for cobalt shall be 0.05 under min or over maximum.

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

5.1 Bars, Forgings, and Mechanical Tubing: Annealed and descaled, having hardness not higher than Brinell 341 or equivalent.

5.2 Forging Stock: As ordered by the forging manufacturer.

6. TECHNICAL REQUIREMENTS: When ASTM test 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 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, ASTM E112, McQuaid-Ehn test.

6.2 Decarburization:

6.2.1 Bars and tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces. Inside decarburization of such tubing shall not exceed the maximum depth specified in 6.2.4.

6.2.2 Allowable decarburization of bars, billets, and tubing ordered for redrawing or forging or to specified microstructural requirements shall be as agreed upon by purchaser and vendor.

6.2.3 Decarburization of bars to which 6.2.1 or 6.2.2 is not applicable shall be not greater than the following:

Nominal Diameter or Distance Between Parallel Sides Inches	Depth of Decarburization Inch
Up to 0.375, incl	0.010
Over 0.375 to 0.500, incl	0.012
Over 0.500 to 0.625, incl	0.014
Over 0.625 to 1.000, incl	0.017
Over 1.000 to 1.500, incl	0.020
Over 1.500 to 2.000, incl	0.025
Over 2.000 to 2.500, incl	0.030
Over 2.500 to 3.000, incl	0.035
Over 3.000 to 5.000, incl	0.045

6.2.3.1 Limits for depth of decarburization of bars over 5.000 in. in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

6.2.4 Decarburization of tubing to which 6.2.1 or 6.2.2 is not applicable shall be not greater than the following:

Nominal Wall Thickness Inches	Depth of Decarburization, Inch	
	ID	OD
Up to 0.109, incl	0.008	0.015
Over 0.109 to 0.203, incl	0.010	0.020
Over 0.203 to 0.400, incl	0.012	0.025
Over 0.400 to 0.600, incl	0.015	0.030
Over 0.600 to 1.000, incl	0.017	0.035
Over 1.000	0.020	0.040

6.2.5 Unless otherwise agreed upon by purchaser and vendor, decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale hardness method, or equivalent hardness testing method, on hardened but untempered specimens protected during heat treatment to prevent changes in surface carbon content. Depth of decarburization, when measured by a hardness method, is defined as the perpendicular distance from the surface to the nondecarburized depth under that surface below which there is no further increase in hardness. Such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization or lack of decarburization thereon.

6.2.5.1 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the above limits by more than 0.005 in. and the width is 0.065 in. or less.

6.3 Inclusion Rating: Unless otherwise specified, the inclusion rating determined in accordance with ASTM E45, Method D, using not less than 9 specimens per heat selected parallel to the direction of rolling and representing the worst area of inclusions in the inspection sample, shall be as specified below. The method of selection of specimens shall be such that suitable rating of the heat of steel being qualified is assured. Two thirds of all specimens as well as the average of all specimens shall not exceed the following limits, except that the length of any inclusion shall be not greater than 0.015 inch.

Type	Inclusion Rating			
	A	B	C	D
Thin	1.5	1.5	1.5	2.0
Heavy	1.0	1.0	1.0	1.5

6.4 Properties After Normalizing, Hardening, and Tempering: Material, normalized by heating to 1650 F ± 50 (898.9 C ± 28), holding at heat for 1 hr per in. of maximum cross-section, and cooling in air to room temperature; hardened by heating to 1550 F ± 15 (843.3 C ± 8.3), holding at heat for 1 hr per in. of maximum section thickness but not less than 1 hr, and quenching section thicknesses up to 4 in. into room-temperature oil or water and section thicknesses 4 in. and over into room-temperature oil only; and double tempered by heating to 1000 F ± 10 (537.8 C ± 5.6), holding at heat for 2 hr, suitably cooling to approximately 125 F (52 C), reheating to 1000 F ± 10 (537.8 C ± 5.6), holding at heat for 2 hr, and suitably cooling to room temperature, shall conform to the following requirements; location of specimens from forgings shall be as agreed upon by purchaser and vendor.

6.4.1 Tensile Properties:

Tensile Strength, psi	220,000 min
Yield Strength at 0.2% Offset or at 0.0169 in. in 2 in. Extension Under Load (E = 29,500,000), psi	190,000 min
Elongation, % in 2 in. or 4D	10 min
Reduction of Area, %	40 min

6.4.2 Impact Strength: The product shall be capable of showing a Charpy impact value not less than 20 ft-lb when tested at room temperature in accordance with ASTM E23 using a V-notched specimen.

6.4.3 Fracture Toughness: When specified, shall be determined by a suitable method. The method of testing and standards for acceptance shall be as agreed upon by purchaser and vendor.

7. QUALITY: Steel shall be premium quality and shall conform to the requirements of the latest issue of AMS 2300. Unless otherwise permitted, material shall be multiple melted using consumable electrode practice in the remelt cycle; at least one of the melting cycles shall be under vacuum. 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 all applicable requirements of the following:

8.1 Bars: The latest issue of AMS 2251; for all hexagons, tolerances for cold finished shall apply.

8.2 Mechanical Tubing: The latest issue of AMS 2253.

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, inclusion rating, and AMS 2300 frequency-severity rating of each ingot lot number in the shipment, and for tensile properties of each size from each ingot lot number after heat treatment as in 6.4. A heat shall be the consumable electrode remelted ingots produced from steel originally melted in a single furnace charge. When permitted by purchaser, a heat may be the consumable electrode remelted product of individual melts of similar composition produced from the same lots of controlled raw materials and having the same average composition as agreed upon by purchaser and vendor. This report shall include the purchase order number, ingot lot 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.