Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5626B
Superseding AMS 5626A

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UNS T12001

STEEL BARS AND FORGINGS, TOOL, HIGH SPEED
4.1Cr - 18W - 1.1V

1. SCOPE:

1.1 Form: This specification covers a high-speed tool steel in the form of bars, forgings, and forging stock.

1.2 Application: Primarily for parts, such as counterweights, requiring high density and wear resistance but not high oxidation resistance at temperatures up to 900°F (482°C).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) and Aerospace Standards (AS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon Alloy Steels and Heat and Corrosion Resistant Steels and Alloys
AMS 2808 - Identification, Forgings

2.1.1 Aerospace Standards:

AS 1182 - Standard Machining Allowance, Aircraft Quality and Premium Quality Steel Products

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A370 - Mechanical Testing of Steel Products
ASTM A561 - Macroetch Testing of Tool Steel Bars
ASTM E352 - Chemical Analysis of Tool Steels and Other Similar Medium- and High-Alloy Steels

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

Printed in U.S.A.

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E352, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	0.65 -	0.80
Manganese	0.20 -	0.40
Silicon	0.20 -	0.40
Phosphorus	--	0.030
Sulfur	--	0.030
Chromium	3.75 -	4.50
Tungsten	17.25 -	18.75
Vanadium	0.90 -	1.30
Molybdenum	--	1.00

Ø 3.1.1 Check Analysis: No deviation from the limits of 3.1 will be permitted.

3.2 Condition: The product shall be supplied in the following condition; hardness shall be determined in Ø accordance with ASTM A370:

3.2.1 Bars: Fully annealed.

3.2.1.1 Bars 3.000 in. (76.20 mm) and under in nominal diameter or distance between parallel sides shall Ø be cold finished having hardness not higher than 269 HB or equivalent.

3.2.1.2 Bars over 3.000 in. (76.20 mm) in nominal diameter or distance between parallel sides shall be Ø hot finished having hardness not higher than 255 HB or equivalent.

3.2.2 Forgings: As ordered.

3.2.3 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties: The product shall conform to the following requirements; hardness testing shall be per- Ø formed in accordance with ASTM A370:

3.3.1 Macrostructure: Visual examination, at magnification up to 10X, of transverse sections from bars, Ø billets, and forging stock, etched in accordance with ASTM A561 in hot hydrochloric acid at 150° - 170°F (65.6° - 76.7°C) for sufficient time to develop a well-defined macrostructure, shall show no imperfections, such as pipe, cracks, porosity, segregation, slag, dirt, and inclusions, detrimental to fabrication or to performance of parts. Macrostructure standards shall be as agreed upon by purchaser and vendor.

3.3.2 Decarburization:

3.3.2.1 Bars ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces.

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

3.3.2.3 Ø Decarburization of bars to which 3.3.2.1 or 3.3.2.2 is not applicable shall be not greater than shown in Table I.

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inches	Depth of Decarburization Inch
Up to 0.500, incl	0.013
Over 0.500 to 1.000, incl	0.025
Over 1.000 to 2.000, incl	0.038
Over 2.000 to 3.000, incl	0.050
Over 3.000 to 4.000, incl	0.070

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Depth of Decarburization Millimetres
Up to 12.70, incl	0.33
Over 12.70 to 25.40, incl	0.64
Over 25.40 to 50.80, incl	0.97
Over 50.80 to 76.20, incl	1.27
Over 76.20 to 101.60, incl	1.78

3.3.2.3.1 Ø Limits for depth of decarburization of bars over 4.000 in. (101.60 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.2.4 Ø Decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale 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 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.

3.3.2.4.1 Ø 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. (0.13 mm) and the width is 0.065 in. (1.65 mm) or less.

3.3.3 Ø Response to Heat Treatment: Product, 0.250 in. (6.35 mm) and less in nominal cross section and 0.250-in. ± 0.015 (6.35-mm ± 0.38) thick specimens cut from larger product, shall have hardness not lower than 63 HRC or equivalent after being hardened by preheating to 1500° - 1600°F (815.6° - 871.1°C) transferring to a controlled atmosphere furnace which is at 2350°F ± 25 (1287.8°C ± 14), heating to 2350°F ± 25 (1287.8°C ± 14), holding at heat for 5 - 15 min., and quenching in oil and tempered twice by heating to 1025°F ± 10 (551.7°C ± 5.6), holding at heat for 2 hr ± 5 min., and cooling in air.

3.4 Ø Quality: The product, as received by the purchaser, shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

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

3.4.2 Product ordered to surface conditions other than ground, turned, or polished shall, after removal of ø 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 AS 1182.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.6 Tolerances: Unless otherwise specified, the following tolerances shall apply:

3.6.1 Cold Finished:

3.6.1.1 Rounds, Hexagons, Octagons, and Quarter Octagons:

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TABLE II

Nominal Diameter or Distance Between Parallel Sides Inches	Tolerance Inch plus and minus
0.250 to 0.500, excl	0.002
0.500 to 1.000, excl	0.0025
1.000 to 2.750, excl	0.003

TABLE II (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tolerance Millimetre plus and minus
6.35 to 12.70, excl	0.05
12.70 to 25.40, excl	0.064
25.40 to 69.85, excl	0.08

3.6.1.2 Squares and Flats:

TABLE III

Nominal Thickness or Width Inches	Tolerance, Inch plus and minus
0.250 to 0.750, incl	0.002
Over 0.750 to 1.500, incl	0.003
Over 1.500	0.004

TABLE III (SI)

Nominal Thickness or Width Millimetres	Tolerance, Millimetre plus and minus
6.35 to 19.05, incl	0.05
Over 19.05 to 38.10, incl	0.08
Over 38.10	0.10

3.6.2 Centerless Ground:

TABLE IV

Nominal Diameter Inches	Tolerance, Inch plus and minus
0.250 to 0.500, excl	0.0015
0.500 to 3.0625, excl	0.002

TABLE IV (SI)

Nominal Diameter Millimetres	Tolerance, Millimetre plus and minus
6.35 to 12.70, excl	0.038
12.70 to 77.788, excl	0.05

3.6.3 Hot Finished:

3.6.3.1 Rounds, Squares, Hexagons, Octagons, and Quarter Octagons:

TABLE V

Nominal Diameter or Distance Between Parallel Sides Inches	Tolerance Inch	
	plus	minus
Up to 0.500, incl	0.012	0.005
Over 0.500 to 1.000, incl	0.016	0.005
Over 1.000 to 1.500, incl	0.020	0.006
Over 1.500 to 2.000, incl	0.025	0.008
Over 2.000 to 2.500, incl	0.030	0.010
Over 2.500 to 3.000, incl	0.040	0.010
Over 3.000 to 4.000, incl	0.050	0.012
Over 4.000 to 5.500, incl	0.060	0.015
Over 5.500 to 6.500, incl	0.100	0.018
Over 6.500 to 8.000, incl	0.150	0.020

TABLE V (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tolerance Millimetres	
	plus	minus
Up to 12.70, incl	0.30	0.13
Over 12.70 to 25.40, incl	0.41	0.13
Over 25.40 to 38.10, incl	0.51	0.15
Over 38.10 to 50.80, incl	0.64	0.20
Over 50.80 to 63.50, incl	0.76	0.25
Over 63.50 to 76.20, incl	1.02	0.25
Over 76.20 to 101.60, incl	1.27	0.30
Over 101.60 to 139.70, incl	1.52	0.38
Over 139.70 to 165.10, incl	2.54	0.46
Over 165.10 to 203.20, incl	3.81	0.51

3.6.3.2 Rectangles:

TABLE VI

Nominal Width Inches	Thickness Tolerance, Inch For Thickness Ranges Shown, Inches							
	Up to 0.250, incl		Over 0.250 to 0.500, incl		Over 0.500 to 1.000, incl		Over 1.000 to 2.000, incl	
	plus	minus	plus	minus	plus	minus	plus	minus
Up to 1.000, incl	0.010	0.006	0.012	0.008	0.016	0.010	--	--
Over 1.000 to 2.000, incl	0.014	0.006	0.016	0.008	0.020	0.010	0.024	0.020
Over 2.000 to 3.000, incl	0.018	0.006	0.020	0.008	0.024	0.010	0.027	0.020
Over 3.000 to 4.000, incl	0.020	0.008	0.022	0.010	0.024	0.013	0.030	0.024
Over 4.000 to 5.000, incl	0.020	0.010	0.024	0.012	0.030	0.015	0.035	0.027
Over 5.000 to 6.000, incl	0.020	0.012	0.030	0.014	0.030	0.018	0.035	0.030

TABLE VI (SI)

Nominal Width Millimetres	Thickness Tolerance, Millimetre For Thickness Ranges, Shown, Millimetres							
	Up to 6.35, incl		Over 6.35 to 12.70, incl		Over 12.70 to 25.40, incl		Over 25.40 to 50.80, incl	
	plus	minus	plus	minus	plus	minus	plus	minus
Up to 25.40, incl	0.25	0.15	0.30	0.20	0.41	0.25	--	--
Over 25.40 to 50.80, incl	0.36	0.15	0.41	0.20	0.51	0.25	0.61	0.51
Over 50.80 to 76.20, incl	0.46	0.15	0.51	0.20	0.61	0.25	0.69	0.51
Over 76.20 to 101.60, incl	0.51	0.20	0.56	0.25	0.61	0.33	0.76	0.61
Over 101.60 to 127.00, incl	0.51	0.25	0.61	0.30	0.76	0.38	0.89	0.69
Over 127.00 to 152.40, incl	0.51	0.30	0.76	0.36	0.76	0.46	0.89	0.76

3.6.3.2.2 Width:

TABLE VII

Nominal Width Inches	Width Tolerance, Inch	
	plus	minus
Up to 1.000, incl	0.031	0.016
Over 1.000 to 3.000, incl	0.047	0.031
Over 3.000 to 5.000, incl	0.063	0.047
Over 5.000	0.094	0.063

TABLE VII (SI)

Nominal Width Millimetres	Width Tolerance, Millimetres	
	plus	minus
Up to 25.40, incl	0.79	0.41
Over 25.40 to 76.20, incl	1.19	0.79
Over 76.20 to 127.00, incl	1.60	1.19
Over 127.00	2.39	1.60

4. QUALITY ASSURANCE PROVISIONS: