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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 5022K

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Superseding AMS 5022K

STEEL BARS, FORGINGS, AND TUBING, FREE CUTTING 0.14 - 0.20C (SAE 1117)

UNS G11170

1. SCOPE:

1.1 Form: This specification covers a free-cutting carbon steel in the form of bars, forgings, mechanical tubing, and forging stock.

1.2 Application: Primarily for parts requiring good machinability and response to carburizing heat treatment.

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

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 AMS 2231 - Tolerances, Carbon Steel Bars
MAM 2231 - Tolerances, Metric, Carbon Steel Bars
AMS 2253 - Tolerances, Carbon and Alloy Steel Tubing
MAM 2253 - Tolerances, Metric, Carbon and Alloy Steel Tubing
AMS 2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2350 - Standards and Test Methods
AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock
AMS 2372 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Forgings and Forging Stock
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys
AMS 2808 - Identification, Forgings

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

ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

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

2.3.1 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, Ø determined by wet chemical methods in accordance with ASTM E350 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Carbon	0.14	0.20
Manganese (3.1.1)	1.00	1.30
Phosphorus	--	0.040
Sulfur	0.08	0.13

3.1.1 When agreed upon by purchaser and vendor, manganese may be as high as 1.60.

3.1.2 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Bars and Mechanical Tubing 2.50 In. (62.5 mm) and Under in Nominal Diameter or Distance Between Parallel Sides: Cold finished, suitable for machining on high speed automatic screw machines.

3.2.2 Rounds Over 2.50 to 6.25 in. (62.5 to 160 mm), Incl, in Nominal Diameter and Hexagons Over 2.50 to 3.125 in. (62.5 to 80 mm), Incl, in Nominal Distance Between Parallel Sides: Cold finished, suitable for machining on high speed automatic screw machines or, when specified, hot finished and normalized or otherwise heat treated to produce best machining qualities.

3.2.3 Rounds Over 6.25 In. (160 mm), Hexagons Over 3.125 In. (80 mm), Bars Other Than Rounds and Hexagons Over 2.50 In. (62.5 mm), and Mechanical Tubing Over 2.50 In. (62.5 mm) in Nominal OD or Distance Between Parallel Sides: Hot finished and normalized or otherwise heat treated to produce best machining qualities.

3.2.4 Forgings: Normalized or otherwise heat treated to produce best machining qualities.

3.2.5 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties: The product shall conform to the following requirements:

3.3.1 Hardness: Shall be as follows, or equivalent, determined in accordance with ASTM E10 on the surface except on rounds where a flat as necessary for Brinell accuracy may be made:

3.3.1.1 Bars:

3.3.1.1.1 Cold Finished:

Nominal Diameter or Distance Between Parallel Sides		Brinell Hardness	
Inches	Millimetres	min	max
Up to 1.00, excl	Up to 25, excl	156	207
1.00 to 6.25, incl	25 to 160, incl	143	207

3.3.1.1.2 Hot Finished:

Nominal Diameter or Distance Between Parallel Sides		Brinell Hardness	
Inches	Millimetres	min	max
Over 2.50	Over 62.5	--	179

3.3.1.2 Tubing:

Nominal OD		Brinell Hardness	
Inches	Millimetres	min	max
Up to 1.00, excl	Up to 25.0, excl	156	248
1.00 to 2.50, incl	25.0 to 62.5, incl	143	248
Over 2.50	Over 62.5	--	179

3.3.1.3 Forgings: Not higher than 179 HB, or equivalent.

3.4 Quality: The product, as received by purchaser, shall be uniform in quality and condition, sound, and, consistent with the type of steel involved, free from foreign materials and from imperfections detrimental to usage of the product.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars and tubing will be acceptable in mill lengths of 6 - 20 ft (2 - 6 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.6 Tolerances: Shall conform to all applicable requirements of the following:

3.6.1 Bars: AMS 2231 or MAM 2231.

3.6.2 Mechanical Tubing: AMS 2253 or MAM 2253.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars and Mechanical Tubing: AMS 2370.

4.3.2 Forgings and Forging Stock: AMS 2372.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment a report stating that the chemical composition and hardness conform to the requirements of this specification. This report shall include the purchase order number, AMS 5022K, size, and quantity. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 5022K, 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 either a statement that the material conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with the following:

4.5.1 Bars and Mechanical Tubing: AMS 2370.

4.5.2 Forgings and Forging Stock: AMS 2372.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars and Tubing: In accordance with AMS 2806.

5.1.2 Forgings: In accordance with AMS 2808.

5.1.3 Forging Stock: As agreed upon by purchaser and vendor.