AEROSPACE MATERIAL SPECIFICATION

AMS5070™	REV. K

Issued 1942-03
Reaffirmed 2011-05
Revised 2020-10

Superseding AMS5070J

Steel, Bars and Forgings
0.18 - 0.23C (SAE 1022)
(Composition similar to UNS G10220)

RATIONALE

AMS5070K is a Five-Year Review and update of this specification that revises composition analytical methods (3.1), adds tensile strain rates (3.3.1.3), prohibits unauthorized exceptions (3.6), and revises reporting (4.4.4) and marking (5.2.1).

1. SCOPE

1.1 Form

This specification covers a carbon steel in the form of bars up through 3.000 inches (76.2 mm), forgings, and forging stock.

1.2 Application

This product has been used typically for parts requiring low strength and high ductility, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2231 Tolerances, Carbon Steel Bars

AMS2259 Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels

AMS2370 Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock

AMS2372 Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Forgings

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5070K

AMS2806 Identification Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

AMS2808 Identification Forgings

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A370 Mechanical Testing of Steel Products

ASTM A751 Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

ASTM E112 Determining Average Grain Size

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.18	0.23
Manganese	0.70	1.00
Silicon	0.15	0.35
Phosphorus	--	0.040
Sulfur	--	0.050

3.1.1 Aluminum, vanadium, and columbium are optional grain refining elements and need not be determined or reported unless used to satisfy the average grain size requirements of 3.3.2.2.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Bars

Cold finished. Bar shall not be cut from plate (also see 4.4.2).

3.2.2 Forgings

Normalized.

3.2.3 Forging Stock

As ordered by the forging manufacturer.

3.3 Properties

Bars and forgings shall conform to the following requirements:

3.3.1 Tensile Properties

Shall be as follows, determined in accordance with ASTM A370:

3.3.1.1 Bars

Shall be as shown in Table 2.

Table 2A - Minimum tensile properties, inch/pound units

Nominal Diameter or Least Distance Between Parallel Sides Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %
Up to 0.875, incl	70	60	18
Over 0.875 to 1.250, incl	65	55	16
Over 1.250 to 2.000, incl	60	50	15
Over 2.000 to 3.000, incl	55	45	15

Table 2B - Minimum tensile properties, SI units

Nominal Diameter or Least Distance Between Parallel Sides Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %
Up to 22.22, incl	483	414	18
Over 22.22 to 31.75, incl	448	379	16
Over 31.75 to 50.80, incl	414	345	15
Over 50.80 to 76.20, incl	379	310	15

3.3.1.1.1 Tensile property requirements for product outside the range covered by Table 2 shall be agreed upon between purchaser and producer.

3.3.1.2 Forgings

Shall be as shown in Table 3.

Table 3 - Minimum tensile properties

Property	Value
Tensile Strength	55 ksi (379 MPa)
Yield Strength at 0.2% Offset	36.0 ksi (248 MPa)
Elongation in 4D	22%

3.3.1.2.1 For each 2.0 ksi (14 MPa) in excess of 55 ksi (379 MPa) tensile strength, a reduction in elongation of 1% to a minimum elongation of 10% is permissible.

3.3.1.3 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min).

3.3.2 Average Grain Size

Average grain size shall be determined by either 3.3.2.1 or 3.3.2.2.

3.3.2.1 Shall be ASTM No. 4 or finer determined in accordance with ASTM E112.

3.3.2.2 The product of a heat shall be considered to have an ASTM No. 4 or finer austenitic grain size if one or more of the following are determined by heat analysis (see 8.4):

3.3.2.2.1 A total aluminum content of 0.020 to 0.050%.

3.3.2.2.2 An acid soluble aluminum content of 0.015 to 0.050%.

3.3.2.2.3 A vanadium content of 0.02 to 0.08%.

3.3.2.2.4 A columbium content of 0.02 to 0.05%.

3.4 Quality

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.4.1 Grain flow of die forgings, except in areas that contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of reentrant grain flow.

3.5 Tolerances

Bars shall conform to all applicable requirements of AMS2231.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.4.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.1), average grain size (3.3.2), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable. If grain refining elements (3.3.2.2) are not present, the ASTM E112 grain size test (3.3.2.1) shall be conducted on each lot.

4.2.2 Periodic Tests

If grain refining elements (3.3.2.2) are present, the ASTM E112 grain size test (3.3.2.1) shall be conducted on a periodic basis and shall be performed at a frequency selected by the producer (not to exceed 1 year) unless frequency of testing is specified by purchaser. Grain flow of die forgings (3.4.1) is a periodic test and shall be performed at a frequency selected by the producer unless a frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Bars and Forging Stock

In accordance with AMS2370.

4.3.2 Forgings

In accordance with AMS2372.

4.4 Reports

4.4.1 The producer of bars and forgings shall furnish with each shipment a report showing the producer identity, results of tests for chemical composition of each heat and for tensile properties and, if measured, average grain size of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS5070K, size, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included. If the grain size requirement of 3.3.2.2 is met by the aluminum, vanadium, and/or columbium content, the aluminum, vanadium, and/or columbium content shall be reported and a statement that the chemistry satisfies the grain size requirement shall be included.

4.4.2 If the ship size/shape is cut from a larger cross section, report the nominal metallurgically worked size (also see 3.2.1).

4.4.3 The producer of forging stock shall furnish with each shipment a report showing the producer identity, results of tests for composition, of each heat and the results of any additional property requirements imposed by the purchase order (see 8.5). This report shall include the purchase order number, heat number, AMS5070K, size, and quantity.

4.4.4 When material produced to this specification is beyond the sizes allowed in the scope or tables, or other exceptions are taken to the technical requirements listed in Section 3, the report shall contain a statement “This material is certified as AMS5070K(EXC) because of the following exceptions:” and the specific exceptions shall be listed (also see 5.2.1).

4.5 Resampling and Retesting

Shall be as follows:

4.5.1 Bars and Forging Stock

In accordance with AMS2370.

4.5.2 Forgings

In accordance with AMS2372.

5. PREPARATION FOR DELIVERY

5.1 Sizes

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