

**STEEL BARS AND FORGINGS
(0.18 - 0.23C) (SAE 1022)**

UNS G10220

1. SCOPE:

1.1 **Form:** This specification covers a carbon steel in the form of bars, forgings, and forging stock.

1.2 **Application:** Primarily for parts requiring low strength and high ductility.

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

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

2.1.1 **Aerospace Material Specifications:**

AMS 2231 - Tolerances, Carbon Steel Bars

MAM 2231 - Tolerances, Metric, Carbon Steel Bars

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 Corrosion and Heat Resistant Steels and Alloys

AMS 2808 - Identification, Forgings

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2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM E 8 - Tension Testing of Metallic Materials
 ASTM E 8M - Tension Testing of Metallic Materials (Metric)
 ASTM E 112 - Determining Average Grain Size
 ASTM E 350 - 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, 0 determined by wet chemical methods in accordance with ASTM E 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	mi nmax
Carbon	0.18 - 0.23
Manganese	0.70 - 1.00
Silicon	0.15 - 0.35
Phosphorus	-- 0.040
Sulfur	-- 0.050

3.1.1 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: Cold finished.

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 E 8 or ASTM E 8M:

3.3.1.1 Bars:

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
Up to 0.875, incl	70,000	60,000	18
Over 0.875 to 1.250, incl	65,000	55,000	16
Over 1.250 to 2.000, incl	60,000	50,000	15
Over 2.000 to 3.000, incl	55,000	45,000	15

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min
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 bars over 3.000 inches (76.20 mm) in nominal diameter or least distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.1.2 Forgings:

Tensile Strength, minimum	55,000 psi (379 MPa)
Yield Strength at 0.2% Offset, minimum	36,000 psi (248 MPa)
Elongation in 4D, minimum	22%

3.3.1.2.1 For each 2000 psi (14 MPa) in excess of 55,000 psi (379 MPa) tensile strength, a reduction in elongation of 1% to a minimum elongation of 10% is permissible.

3.3.2 Grain Size: Predominantly 4 or finer with occasional grains as large as 2 permissible, determined in accordance with ASTM E 112.

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.

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

3.6 Tolerances: Bars shall conform to all applicable requirements of AMS 2231 or MAM 2231.

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 for all technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing: Shall be in accordance with the following; the number of specimens to be sampled shall be the minimum number of specimens tested:

4.3.1 Bars: AMS 2370.

4.3.2 Forgings and Forging Stock: AMS 2372.

4.4 Reports:

4.4.1 The vendor of bars and forgings shall furnish with each shipment a report showing the results of tests for chemical composition and grain size of each heat and for tensile properties of each lot. This report shall include the purchase order number, lot number, AMS 5070G, 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 forging stock shall furnish with each shipment a report showing the results of tests for chemical composition of each heat. This report shall include the purchase order number, heat number, AMS 5070G, size, and quantity.

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

4.5.1 Bars: AMS 2370.

4.5.2 Forgings and Forging Stock: AMS 2372.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be as follows:

5.1.1 Bars: 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.

5.2 Protective Treatment: Bars ordered cold drawn, cold rolled, ground, turned, or polished shall be coated with a suitable corrosion-preventive compound prior to shipment.