

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS 5638E

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Superseding AMS 5638D

Submitted for recognition as an American National Standard

STEEL, CORROSION RESISTANT, BARS AND FORGINGS

0.14S - 18Cr - 9.5Ni - 0.50Mo - 0.80Al

Free-Machining; Swaging or Upsetting

Solution Heat Treated

UNS S30345

1. SCOPE:

1.1 Form:

This specification covers a free-machining, corrosion-resistant steel in the form of bars, forgings, and forging stock.

1.2 Application:

These products have been used typically for parts on which the amount of machining warrants use of a free-machining grade of steel, requiring corrosion resistance similar to the 18-8 type of steel, not subjected to temperatures exceeding 700 °F (371 °C) during fabrication or in service, but usage is not limited to such applications.

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 the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2241 Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire

MAM 2241 Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire

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2.1 (Continued):

AMS 2248 Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

AMS 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS 2374 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steel and Alloy Forgings

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

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 262 Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

ASTM E 10 Brinell Hardness of Metallic Materials

ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.15
Manganese	--	2.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	0.11	0.16
Chromium	17.00	19.00
Nickel	8.50	10.50
Molybdenum	0.40	0.60
Aluminum	0.60	1.00
Copper	--	0.50

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Bars and Forgings: Solution heat treated, free from continuous carbide network, and descaled.

3.2.1.1 All hexagons and other bars 2.75 inches (69.8 mm) and under in nominal diameter or distance between parallel sides shall be cold finished.

3.2.1.2 Bars, other than hexagons, over 2.75 inches (69.8 mm) in nominal diameter or distance between parallel sides shall be hot finished.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Heat Treatment:

(R)

Bars and forgings shall be solution heat treated by heating to a temperature not lower than 1900 °F (1038 °C), holding at the selected temperature within ± 25 °F (± 14 °C) for a time commensurate with cross-sectional thickness, and cooling rapidly.

3.3.1 Bars may be heat treated immediately following hot working, while the metal temperature is sufficiently high that all grain boundary carbides are in solid solution, and cooling rapidly to prevent grain boundary carbide precipitation.

3.4 Properties:

The product shall conform to the following requirements:

3.4.1 Hardness: Shall be as follows, determined in accordance with ASTM E 10:

- 3.4.1.1 Bars: Shall be as shown in Table 2, or equivalent (See 8.2), determined at approximate mid-radius or quarter thickness.

TABLE 2 - Hardness

Nominal Diameter or Distance Between Parallel Sides Inches	Nominal Diameter or Distance Between Parallel Sides Millimeters	Hardness
Up to 0.75, incl	Up to 19.0, incl	170 to 255 HB
Over 0.75	Over 19.0	140 to 241 HB

- 3.4.1.2 Forgings: Shall have hardness not higher than 187 HB, or equivalent (See 8.2).

- 3.4.2 Susceptibility to Intergranular Attack: Specimens from the product shall pass the intergranular corrosion acid test performed in accordance with ASTM A 262, Practice E.

3.5 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.

- 3.5.1 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of re-entrant grain flow.

3.6 Tolerances:

Shall conform to all applicable requirements of AMS 2241 or MAM 2241.

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection:
(R)

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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:

- 4.2.1 Acceptance Tests: The following requirements are acceptance tests and shall be performed on each heat or lot as applicable:

- 4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Hardness (3.4.1) of each lot of bars and forgings.

4.2.1.3 Susceptibility to intergranular attack (3.4.2) for each lot of bars and forgings.

4.2.1.4 Tolerances (3.6) of bars.

4.2.2 Periodic Tests: Grain flow of die forgings (3.5.1) is a periodic test and shall be performed at a (R) frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

(R) Shall be as follows:

4.3.1 Bars and Forging Stock: In accordance with AMS 2371.

4.3.2 Forgings: In accordance with AMS 2374.

4.4 Reports:

(R) The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and the results of tests of each lot to determine conformance to the other acceptance test requirements and, when performed, to the periodic test requirements. This report shall include the purchase order number, heat and lot number, AMS 5638E, 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.

4.5 Resampling and Retesting:

Shall be as follows:

4.5.1 Bars and Forging Stock: In accordance with AMS 2371.

4.5.2 Forgings: In accordance with AMS 2374.

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).