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400 Commonwealth Dr., Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5638D

Issued 1-15-63
Revised 7-1-89

Superseding AMS 5638C

STEEL BARS AND FORGINGS, CORROSION RESISTANT
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 one type of free-machining, corrosion-resistant steel in the form of bars, forgings, and forging stock.

1.2 Application: Primarily 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 but not subjected to temperatures exceeding 700°F (371°C) during fabrication or in service.

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 documents 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 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
AMS 2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products Except Forgings and Forging Stock

2.1.1 Aerospace Material Specifications (Cont'd.):

AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Forgings and Forging Stock
AMS 2750 - Pyrometry
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.

ASTM A262 - Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

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 Specifications:

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 E353, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	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 applicable 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: Bars and forgings shall be solution heat treated by heating Ø to a temperature not lower than 1900°F (1038°C), holding at the selected temperature within ±25°F (±14°C) for not less than 15 minutes, and cooling rapidly. Pyrometry shall be in accordance with AMS 2750.

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

3.4 Properties: The product shall conform to the following requirements; hardness testing shall be performed in accordance with ASTM E10:

3.4.1 Hardness:

3.4.1.1 Bars: Shall be as follows, or equivalent Rockwell hardness, determined at approximate mid-radius or quarter thickness:

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

3.4.1.2 Forgings: Shall have hardness not higher than 187 HB, or equivalent.

3.4.2 Susceptibility to Intergranular Attack: The product shall pass the Ø ntergranular corrosion acid test performed in accordance with ASTM A262, 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 Forgings shall have substantially uniform macrostructure. Standards for Ø acceptance shall be as agreed upon by purchaser and vendor.

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

3.6 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).

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

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: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374.

4.4 Reports: The vendor of the product shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and for hardness of each lot and stating that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, heat number, AMS 5638D, 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 in accordance with the following:

4.5.1 Bars: AMS 2371.

4.5.2 Forgings and Forging Stock: AMS 2374.

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.