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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5616J

Issued 1 MAR 1948
Revised 1 JUL 1992

Superseding AMS 5616H

Submitted for recognition as an American National Standard

STEEL, CORROSION AND HEAT RESISTANT, BARS, WIRE, FORGINGS, TUBING, AND RINGS
13Cr - 2.0Ni - 3.0W
Annealed

UNS S41800

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant steel in the form of bars, wire, forgings, mechanical tubing, flash welded rings, and stock for forging, flash welded rings, or heading.

1.2 Application:

These products have been used typically for parts requiring oxidation resistance up to 1000 °F (538 °C), but usage is not limited to such applications. Strength at the higher temperature is superior to that of the standard 12Cr type steel.

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
AMS 2243 Tolerances, Corrosion and Heat Resistant Steel Tubing
MAM 2243 Tolerances, Metric, Corrosion and Heat Resistant Steel Tubing

2.1 SAE Publications (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 2303 Aircraft Quality Steel Cleanliness, Martensitic Corrosion-Resistant Steels, Magnetic Particle Inspection Procedure
MAM 2303 Aircraft Quality Steel Cleanliness, Martensitic Corrosion-Resistant Steels, Magnetic particle Inspection Procedure, Metric (SI) Measurement
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
AMS 7493 Rings, Flash Welded, Non-Austenitic Corrosion Resistant Steels
AS1182 Standard Machining Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel, Bars and Mechanical Tubing

2.2 ASTM Publications:

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

ASTM A 370 Mechanical Testing of Steel Products
ASTM E 112 Determining Average Grain Size
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 Standardization Documents Order 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:
(R)

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	0.20
Manganese	--	0.50
Silicon	--	0.50
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	12.00	14.00
Nickel	1.80	2.20
Tungsten	2.50	3.50
Molybdenum	--	0.50
Aluminum	--	0.15
Copper	--	0.50
Tin	--	0.05
Nitrogen	--	0.08

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; hardness and tensile strength shall be determined in accordance with ASTM A 370 (See 8.2).

3.2.1 Bars: Annealed having hardness not higher than 311 HB, or equivalent.

3.2.1.1 Bars over 0.500 to 2.750 inches (12.70 to 69.85 mm), inclusive, in nominal diameter or distance between parallel sides and all hexagons shall be cold finished.

3.2.1.2 Bars, other than hexagons, over 2.750 inches (69.85 mm) in nominal diameter or distance between parallel sides shall be hot finished.

3.2.2 Wire: Annealed and cold finished having tensile strength not higher than 155 ksi (1069 MPa) or equivalent hardness.

3.2.3 Forgings: Annealed having hardness not higher than 311 HB, or equivalent.

3.2.4 Mechanical Tubing: Annealed and cold finished having hardness not higher than 311 HB, or equivalent.

3.2.5 Flash Welded Rings: Annealed having hardness not higher than 311 HB, or equivalent.

3.2.5.1 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS 7493.

3.2.6 Stock for Forging, Flash Welded Rings, or Heading: As ordered by the forging, flash welded ring, or heading manufacturer.

3.3 Properties:

The product shall conform to the following requirements:

3.3.1 Response to Heat Treatment: Product 0.375 inch (9.52 mm) and under in nominal thickness and 0.375 inch ± 0.010 (9.52 mm ± 0.25) thick specimens cut from larger product shall have hardness not lower than 45 HRC, or equivalent, determined in accordance with ASTM A 370, after being heated to 1750 °F ± 10 (954 °C ± 6), held at heat for 25 to 30 minutes, and quenched in commercial paraffin oil [approximately 100 SUS at 100 °F (38 °C)] at room temperature.

3.3.2 (R) Grain Size: Shall be predominantly 5 or finer with occasional grains as large as 3 permissible for product 2 inches (51 mm) and under in nominal diameter or least distance between parallel sides, determined by comparison of a polished and etched specimen with the chart in ASTM E 112. Grain size requirements for product over 2 inches (51 mm) in nominal diameter or least distance between parallel sides shall be as agreed upon by purchaser and vendor.

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 Steel shall be aircraft quality and, when specified, shall conform to AMS 2303 or MAM 2303.

3.4.2 (R) Bars ordered hot rolled or cold drawn, or ground, turned, or polished, shall, after removal of the standard machining allowance in accordance with AS1182, be free from seams, laps, tears, and cracks open to the ground, turned, or polished surface.

3.4.3 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.

3.5 Tolerances:

Shall conform to all applicable requirements of the following:

3.5.1 Bars and Wire: AMS 2241 or MAM 2241.

3.5.2 Mechanical Tubing: AMS 2243 or MAM 2243.

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:

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

4.3 Sampling and Testing:

(R)

Shall be in accordance with the following:

4.3.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading: AMS 2371.

4.3.2 Forgings: 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 and, when specified, frequency-severity cleanliness rating of each heat and the results of tests for grain size and response to heat treatment of each lot. This report shall include the purchase order number, lot number, AMS 5616J, size, and quantity. If forgings are supplied, the part number and the size and melt source of stock used to make the forging shall also be included.

4.5 Resampling and Retesting:

Shall be in accordance with the following:

4.5.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, and Stock for Forging, Flashing Welded Rings, or Heading: AMS 2371.

4.5.2 Forgings: AMS 2374.