AEROSPACE MATERIAL SPECIFICATION

AMS5616	REV. M

Issued 1948-03
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Revised 2014-06

Superseding AMS5616L

Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings
13Cr - 2.0Ni - 3.0W
Annealed
(Composition similar to UNS S41800)

RATIONALE

AMS5616M revises Condition (3.2.1), Response to Heat Treatment (3.3.1), Sampling and Testing (4.3.3), and Reports (4.4) and is a Five Year Review and update of this specification.

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 formed 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 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 724-776-4970 (outside USA), www.sae.org.

AMS2241 Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire

AMS2243 Tolerances, Corrosion and Heat-Resistant Steel Tubing

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**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS5616M

AMS2248 Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

AMS2303 Steel Cleanliness, Aircraft Quality, Martensitic Corrosion-Resistant Steels, Magnetic Particle Inspection Procedure

AMS2371 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS2374 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings

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

AMS2808 Identification, Forgings

AMS7493 Rings, Flash Welded, Ferritic and Martensitic, Corrosion-Resistant Steels

AS1182 Standard Stock Removal Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

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 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

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	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 applicable requirements of AMS2248.

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:

3.2.1 Bars

Annealed having hardness not greater than 311 HB, or equivalent (See 8.2). Bar shall not be cut from plate (Also see 4.4.2).

3.2.1.1 Hexagons, regardless of size, and bars over 0.500 to 2.750 inches (12.70 to 69.85 mm), inclusive, in nominal diameter or least distance between parallel sides shall be cold finished.

3.2.1.2 Bars, other than hexagons, over 2.750 inches (69.85 mm) in nominal diameter or least 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 (See 8.3).

3.2.3 Forgings

Annealed having hardness not higher than 311 HB, or equivalent (See 8.2).

3.2.4 Mechanical Tubing

Annealed and cold finished having hardness not higher than 311 HB, or equivalent (See 8.2).

3.2.5 Flash Welded Rings

Annealed having hardness not higher than 311 HB, or equivalent (See 8.2).

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 AMS7493.

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

Utilizing specimens as in 4.3.3, 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 (See 8.2), 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 Average Grain Size

Bars 2 inches (51 mm) and under in nominal diameter or least distance between parallel sides shall have an average grain size of ASTM No. 5 or finer, 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.

3.4.1 Steel shall be aircraft quality and, when specified, shall conform to AMS2303.

3.4.2 Bars ordered hot rolled or cold drawn, or ground, turned, or polished, shall, after removal of the standard stock removal 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 reentrant grain flow.

3.5 Tolerances

Shall conform to all applicable requirements of the following:

3.5.1 Bars and Wire

AMS2241.

3.5.2 Mechanical Tubing

AMS2243.

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 the performance of all required tests. Purchaser reserves the right to sample and to 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), condition (3.2), response to heat treatment (3.3.1), average grain sizes of bars 2.00 inches (51 mm) and under in nominal diameter or least distance between parallel sides (3.3.2), frequency-severity cleanliness rating when specified (3.4.1), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Grain flow of die forgings is a periodic test and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Bars, Wire, Mechanical Tubing, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.