SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5867A

Issued APR 1992
Revised MAY 2001
Reaffirmed APR 2006

Superseding AMS 5867

Steel, Corrosion and Heat Resistant, Forgings
12.5Cr (SAE 51410)
Enhanced Fracture Toughness, Annealed

(Composition similar to UNS S41000)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant steel in the form of forgings and forging stock.

1.2 Application:

These forgings have been used typically for structural parts requiring oxidation resistance up to 1000 °F (538 °C) and enhanced fracture toughness, but usage is not limited to such applications.

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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

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

AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys
AMS 2303	Steel Cleanliness, Aircraft-Quality, Martensitic Corrosion Resistant Steels, Magnetic Particle Inspection Procedure
MAM 2303	Steel Cleanliness, Aircraft-Quality, Martensitic Corrosion Resistant Steels, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
AMS 2315	Determination of Delta Ferrite Content

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

AMS 2374 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steel and Alloy Forgings
AMS 2808 Identification, Forgings

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 370 Mechanical Testing of Steel Products
ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E 399 Plane-Strain Fracture Toughness of Metallic Materials

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	0.10	0.13
Manganese	--	0.50
Silicon	--	1.00
Phosphorus	--	0.020
Sulfur	--	0.030
Chromium	11.50	13.50
Nickel	--	0.75
Molybdenum	--	0.50
Aluminum	--	0.05
Copper	--	0.50
Vanadium	--	0.04
Tin	--	0.05
Nitrogen	--	0.08

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 Forgings: Annealed having hardness not higher than 241 HB, or equivalent (See 8.2); hardness shall be determined in accordance with ASTM A 370.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties:

The product shall conform to the following requirements; hardness testing shall be performed in accordance with ASTM A 370:

3.3.1 Forgings:

3.3.1.1 Properties After Heat Treatment: Forgings shall have the following properties, determined on full-section specimens from forgings 0.500 inch (12.70 mm) and under in nominal diameter or distance between parallel sides or on 0.500 inch ± 0.010 (12.70 mm ± 0.25) diameter specimens cut from larger forgings after being heat treated as follows: Heat to 1825 °F ± 25 (996 °C ± 14), hold at heat for not less than one hour, and cool to room temperature. Cooling rate between 1550 and 1000 °F (843 and 538 °C) shall be 50 F (28 C) degrees per minute or faster, except oil or water quenching is prohibited. Temper at 1015 °F ± 15 (546 °C ± 8) for not less than one hour and cool.

3.3.1.1.1 Hardness: Shall be 30 to 38 HRC, or equivalent (See 8.2).

3.3.1.1.2 Microstructure: When required, shall be in accordance with standards established by purchaser.

3.3.1.1.3 Ferrite Content: Shall be not more than 2%, determined in accordance with AMS 2315.

3.3.2 Forging Stock: A sample of forging stock forged to a test coupon shall be annealed to a hardness not exceeding 241 HB, or equivalent (See 8.2), heated to 1375 °F ± 25 (746 °C ± 14), held at heat for not less than three hours, cooled and then heat treated as in 3.3.1.1. Room temperature fracture toughness (K_{1c}), determined in accordance with ASTM E 399, shall be not less than 40 ksi $\sqrt{\text{inch}}$ (44 MPa $\sqrt{\text{m}}$)

3.4 Quality:

Forgings, 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 forgings.

3.4.1 Steel shall be aircraft quality conforming to AMS 2303 or MAM 2303.

3.4.2 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.

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: Hardness (3.3.1.1.1), ferrite content (3.3.1.1.3), microstructure, when required (3.3.1.1.2), and fracture toughness of forging stock (3.3.2) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Grain flow of die forgings (3.4.2) 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 in accordance with AMS 2374.

4.4 Reports:

4.4.1 The vendor of forgings shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and for condition, hardness, microstructure (when specified) and ferrite content after heat treatment of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, lot numbers, AMS 5867A, size, quantity, and melt source of stock used to make the forgings.

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, and for fracture toughness of each lot. This report shall include the purchase order number, heat number, AMS 5867A, size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2374.

5. PREPARATION FOR DELIVERY:

5.1 Identification:

Shall be as follows: