



AEROSPACE MATERIAL SPECIFICATION

AMS2376™**REV. E**

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Superseding AMS2376D

Qualification, Approval, and Control of Premium-Quality Forgings
Alloy Steels and Heat-Treatable Corrosion and Heat Resistant Steels and Alloys

RATIONALE

AMS2376E has been declared stabilized as AMS Carbon and Low Alloy Steels Committee E and AMS Corrosion Heat Resistant Alloys Committee F cannot find any users or active specifications referencing this specification.

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AMS2376E has been declared "STABILIZED" by SAE AMS Carbon and Low Alloy Steels Committee E and SAE AMS Corrosion Heat Resistant Alloys Committee F. This document will no longer be updated and may no longer represent standard industry practice. This document was stabilized because there are not any active specifications that reference the document. Previously this document was Reaffirmed Non-Current. The last technical update of this document occurred in April 1992. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to this specification; including exceptions listed on the certification.

NOTE: In many cases, the purchaser may represent a sub tier supplier and not the cognizant engineering organization.

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1. SCOPE:

1.1 Purpose:

This specification covers procedures for approval of premium-quality forgings, usually serialized, the stock from which such forgings are produced, and the controls to be exercised in producing the forgings and forging stock.

1.2 Application:

This procedure has been used typically for highly-stressed parts produced from forgings which require approval of the forgings and the stock from which they are made and facets of their production to ensure that production lots of forgings are of the same metallurgical quality and are produced by the same basic procedures as the forgings and stock originally qualified, but usage is not limited to such applications.

- 1.2.1 This specification is applicable to parts made of steels and heat-treatable corrosion and heat resistant alloys and which are subjected to rigid inspection standards throughout manufacture from ingot to finished part.

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 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
AMS 2630	Ultrasonic Inspection, Product Over 0.5 Inch (12.5 mm) Thick
AMS 2750	Pyrometry
AMS 2759	Heat Treatment of Steel Parts, General Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Ingot:

Shall be produced, by a source approved by purchaser of the forgings, under effective, documented controls of all variables of the melting processes to consistently produce uniform ingots which will yield products meeting the requirements of this specification, the applicable material specification, and applicable drawings.

- 3.1.1 Melting Practice: Shall be as specified in the applicable material specification. Melting parameters shall be established and shall be monitored and recorded on a continuous or periodic basis acceptable to purchaser. Deviations from established process control factors (See 4.4.2.1.1) shall be reported to purchaser of forgings and approval obtained before the ingot is considered acceptable.
- 3.1.2 Ingot Molds: Shall be clean and free of foreign materials. Molds used for casting leaded steels and alloys shall not be used.
- 3.1.3 Identification: Each ingot shall be marked with the mill heat number and pouring sequence/remelt identity such that the top and/or bottom is traceable.

3.2 Forging Stock:

Billets, bars, slabs, and tubes for forging shall be manufactured from ingot produced as in 3.1 and shall be procured only from sources approved by purchaser of the forgings. Parameters shall be established for ingot conversion procedures which will produce stock conforming to the requirements of 3.2.1, 3.2.2, 3.2.3, and 3.2.4. These parameters shall be monitored and recorded on a continuous or periodic basis acceptable to purchaser. Deviations from established process control factors (See 4.4.2.1.1) shall be reported to purchaser of forgings and approval obtained before the stock is considered acceptable.

- 3.2.1 Macrostructure: Shall be as specified in the applicable material specification.
- 3.2.2 Magnetic Particle Cleanliness: Shall be as specified in the applicable material specification. If not specified, ferromagnetic steels shall meet the requirements of AMS 2300 or MAM 2300.
- 3.2.3 Identification: Each piece of forging stock shall be marked with the heat number and ingot number. Forging stock, 4.0 inches (102 mm) and over in nominal diameter or distance between parallel sides, shall be identified as to its location and orientation in the remelt ingot. When specified, forging stock under the above size limit shall be identified to at least the quarter section of the remelt ingot from which it was taken. The forging stock vendor shall maintain a map or other descriptive information which correlates the identification to the remelt ingot location. Records shall be maintained of those portions of the ingots which were not acceptable, other than normal end croppage, and include the reason for rejection.
- 3.2.4 The forging vendor shall be responsible for ensuring that the stock conforms to the applicable material specification and will yield acceptable forgings. Tests which are characteristic of a heat and which are conducted by the forging stock vendor need not be repeated by the forging vendor. Forging vendor shall also determine that the stock is from an approved mill source.
 - 3.2.4.1 The forging vendor shall obtain complete test reports from the mill on each heat of forging stock; the reported results shall be verified in conjunction with quality conformance testing.

3.3 Forgings:

Shall be produced from stock conforming to 3.2. Forgings shall be formed to their final rough dimensions by one or a combination of the following processes, unless a particular process is specified:

- Hammer die
- Press die
- Hot upset
- Ring roll
- Mandrel forge
- Extrusion
- Rotary

3.3.1 Preproduction Forgings:

- 3.3.1.1 Vendor shall establish the forging sequence and other processing procedures, such as heat treating and cleaning, suitable for producing premium-quality forgings. These procedures shall be documented on operation sheets for the purpose of maintaining consistent practices. The operation sheets shall be submitted to purchaser for approval, unless such approval be waived by purchaser.
- 3.3.1.2 Vendor shall produce one or more preproduction forgings and shall heat treat and test a forging or sections thereof to all requirements of the material specification, the drawing, and any additional requirements specified by purchaser. The preproduction forgings shall be produced by the practices to be used on production forgings in accordance with approved operation sheets and may be produced as part of the initial production run. A duplicate preproduction forging or the remaining section of such forging shall be submitted to purchaser for confirmatory testing when requested by purchaser.
- 3.3.1.3 The location(s) from which coupons for mechanical tests are taken and the sections for grain flow examination shall be as specified by purchaser. The vendor shall perform the required tests on specimens from these locations. If no locations are specified, vendor shall select representative areas for testing.
- 3.3.1.4 Grain Flow: A forging shall be sectioned through areas indicated by purchaser and the sections suitably etched to show the grain flow. Photographs showing the grain flow shall be made of each section and the photographs shall be identified to show the relationship to the corresponding sections in the forging. Except in areas of forgings which contain end grain, the grain flow shall follow the general contour of the forgings, showing no evidence of re-entrant grain flow. Standards for acceptance shall be as agreed upon by purchaser and vendor.