AEROSPACE MATERIAL SPECIFICATION

AMS2374™	REV. F
Issued 1976-07 Revised 2023-06 Superseding AMS2374E	

(R) Quality Assurance Sampling and Testing
Corrosion- and Heat-Resistant Steel and Alloy Forgings

RATIONALE

AMS2374F is the result of a Five-Year Review and update of the specification. The revision separates heat and lot definitions (3.3.2 and 3.3.3), reorganizes and updates requirements for forging classes (3.3.4), adds reporting of composition note (3.3.5.2.1), updates specimen requirements (3.3.5.2.2), adds strain rate requirement for tensile tests (3.3.5.2.2.3), adds impact and fracture toughness testing (3.3.5.2.3, 3.3.5.2.4), addresses when more stringent NDT has been performed (3.3.5.2.7), and updates retesting requirements (3.3.6).

1. SCOPE

This specification covers quality assurance sampling and testing procedures used to determine conformance to applicable material specifications of corrosion- and heat-resistant steel and alloy forgings.

1.1 Quality assurance sampling and testing procedures for forging stock are covered in AMS2371.

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 +1 724-776-4970 (outside USA), www.sae.org.

AMS2808 Identification Forgings

AS7766 Terms Used in Aerospace Metals Specifications

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 A370 Mechanical Testing of Steel Products

ASTM E8/E8M Tension Testing of Metallic Materials

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ASTM E292 Conducting Time-for-Rupture Notch Tension Tests of Materials

ASTM E399 Metallic Material Fracture Toughness Testing

2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 General Requirements

3.1.1 Omission from this specification of confirmatory tests of certain material properties or attributes controlled by the applicable material specifications does not relieve the producer of responsibility for furnishing forgings that conform in all aspects to the applicable material specification.

3.1.2 In event of conflict between requirements specified herein and requirements of a particular material specification, requirements of the material specification shall take precedence.

3.2 Responsibility for Tests

The producer of forgings shall supply all samples for the producer's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by the applicable material specification.

3.3 Detail Requirements

3.3.1 Classification

For the purpose of clarifying test requirements, forgings shall be classified as shown in Table 1.

Table 1 - Classifications of forgings

Class	Description
I	Forgings supplied in the final heat-treated condition and requiring destructive testing for verification of specified mechanical properties.
II	Forgings supplied in any heat-treated condition other than the final heat-treated condition that require testing to ensure conformance to specified mechanical properties after subsequent heat treatment.
III	Forgings supplied in the final heat-treated condition to only a specified hardness.
IV	Forgings supplied in a preliminary heat-treated condition for machinability, welding, etc., and not subject to testing for specified mechanical properties, other than hardness, after final heat treatment.

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3.3.2 Heat

A heat shall be all steel or alloy melted in a single furnace charge. For consumable electrode remelted steel or alloy, a heat shall be all consumable electrode remelted ingots processed from steel or alloy originally melted as a single furnace charge.

3.3.3 Lot

A lot shall be all forgings of a similar configuration, opposite hand being considered as a single configuration, identifiable to a single heat of steel or alloy, forged under the same nominal forging process parameters, and processed by either of the following methods (see 3.3.3.1 or 3.3.3.2):

3.3.3.1 Sequentially heat treated during a 24-hour period in a continuous furnace with no interruptions in operations and no change in furnace temperature, charge rate, or racking pattern.

3.3.3.2 Sequentially heat treated during a 48-hour period in one or a series of batch-type furnace loads provided the loads are processed in the same furnace or same series of furnaces and there is no change in power, set temperature, soak time, quench parameters, or racking pattern.

3.3.4 Hardness Sampling

Shall be as follows:

3.3.4.1 Class I Forgings

Shall be tested for conformance on the basis of at least one forging from each lot for any specified mechanical properties other than hardness. If hardness is specified, production forgings shall be sampled for hardness as shown in Table 2.

3.3.4.2 Class II Forgings

Samples shall be taken from each lot, heat treated as specified, and tested to demonstrate conformance to specified requirements. In addition, if hardness is specified, production forgings shall be sampled for hardness as shown in Table 3.

3.3.4.3 Class III Forgings

Shall be sampled for hardness as shown in Table 2. All samples tested shall conform to the specified hardness or all forgings shall be tested. If all forgings are checked, the producer may reheat treat nonconforming forgings, submit the nonconformance to the purchaser for disposition, or reject the nonconforming forgings.

3.3.4.4 Class IV Forgings

If hardness is specified, shall be sampled as shown in Table 3.

Table 2 - Hardness sampling plan for class I or class III forgings

Lot Quantity	Sample Size
1 - 44	All
45 - 65	44
66 - 110	60
111 - 180	67
181 - 300	73
301 - 500	78
501 - 800	80
Over 800	10% or 85 pieces, minimum

Table 3 - Hardness sampling plan for class II or class IV forgings

Lot Quantity	Sample Size
1 - 20	All
20 - 100	25% or 20 pieces, minimum
101 - Over	10% or 25 pieces, minimum

3.3.5 Testing

Shall be as follows:

3.3.5.1 Tests for properties that are characteristic of the heat, such as composition, hardenability, cleanliness, etc., need not be repeated on forgings from a heat, provided that these tests have been performed on the forging stock or forging(s) from that heat and that heat identity of the forgings is maintained.

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3.3.5.2 Test Methods

Shall be in accordance with requirements of the applicable material specification. If a test method is not specified, the method of test shall be acceptable to the purchaser.

3.3.5.2.1 The producer may test for any element not listed in the composition table in the relevant base metal specification and include this analysis in the report. Reporting of any element not listed in the composition table is not a basis for rejection.

3.3.5.2.2 Tensile, Stress-Rupture, and Creep Properties

3.3.5.2.2.1 Orientation

Longitudinal specimens shall be taken with the axis of the specimen within 15 degrees of parallel to the forging flow lines, except when transverse tensile properties are required by the applicable material specification or by the purchaser; in which case, specimens shall be taken with the axis of the specimen within 15 degrees of perpendicular to the forging flow lines. When forging flow lines are difficult to determine, the direction with the greater elongation and reduction of area shall be used for longitudinal specimens and transverse specimens shall be perpendicular to the longitudinal specimens.

3.3.5.2.2.2 Size

Specimens, except notched and combination smooth-and-notched stress-rupture specimens, shall conform to ASTM A370 or ASTM E8/E8M per the material specification and shall be either 0.250-inch (6.35-mm) diameter at the reduced parallel gage section, 0.500-inch (12.70-mm) diameter at the reduced parallel gage section, standard rectangular specimens, or subsize specimens proportional to the standard when the configuration of the forging does not permit the use of standard size specimens. Notched specimens and combination smooth-and-notched specimens shall conform to the respective dimensions shown in ASTM E292.

3.3.5.2.2.3 Strain Rate

When mechanical properties are specified beyond a maximum ultimate tensile strength, (e.g., elongation or yield strength are requirements) the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (±0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced parallel section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min). The requirement for compliance becomes effective for material produced 1 year after the publication date of this specification

3.3.5.2.3 Impact Testing

At least one specimen shall be taken with the same orientation as tensile specimens (3.3.5.2.2.1). Additional sample details shall be acceptable to the purchaser.

3.3.5.2.4 Fracture Toughness Testing

3.3.5.2.4.1 To facilitate determination of fracture toughness, a tensile specimen taken immediately adjacent to the location of the fracture toughness specimen is required. Fracture planes of the tensile and K_{IC} specimen shall be in the same orientation. If a tensile specimen cannot be excised with the fracture plane in the same orientation as that of the fracture toughness specimen, the orientation of the tensile specimen shall be as approved by the purchaser.

3.3.5.2.4.2 Invalid test results in accordance with ASTM E399 shall be considered meaningful and the material shall be accepted to K_{IC} requirements if the thickest possible specimen was used, the calculated K_Q equals or exceeds the required K_{IC}, and the invalidity is due to one or both of the following conditions:

a. $W - a < 2.5 (K_Q/\sigma_{YS})^2$

b. $P_{max}/P_Q > 1.10$

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