



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 2374

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Revised

QUALITY ASSURANCE SAMPLING OF CORROSION AND HEAT RESISTANT STEELS AND ALLOYS Forgings and Forging Stock

1. SCOPE: This specification covers quality assurance procedures which may be used to determine conformance of corrosion and heat resistant steel and alloy forgings and forging stock to applicable material specification requirements.
2. APPLICABLE DOCUMENTS: None.
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 specification does not relieve the vendor of responsibility for furnishing products which conform in all aspects to the applicable specification.
 - 3.1.2 In the event of conflict between the requirements specified herein and the requirements of a particular material specification, the following rules shall apply:
 - 3.1.2.1 When the requirements of the material specification are more stringent, they shall take precedence.
 - 3.1.2.2 When the requirements of this AMS are more stringent, they shall take precedence.
 - 3.1.3 When instructions are issued by the purchaser regarding quality assurance sampling procedures, such instructions shall take precedence over the requirements of this specification or the particular specification in which this specification is invoked.
 - 3.2 Responsibility for Test: The vendor of the product shall supply all samples 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 Forging Stock: The product of each heat shall be subjected to such tests and inspections as necessary to ensure conformance to applicable requirements. When the material is melted by a consumable-electrode remelt method, a heat shall be all consumable-electrode remelted ingots originally melted in a single furnace charge.
 - 3.3.1.1 For consumable-electrode remelted material, the chemical composition shall be that of the parent heat, except that those elements subject to change during remelting shall be determined on the consumable remelted product.

SAE Technical Board rules provide that: "All technical reports, including standards, approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

- 3.3.1.2 If the applicable specification does not establish the stage of manufacture for testing or the method of preparing test material, tests to ensure that forging stock conforms to specified properties may be made on the stock size supplied, forged-down test bars, or upset pancakes, or as otherwise agreed upon by forging producer and forging stock vendor, for all material that requires hardening and tempering, solution heat treatment, or solution and precipitation heat treatment to develop final properties.
- 3.3.1.3 Tests for conformance to characteristics other than mechanical properties shall be performed on the forging stock in the size and condition offered for shipment, except as otherwise permitted.
- 3.3.2 Forgings: For the purpose of clarifying test requirements, forgings shall be given a class number and an inspection lot designation, as follows:

3.3.2.1 Class Number:

Class	Description
I -	Forgings furnished in the final heat treated condition and requiring destructive testing for verification of specified mechanical properties.
II -	Forgings, furnished 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 furnished in the final heat treated condition to only a specified hardness.
IV -	Forgings furnished in a preliminary heat treated condition for machinability, welding, etc and not subject to testing for specified mechanical properties after final heat treatment.

3.3.2.2 Inspection Lot Designation:

Inspection Lot	Description
A -	Shall consist of all forgings of a similar configuration identifiable to a single heat. Opposite end shall be considered as a single configuration, unless otherwise specified.
B -	Shall consist of all the restrictions listed for Inspection Lot A. In addition, the lot shall be further restricted to those forgings heat treated as a batch or sequentially heat treated in a continuous furnace.
C -	Shall consist of all the restrictions listed for Inspection Lot A. In addition, the lot shall be further restricted to those forgings produced by the same technique and processed through the final forging operation on the same setup.
D -	Shall consist of all of the restrictions listed for Inspection Lots A, B and C.

3.3.2.2.1 Inspection Lot A shall be used, unless otherwise specified.

3.3.3 Test Methods: Shall be in accordance with the requirements of the applicable material specification. If a test method is not specified, the method of test shall be as agreed upon by purchaser and vendor.

3.3.4 Sampling of Forgings:

3.3.4.1 Class I forgings shall be sectioned and tested for conformance on the basis of one forging per inspection lot for mechanical properties other than hardness; in addition, production forgings shall be sampled in accordance with Table I if hardness is specified.

3.3.4.2 A Class II forging shall be taken from each inspection lot, heat treated as specified, sectioned, and tested to demonstrate conformance; in addition, production forgings shall be sampled for hardness in accordance with Table II if hardness is specified.

3.3.4.3 Class III forgings shall be sampled for hardness in accordance with Table I.

3.3.4.4 Class IV forgings shall be sampled in accordance with Table II if hardness is specified.

3.3.4.5 Sampling for hardness shall be as shown in Table I or Table II.

TABLE I

Class I or Class III Forgings

Lot Quantity	Sample Size
1 - 44	100%
45 - 65	44
66 - 110	60
111 - 180	67
180 - 300	73
301 - 500	78
501 - 800	80
Over - 800	10% (85 pcs minimum)

TABLE II

Class II or Class IV Forgings

Lot Quantity	Sample Size
1 - 20	100%
21 - 100	25% (20 pcs minimum)
Over 100	10% (25 pcs minimum)

3.3.4.5.1 Each furnace load and/or container of forgings shall be included in the selection of samples.

3.3.4.5.2 All samples shall conform to the specified hardness or 100% inspection shall be applied. If pieces are checked 100%, the vendor may reheat treat nonconforming pieces, submit nonconforming pieces to the purchaser for consideration, or scrap the pieces.

3.3.5 Testing of Forgings:

- 3.3.5.1 General: Tests for properties which 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 stock from that heat and that heat identity of the forgings is maintained.
- 3.3.5.2 Grain Flow: When grain flow is specified, a preproduction forging shall be sectioned and macro-etched to reveal the grain flow pattern. The pattern shall be in essential agreement with flow lines sketched on the drawing or as agreed upon by purchaser and vendor. This procedure shall be repeated following any major change in forging technique or die design.
- 3.3.5.3 Decarburization, Intergranular Attack, and Other Microstructural Requirements: When microstructural requirements other than cleanliness are specified, the location of specimens and method of testing shall be as agreed upon by purchaser and vendor.
- 3.3.5.4 Nondestructive Testing: Shall be performed to ensure freedom from harmful imperfections. The methods, standards, and frequency shall be as agreed upon by purchaser and vendor.
- 3.3.5.5 Dimensions: Forgings shall be inspected as required to ensure conformance to dimensions shown on the applicable drawing.
- 3.3.5.6 Markings: Each forging shall be examined to determine that all markings are legible and conform to the purchaser's requirements.
- 3.3.5.7 Location of Test Specimens: When destructive testing of a forging is required, the test specimens shall be taken from the location(s) shown on the drawing or sketch. Deviations from specified properties because of section size or specimen orientation shall be as agreed upon by purchaser and vendor.
- 3.3.5.7.1 Periodic or Capability Tests: When a requirement in the applicable specification is expressed as a periodic test or "capability" requirement, the reporting of a test result for each lot is not required. Either the vendor or the purchaser may test for these requirements at his option. If such test is made and fails to meet such requirement, the lot shall be subject to rejection. If capability tests are performed, the results shall be reported.
- 3.3.5.7.2 Integral Coupon Tests: When permitted by purchaser, specimens from integral coupons may be used for tests.
- 3.3.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens, selected as in 3.3.6.1 or 3.3.6.2, for each original nonconforming specimen. Except as permitted in 3.3.6.1 and 3.3.6.2, failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Except as permitted in 3.3.6.2.1, results of all tests shall be reported.
- 3.3.6.1 Forging Stock:
- 3.3.6.1.1 Aircraft Quality: Should resampling and retesting be required for macrostructure, microstructure, or magnetic particle testing of aircraft quality material, the additional specimens shall be taken from material representing the same position in each of the two available ingots most immediately adjacent in pouring sequence to that from which the failed specimen was taken and one from the original nonconforming ingot after additional discard; should the latter specimen be unacceptable, resampling and retesting on the nonconforming ingot may be repeated after as many consecutive discards as necessary and desired to obtain sound material.