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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2372D

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Superseding AMS 2372C

Quality Assurance Sampling and Testing Carbon and Low-Alloy Steel Forgings

1. SCOPE:

This specification covers quality assurance sampling and testing procedures used to determine conformance to applicable specification requirements of carbon and low-alloy steel forgings.

1.1 Quality assurance sampling and testing procedures for forging stock are covered by AMS 2370.

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 2808 Identification, Forgings

2.2 ASTM Publications:

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

ASTM E 8 Tension Testing of Metallic Materials
ASTM E 8M Tension Testing of Metallic Materials (Metric)

3. TECHNICAL REQUIREMENTS:

3.1 General Requirements:

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
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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 vendor of responsibility for furnishing forgings which conform in all aspects to the applicable material specification.

3.1.2 In the event of a 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 vendor of forgings shall supply all samples for vendor'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 follows:

Class	Description
I	Forgings supplied in the final heat treated condition and requiring destructive testing for verification of specified mechanical properties.
II	Forgings supplied normalized, normalized and tempered, normalized and annealed, or annealed only, that require testing to ensure conformance to specified mechanical properties after subsequent heat treatment.
III	Forgings supplied hardened and tempered only to a specified hardness.
IV	Forgings supplied normalized, normalized and tempered, normalized and annealed, or annealed only, e.g., carburizing grades, not subject to testing for specified mechanical properties after final heat treatment.

3.3.2 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, and processed by either of the following methods (See 3.3.2.2 and 3.3.2.3):

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

3.3.2.2 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.

3.3.2.3 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.

3.3.3 Sampling and Testing: Shall be as follows:

3.3.3.1 Class I Forgings: Shall be sectioned and tested for conformance on the basis of at least one forging from each lot for mechanical properties, other than hardness, if specified; in addition, production forgings shall be sampled for hardness in accordance with Table 1 if hardness is specified.

3.3.3.1.1 Once a valid hardness/tensile property relationship has been established for a given forging and heat treat cycle, the frequency of destructive testing may be reduced, when permitted by purchaser, and hardness used as the conformance criterion.

TABLE 1 - Class I or Class III Forgings

Lot Quantity	Sample Size
1 to 44	100%
45 to 65	44
66 to 110	60
111 to 180	67
181 to 300	73
301 to 500	78
501 to 800	80
801 and over	10% or 85 pieces, min

TABLE 2 - Class II or Class IV Forgings

Lot Quantity	Sample Size
1 to 20	100%
21 to 100	25% or 20 pieces, min
101 and Over	10% or 25 pieces, min

3.3.3.1.2 Each furnace load or container of forgings shall be included in the selection of samples.

3.3.3.1.3 All samples tested shall conform to the specified hardness or 100% inspection shall be applied. If forgings are checked 100%, the vendor may either re-heat treat nonconforming forgings, submit the nonconformance to purchaser for disposition, or reject the forgings.

3.3.3.2 Class II Forgings: Samples shall be taken from each lot, heat treated as specified, sectioned, and tested to demonstrate conformance to specified requirements. In the case of ultra-high-strength alloy steel forgings, specimen blanks may be cut from the proper locations and heat treated in accordance with specification requirements. In addition, production forgings shall be sampled for hardness in accordance with Table 2, if hardness is specified.

3.3.3.3 Class III Forgings: Shall be sampled for hardness in accordance with Table 1.

3.3.3.4 Class IV Forgings: Shall be sampled in accordance with Table 2 if hardness is specified.

3.3.4 Testing: Shall be as follows:

3.3.4.1 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 forging stock from that heat and that heat identity of the forgings is maintained.

3.3.4.2 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 as agreed upon by purchaser and vendor.

3.3.4.2.1 Tensile Properties: When tensile testing of a forging is specified, location of the specimens within the part shall be as shown on the drawing or sketch or in the material specification.

3.3.4.2.1.1 Orientation: Longitudinal specimens shall be taken with the axis of specimen within 15 degrees of parallel to the forging flow lines. Transverse specimens shall be taken with the axis of specimen within 15 degrees of perpendicular to the forging flow lines.

3.3.4.2.1.2 Size: Specimens shall conform to ASTM E 8 or ASTM E 8M and shall be either 0.500 inch (12.70 mm) diameter at the reduced parallel gage section, 0.250 inch (6.35 mm) diameter at the reduced parallel gage section, standard rectangular specimens, or subsize specimens proportional to the standard when the configuration of the forgings does not permit the use of standard size specimens.

3.3.4.2.1.3 Number of Tests: Class I forgings shall be sectioned and tested on the basis of one forging per lot. The number of specimens and orientation of the specimens shall be as specified by purchaser. If the number and orientation of specimens are not specified, they shall be as agreed upon by purchaser and forging vendor (See 3.3.3.1).

3.3.4.2.2 Grain Flow: When grain flow is specified, a preproduction forging shall be sectioned and macroetched to reveal the grain flow pattern. The pattern shall be in essential agreement with flow lines sketched on the drawing; if such lines are not shown on the drawing, the grain flow, in areas other than those affected by flash-line end grain, shall follow the general contour of the forging and shall not exhibit reentrant folds.