

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE

AMS 3045C

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Superseding AMS 3045B

MAGNETIC PARTICLES, FLUORESCENT Wet Method, Oil Vehicle, Ready-to-Use

1. SCOPE:

1.1 Form:

This specification covers fluorescent magnetic particles in the form of a mixed, ready-to-use suspension in an odorless inspection oil vehicle.

1.2 Application:

These particles have been used typically as the inspection medium in a wet method, magnetic inspection system as defined in ASTM E 1444, but usage is not limited to such application.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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.

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2.1 SAE Publications:

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

AMS 2641 Vehicle, Magnetic Particle Inspection, Petroleum Base
AMS 2825 Material Safety Data Sheets
AMS 3044 Magnetic Particles, Fluorescent, Wet Method, Dry Powder

SAE J438 Tool and Die Steels

2.2 ASTM Publications:

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

ASTM D 96 Water and Sediment in Crude Oil by Centrifugal Method (Field Procedure)
ASTM E 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 1444 Magnetic Particle Examination

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue,
Philadelphia, PA 19111-5094.

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging
Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The product shall be composed of durable fluorescent magnetic particles, suitable for long time use, which have been dyed or otherwise treated to attain the fluorescent color specified. The particles shall be supplied ready-to-use, mixed in the proper proportion with an inspection vehicle.

3.1.1 Fluorescent particles shall conform to AMS 3044.

3.1.2 Magnetic particle inspection vehicle shall conform to AMS 2641.

3.2 Storage Life:

The product shall meet the requirements of 3.3 when tested at any time up to 12 months from date of manufacture.

3.3 Properties:

The product shall conform to the following requirements; tests shall be performed, on the product supplied, in accordance with specified test methods:

3.3.1 Contamination: The product shall show no evidence of foreign matter, agglomeration, or scum, determined by visual examination of the suspension at the following times:

3.3.1.1 During preparation of the test suspension as in 4.3.3.

3.3.1.2 After mixing the test suspension, allowing it to stand for not less than 30 minutes, and agitating it slightly.

3.3.1.3 During tests to determine conformance with other characteristics of the product.

3.3.2 Concentration: The concentration of magnetic particles in the vehicle shall be 0.10 to 0.40 mL (R) of fluorescent particles in 100 mL of suspension, determined by mixing the test suspension thoroughly, filling a 100 mL calibrated centrifuge tube as specified in ASTM D 96, allowing it to stand undisturbed for not less than 60 minutes, and reading, on the calibrated tube, the volume of particles settled from the suspension.

3.3.3 Sensitivity:

3.3.3.1 Ring Test: The product shall show a seven-hole indication on the ring test specimen defined in 4.3.4, determined by placing the ring on a 1-inch (25-mm) diameter copper bar and circularly magnetizing the ring in a standard magnetic particle inspection unit by passing 2500 amperes of direct current through the copper bar immediately before flooding the ring with the agitated test suspension that has passed the contamination (3.3.1) and concentration (3.3.2) tests. Examine the ring in a darkened area where the visible light does not exceed 2 foot-candles (20 2x). An ultraviolet (black) light shall be used at a measured intensity of not less than 1,000 $\mu\text{W}/\text{cm}^2$ and a wave length of 320 to 400 nm filtered to peak at 365 nm to activate the fluorescent magnetic particles.

3.3.3.2 Flaw-to-Background Test: Obtain a test part, or prepare a test specimen, containing flaws of the size expected to be found in production inspection. The surface finish of the test specimen shall be representative of production parts. Magnetize and flood the specimen as specified in 3.3.3.1 using a sample of agitated test suspension that has passed the contamination (3.3.1) and concentration (3.3.2) tests. View the flaw indications in a darkened area under backlight as defined in 3.3.3.1. Indications shall be sharp and distinct. Background fluorescence around the flaws shall be of a level which will neither obscure the flaw indications nor cause difficulty in flaw detection.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer of the product shall supply all samples for manufacturer'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 product conforms to specified requirements.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: All technical requirements, except storage life (3.2), are acceptance tests and shall be performed on each lot.
- 4.2.2 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of the product to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when a purchaser deems confirmatory testing to be required.
- 4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

- 4.3.1 Acceptance Tests: Sufficient product shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.
- 4.3.1.1 Lot: A lot shall be all product produced in a single production run from the same batches of raw materials under the same fixed conditions and presented for manufacturer's inspection at one time.
- 4.3.1.2 A statistical sampling plan, acceptable to purchaser, may be used in lieu of sampling (R) as in 4.3.1.
- 4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.
- 4.3.3 Sample Preparation: The product to be sampled shall be mixed thoroughly for not less than 30 minutes and a sample of at least 1 gallon (3.8 L) of suspension drawn off while being stirred.
- 4.3.4 Tool Steel Test Ring:
- 4.3.4.1 Material: Shall be hot rolled tool steel, 01 series, conforming to SAE J438, or equivalent. (R) Ring shall be manufactured from 5.5 inch (140 mm) minimum diameter round bar stock.
- 4.3.4.2 Configuration: Ring configuration, dimensions, and surface finish shall be in accordance with (R) Figure 1. Ring shall have nine side-drilled holes; additional holes may be specified by purchaser.

4.3.4.3 Heat Treatment:

4.3.4.3.1 Prior to machining, each bar shall be normalized by heating slowly to 1500 °F $\pm$ 100 (816 °C $\pm$ 56), holding at heat for 60 minutes $\pm$ 5 per inch (25 mm) of diameter, heating to 1600 °F $\pm$ 100 (871 °C $\pm$ 56), holding at heat for 60 minutes $\pm$ 5 per inch (25 mm) of diameter, and air cooling.

4.3.4.3.2 Ring shall be annealed, after machining, by heating to 1425 to 1500 °F (774 to 816 °C), holding at heat for 60 minutes $\pm$ 5, cooling at a rate not more than 40 F (22 C) degrees per hour to 1000 °F $\pm$ 100 (538 °C $\pm$ 56), and furnace or air cooling to room temperature.

4.3.4.4 Surface oxidation, caused by annealing or normalizing, may be removed by dry blasting using either glass beads or aluminum oxide at 25 to 40 psi (172 to 276 kPa). Part may be protected from rust by applying a coating of oil or grease.

4.3.4.5 Hardness: Hardness, after annealing as in 4.3.4.3.2, shall be 90 to 95 HRB, or equivalent, determined in accordance with ASTM E 18.

4.4 Approval:

4.4.1 Sample product shall be approved by purchaser before product for production use is supplied, unless such approval be waived by purchaser. Results of tests on production product shall be equivalent to those on the approved sample.

4.4.2 Manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection on production product that are the same as those used on the approved sample. If necessary to make any changes in ingredients, processing techniques, or manufacturing procedures, manufacturer shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample product. Production product shall not be shipped prior to receipt of reapproval.

4.5 Reports:

The vendor of the product shall furnish with each shipment a report stating that the product conforms to all technical requirements. This report shall include the purchase order number, lot number, AMS 3045C, manufacturer's material designation, lot number, and date of manufacture.

4.5.1 A material safety data sheet conforming to AMS 2825, or equivalent, shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of the product for production use. Each request for modification of product formulation shall be accompanied by a revised data sheet for the proposed formulation.

4.6 Resampling and Retesting:

If any sample used in the above tests fails to meet specified requirements, disposition of the product may be based on the results of testing three additional samples for each original nonconforming sample. Failure of any retest sample to meet specified requirements shall be cause for rejection of the product represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 The product shall be packaged in containers of a type and size acceptable to purchaser.

5.1.2 A lot of magnetic particles may be packaged in small quantities and delivered under the basic lot approval provided lot identification is maintained.

5.1.3 Each container shall be identified with a durable label, that is legible on receipt, with not less than the following information:

MAGNETIC PARTICLES, FLUORESCENT, WET METHOD, OIL VEHICLE, READY-TO-USE
AMS 3045C _____

MANUFACTURER'S IDENTIFICATION _____

DATE OF MANUFACTURE _____ * _____

LOT NUMBER _____

QUANTITY _____

MANUFACTURER'S INSTRUCTIONS FOR USE _____ ** _____

APPROPRIATE WARNINGS OR PRECAUTIONARY NOTICES _____

* May be included in manufacturer's identification or lot number.

** May be on a separate sheet.

5.1.4 Individual packages or containers shall be packed in an exterior shipping container capable of protecting the product, during shipment and storage, against damage from exposure to moisture, weather, or any other normal hazard.

5.1.5 Containers of the product shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery.

5.1.6 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-2073-1, Level C, unless Level A is specified in the request for procurement.

6. ACKNOWLEDGMENT:

A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.