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

AEROSPACE MATERIAL SPECIFICATION

AMS3044B
Superseding AMS 3044A
Issued 3-1-74
Revised 7-16-79

MAGNETIC PARTICLES, FLUORESCENT
Wet Method, Dry Powder

1. SCOPE:

1.1 Form: This specification covers one type of fluorescent magnetic particles in the form of packaged, dry powders and, when specified, the type of oil or vehicle to be used in the proportions required.

1.2 Application: Primarily as the inspection medium in a wet, fluorescent magnetic particle inspection system as defined in AMS 2640 or MIL-I-6868, using either an oil or an inhibited-water vehicle.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2640 - Magnetic Particle Inspection
AMS 3161 - Inspection Oil, Odorless, Heavy Solvent

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D96 - Water and Sediment in Crude Oils
ASTM E11 - Wire-Cloth Sieves for Testing Purposes

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-I-6868 - Inspection Process, Magnetic Particle

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: The product shall be composed of durable fluorescent magnetic particles, suitable for long time use, which may have been dyed or otherwise treated to attain the color specified. This dry powder is designed for use with an aqueous vehicle or an odorless inspection oil conforming to AMS 3161, or equivalent odorless oil, and shall disperse evenly and thoroughly in the recommended vehicle.

Printed in U.S.A.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with the test procedures of this specification, using a test suspension prepared as in 4.3.1:

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

3.2.1.1 During preparation of the test suspension as in 4.3.1.

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

3.2.1.3 During the tests to determine other characteristics of the product.

3.2.2 Color: The color of the magnetic particles shall be fluorescent in the yellow-green range, determined by observing a well-dispersed sample of test suspension in a glass container in a darkened area where the white light does not exceed 3 ft-candles (32 lx/m^2). A 100-W mercury-arc ultraviolet (black) light shall be used at a measured intensity of not less than 10 W/m^2 and a wave length of 3200 - 4000 Angstroms filtered to peak at 3650 Angstroms to activate the fluorescent magnetic particles.

3.2.3 Particle Size: The fluorescent magnetic particles shall be of such size that not less than 98% by weight shall pass through a 3-in. (76-mm) diameter U.S. Standard No. 325 (45 μm) sieve, as defined in ASTM E11, determined by passing a 1-qt (1-L) sample of thoroughly-mixed test suspension through the screen/sieve. After the test suspension liquid carrier has completely passed through the sieve, rinse with 1 qt (1 L) of the original liquid carrier. Dry the sieve to remove all of the liquid and determine the dry weight of the residual particulate material not passing through the screen/sieve as related to the original weight of the particulate material in the sample, expressed in percent.

3.2.4 Magnetic Extraction: The fluorescent magnetic particles shall be attracted and removed from the vehicle with no more than a trace remaining in the bottom of the container, determined as follows:

3.2.4.1 Prepare an electromagnet consisting of an armco iron core, 0.312 in. ± 0.031 (7.92 mm ± 0.79) diameter and 3.00 in. ± 0.13 (76.2 mm ± 3.3) long, with a 2-in. (51-mm) long nonmagnetic handle attached to one end, the core being wrapped with 25 turns of No. 12 (2.052 mm diameter) enameled copper conductor, or use an equivalent electromagnet.

3.2.4.2 Place 100 mL of thoroughly-mixed suspension, prepared as in 4.3.1, into a 150-mL glass container (approximately 2 in. (50 mm) in diameter). Lower the magnet, energized with 15 A of direct current, into the suspension and progressively extract the particles by carefully removing the probe from the sample shutting off the current, and removing the particles from the electromagnet. Repeat the extraction operation until all possible magnetic particles have been removed from the vehicle. Allow the liquid in the container to stand undisturbed for not less than 30 min. and examine the container over a white surface under a white light of not less than 100 ft-candles (1076 lx/m^2) at the examining surface.

3.2.5 Sensitivity:

3.2.5.1 Ring Test: The product shall show a five-hole indication of the ring test specimen defined in MIL-I-6868, determined by placing the ring on a 1-in. (25-mm) diameter copper bar and circularly magnetizing the ring in a standard magnetic particle inspection unit by passing 2500 A of direct current through the bar immediately before flushing the ring with the agitated test suspension that has passed the contamination (3.2.1), magnetic extraction (3.2.4), and concentration (4.3.1) tests. Examine the ring in a darkened area under the ultraviolet light defined in 3.2.2.

3.2.5.2 Flaw-to-Background Test: Obtain a test part, or prepare a test specimen, containing flaws of the size expected to be found in routine inspections. Magnetize and flush the specimen as specified in 3.2.5.1, using a sample of agitated test suspension that has passed the contamination (3.2.1), magnetic extraction (3.2.4), and concentration (4.3.1) tests. View the flaw indications in a darkened area under the ultraviolet light defined in 3.2.2. 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.

3.2.6 Durability: Fluorescent magnetic particles shall retain their initial sensitivity, color, and brightness of indication after placing not less than 200 mL of thoroughly-mixed suspension, prepared as in 4.3.1, in a 1-qt (1-L) capacity constant speed blender (Waring, Osterizer, or equivalent), operating the blender at approximately 1200 rpm for a total of 10 min. in 2 min. intervals, allowing the suspension to cool during each period of 5 min. between stirring cycles and, at the end of the cumulative 10 min. blending, conducting the sensitivity tests as in 3.2.5.

3.2.7 Long-Term Durability: Fluorescent magnetic particles shall retain their initial sensitivity, color, and brightness of indication after allowing a 1.5 qt (1.42-L) volume of freshly-prepared, thoroughly-mixed suspension to stand undisturbed at room temperature for not less than 14 days. The suspension shall be well redispersed and shall meet the requirements of 3.2.1 through 3.2.6.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: 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 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed on the initial shipment of a product to a purchaser, when a change in material or processing requires reapproval as in 4.4.2, and when 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, the contracting officer, or the request for procurement.

4.3 Sampling: Sufficient product shall be taken at random from each lot to perform all required tests in triplicate. 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 vendor's inspection at one time. A lot may be packaged in smaller quantities and delivered separately under the basic lot approval as long as lot identity is maintained.

4.3.1 Sample Preparation: The test suspension for determining conformance to the technical requirements of this specification shall be prepared by adding sufficient dry powder solids to distilled water or odorless inspection oil, usually 0.10 - 0.25 oz per gal (0.75 - 1.87 g/L), to produce a suspension concentration of 0.2 - 0.5 mL of magnetic particles in 100 mL of suspension. The concentration shall be verified by mixing the suspension thoroughly, filling a 100-mL pear-shaped calibrated centrifuge tube as specified in ASTM D96, allowing the tube to stand undisturbed for at least 30 min., and reading on the calibrated tube the volume of the particles settled from the suspension.

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production material which are essentially the same as those used on the approved sample material. If any change is necessary in ingredients, in processing techniques, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and processing and, when requested, sample material. Production material made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports: The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's material designation, lot number, date of manufacture, and quantity.

4.6 Resampling and Retesting: If any sample 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 samples for each original nonconforming sample. Failure of any retest sample to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Fluorescent magnetic particles in dry powder form shall be packaged in suitable containers for the product supplied. When specified, vehicle, wetting agents, or corrosion inhibitors shall be suitably packaged and shipped in kit form with the fluorescent magnetic particle material.

5.1.2 Each magnetic particle container shall be identified by attaching a durable label bearing characters of such size as to be clearly legible and which will not be obliterated by normal handling. Each label shall show not less than the following information:

MAGNETIC PARTICLES, FLUORESCENT, WET METHOD, DRY POWDER
AMS 3044B
MANUFACTURER'S IDENTIFICATION _____
DATE OF MANUFACTURE _____
LOT NUMBER _____
QUANTITY _____
MANUFACTURER'S INSTRUCTION FOR USE _____ *
APPROPRIATE WARNINGS OR PRECAUTIONARY NOTICES _____

* May be on separate sheet.

5.1.3 The individual packages or containers shall be packed in an exterior shipping container capable of protecting the materials, during shipment and storage, against damage from exposure to weather or any normal hazard.