Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 3044

Issued March 1, 1974
Revised

MAGNETIC PARTICLES, FLUORESCENT
Wet Method, Dry Powder

1. SCOPE:

1.1 Form: This specification covers fluorescent magnetic particles in the form of dry packaged powders and, when specified, the oil or vehicle to be used, of the type and 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., Two Pennsylvania Plaza, New York, New York 10001.

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, Pennsylvania 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, Pennsylvania 19120.

2.3.1 Military Specifications:

MIL-I-6868 - Inspection Process, Magnetic Particle

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.

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 4.3.3.

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 3.2.

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 the test suspension in a glass container in a darkened area where the white light does not exceed 3 ft-candles (32 lm/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% of weight shall pass through a 3-in. (76-mm) diameter U. S. Standard No. 325 sieve, as defined in ASTM E11, determined by passing a 1-qt (1.0-dm^3) sample of stirred test suspension through the screen/sieve. After the test suspension liquid carrier has completely passed through the sieve, rinse with 1 qt (1.0 dm^3) 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 cm^3 of freshly stirred suspension prepared as in 3.2 into a 150 cm^3 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 lm/m^2) at the examining surface.

3.2.5 Sensitivity: The product shall show a five-hole indication of the ring test specimen defined in MIL-I-6868, determined as follows:

3.2.5.1 Place the ring on a 1-in. (25-mm) diameter copper bar and circularly magnetize 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 concentration, contamination, and magnetic extraction tests. Examine the ring in a darkened area under the ultraviolet light defined in 3.2.2.

3.2.6 Durability: Fluorescent magnetic particles shall retain their initial sensitivity, color, and brightness of indication after placing not less than 200 cm^3 of freshly stirred suspension prepared as in 3.2 in a 1-qt (1.0-dm^3) 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 test as in 3.2.5.

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 assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

4.3 Sampling:

4.3.1 Sampling Schedule: Sufficient material shall be taken at random from each lot to perform all required tests in triplicate.

4.3.2 Lot: A lot shall be all material produced in a single production run from the same batch of raw materials under the same fixed conditions and presented for 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.

4.3.3 The test suspension for determining conformance to 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/dm^3), to produce a suspension concentration of 1.5 - 2.4 cm^3 of magnetic particles in 100 cm^3 of suspension. The concentration shall be verified by mixing the suspension thoroughly, filling a 100-cm^3 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 in 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 type of equipment for processing, or in manufacturing procedures which could affect quality or properties of the material, vendor shall submit samples for reapproval unless purchaser grants written approval after review of a detailed statement of materials and processing used on the approved sample and those proposed. No production material made by the revised procedure shall be shipped prior to receipt of approval of such procedure.

4.5 Reports: The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests made on the product to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, material specification number, 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.