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AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3044C

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Superseding AMS 3044B

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 dry powders.

1.2 Application: Primarily as the inspection medium in a wet, fluorescent magnetic particle inspection system as defined in AMS 2640 or MIL-STD-1949, using either an oil or an inhibited-water vehicle.

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 documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2640 - Magnetic Particle Inspection
AMS 2641 - Vehicle, Magnetic Particle Inspection, Petroleum Base
AMS 2825 - Material Safety Data Sheets

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

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

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

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of
MIL-STD-1949 - Inspection, Magnetic Particle

3. TECHNICAL REQUIREMENTS:

3.1 Material: The product shall be composed of durable fluorescent magnetic particles, suitable for long time use, which have been treated to attain the color specified. This dry powder is designated for use with an aqueous vehicle containing appropriate conditioning agents, magnetic particle inspection vehicle conforming to AMS 2641, 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 in accordance with specified test methods using a test suspension prepared as in 4.5:

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 4.5.

3.2.1.2 After mixing the test suspension, allowing it to stand for not less than 30 minutes, 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, unless another color is specified by purchaser, determined by observing the indications formed, during the sensitivity test of 3.2.6, in a darkened area where the white light does not exceed 2 foot candles (20 lx). A mercury-arc ultraviolet (black) light shall be used at a measured intensity of not less than 1,000 uW/cm^2 and a wave length of 320 - 400 nm filtered to peak at 365 nm 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-inch (76-mm) diameter U.S. Standard No. 325 (45 µm) sieve, as defined in ASTM E11, determined by passing a 1 quart (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 quart (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 Durability: Fluorescent magnetic particles shall retain their initial
Ø sensitivity, color, and brightness of indication after placing not less than 400 mL of thoroughly-mixed suspension, prepared as in 4.5, in a 1 quart (1 L) capacity constant speed blender, operating the blender at approximately 10,000 to 12,000 rpm for a total of 10 minutes in 2 minute intervals, allowing the suspension to cool for 5 minutes during each period between stirring cycles and, at the end of the cumulative 10 minute blending, conduct the sensitivity test of 3.2.5.

3.2.5 Long-Term Durability: Fluorescent magnetic particles shall retain their initial sensitivity, color, and brightness of indication after allowing a 1.5-quart (1.4-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 dispersed and shall meet the requirements of 3.2.1 through 3.2.6.

3.2.6 Sensitivity:

3.2.6.1 Ring Test: The product shall show a five-hole indication on the ring
Ø test specimen defined in MIL-STD-1949, 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 bar immediately before flushing the ring with the agitated test suspension that has passed the contamination (3.2.1) and concentration (4.5) tests. Examine the ring in a darkened area under an ultraviolet light as defined in 3.2.2. The test shall be repeated using a sample of test suspension that has been subjected to the durability test of 3.2.4.

3.2.6.2 Flaw-to-Background Test: Obtain a test part, or prepare a test specimen,
Ø containing flaws of the size expected to be found in routine inspection. The surface finish of the test specimen shall be representative of production parts. Magnetize and flush the specimen as specified in 3.2.6.1, using a sample of agitated test suspension that has passed the contamination (3.2.1) and concentration (4.5) tests. View the flaw indications in a darkened area under ultraviolet light as 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. The test shall be repeated using a sample of test suspension that has been subjected to the durability test of 3.2.4.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all Ø 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 4.6. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that solvent conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for contamination (3.2.1), color (3.2.2), particle size (3.2.3), durability (3.2.4), and sensitivity (3.2.6) 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 prior to or on the initial shipment of product to a purchaser, when a change in material and/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 tests material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient product shall be taken at random from each lot to perform all required tests.

4.3.1.1 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 under the basic lot approval provided lot identification is maintained.

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

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 essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production product which are essentially the same as those used on the approved sample product. If necessary to make any changes in ingredients, processing techniques, or manufacturing procedures, vendor 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 Test Suspension Preparation: The test suspension for determining conformance to the technical requirements of this specification shall be prepared in accordance with manufacturer's recommendations by adding sufficient dry powder solids to distilled water containing appropriate conditioning agents or magnetic particle inspection vehicle, usually 0.025 to 0.16 ounce per gallon (0.19 - 1.2 g/L), to produce a suspension concentration of 0.15 - 0.30 mL of magnetic particles in 100 mL of suspension. The concentration shall be verified by mixing the suspension thoroughly, filling a 100 mL calibrated centrifuge tube as specified in ASTM D96, allowing the tube to stand undisturbed for at least 30 minutes, and reading, on the calibrated tube, the volume of the particles settled from the suspension.

4.6 Reports: The vendor of the product shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3044C, vendor's material designation, lot number, date of manufacture, and quantity.

4.6.1 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.

4.7 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 solvent represented and no additional testing shall be permitted. Results of all tests shall be reported.