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

AEROSPACE MATERIAL SPECIFICATION

AMS 3046A
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MAGNETIC PARTICLES, FLUORESCENT
Wet Method, Oil Vehicle, Aerosol Packaged

1. SCOPE:

1.1 Form: This specification covers one type of fluorescent magnetic particles in the form of a mixed, ready-to-use suspension in an odorless inspection oil vehicle and packaged in aerosol cans.

1.2 Application: Primarily as the inspection medium in a wet magnetic particle inspection system as defined in AMS 2640 or MIL-I-6868.

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 2820 - Aerosol Packaging
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 which may have been dyed or otherwise treated to attain the color specified. The particles shall be supplied mixed in the proper proportion with odorless inspection oil conforming to AMS 3161, or equivalent odorless oil, and packaged in aerosol cans.

3.2 Storage Life: The product shall meet the requirements specified in 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 and in accordance with the test procedures of this specification, using a test suspension prepared by spraying the complete contents of several aerosol cans into a clean container to produce at least 1 qt (1 dm^3) of suspension, agitating the aerosol cans frequently to exhaust all particulate material:

3.3.1 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:

3.3.1.1 During preparation of the test suspension as in 3.3.

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

3.3.1.3 During the tests to determine other characterisitcs of the product.

3.3.2 Concentration: The concentration of fluorescent magnetic particles in the freshly-sprayed suspension shall be 0.2 - 0.5 cm^3 of fluorescent magnetic particles in 100 cm^3 of suspension, determined by mixing the test suspension thoroughly, filling a 100-cm^3 pear-shaped, calibrated centrifuge tube as specified in ASTM D96, allowing to stand undisturbed for at least 30 min., and reading on the calibrated tube the volume of the particles settled from the suspension.

3.3.3 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.

3.3.4 Particle Size: The 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 μ m) sieve as defined in ASTM D11, determined by passing a 1-pt (0.5-dm^3) 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 (1.0 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.

3.3.5 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:

3.3.5.1 Prepare an electromagnet consisting of an armco iron core, 0.312 in. $\pm$ 0.031 (7.92 mm $\pm$ 0.79) diameter and 3.00 in. $\pm$ 0.13 (76.2 mm $\pm$ 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.

3.3.5.2 Place 100 cm^3 of freshly stirred suspension, prepared as in 3.3, 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.

3.3.6 Sensitivity:

3.3.6.1 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 (3.3.1), concentration (3.3.2), and magnetic extraction (3.3.5) tests. Examine the ring in a darkened area under the ultraviolet light defined in 3.3.3.

3.3.6.2 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 3.3.6.1, using a sample of agitated test suspension that has passed the contamination (3.3.1), concentration (3.3.2), and magnetic extraction (3.3.5) tests. View the flaw indications in a darkened area under the ultraviolet light defined in 3.3.3. 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.

3.3.7 Durability: Fluorescent magnetic particles shall retain their initial sensitivity, color, and brightness of indication after placing not less than 200 cm^3 of thoroughly-mixed suspension, prepared as in 3.3, 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 tests as in 3.3.6.

3.4 Aerosol Spray Cans: The aerosol cans selected for test shall be maintained at room temperature for not less than 12 hr prior to testing. During testing, the aerosol can may be immersed in water at 25°C ± 1 (77°F ± 2) periodically, to maintain the container and its contents at room temperature.

3.4.1 Sprayability and Leakage:

3.4.1.1 All aerosol pressure cans shall be equipped with a spray nozzle. The nozzle shall provide a fine, steady spray and shall deposit the product evenly on a flat or vertical surface. No chunks of solids shall be expelled and no clogging of the nozzle shall occur. After clearing the nozzle in accordance with the manufacturer's instructions, there shall be no perceptible leakage.

3.4.1.2 The characteristics of the spray pattern and the performance of the spray nozzle shall be evaluated by vigorously shaking the can for not less than 30 sec with the contained pellet sounding on each shake and spraying a pattern on large sheets of newspaper or similar surface to determine the coverage and evenness of the spray. After spraying several patterns, the nozzle shall be examined for evidence of chunks of solids and clogging. The nozzle shall then be cleared by inverting the can and spraying until only gas escapes. The can shall then be immersed for not less than 15 min. in water at 52° - 54°C (126° - 129°F); there shall be no visible evidence of leakage from, or distortion of, the pressurized container. The pressurized can shall then be immersed in water at 25°C ± 1 (77°F ± 2) until the temperature has stabilized and, after vigorous shaking, two more patterns shall be sprayed. The spray characteristics shall have not changed and there shall be no chunking of particles or clogging of the nozzle.

CAUTION: DO NOT HEAT THE PRESSURIZED CAN OVER 54°C (129°F)

3.4.2 Complete Expulsion: The complete usable portion of the contents shall have been expelled before the propellant is expended. The expelled contents shall be not less than 5 fl oz (148 cm^3) and the particle content shall conform to the aerosol spray requirements. Vigorously shake for not less than 30 sec each unused can to be tested, with the contained pellet sounding on each shake, and expel the contents in a series of short blasts into a clean glass container graduated in ounces (cm^3) in such a manner that the entire contents of the can will be retained in the glass container. The aerosol can may be immersed periodically in water at 25°C ± 1 (77°F ± 2) to maintain the can and its contents at room temperature. Repeat the vigorous shaking and short blasts until there is no further escape of gas. Examine the spray nozzle for chunking of particles and clogging during the test.

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, Ø except storage life (3.2), are classified as acceptance tests.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specifica- Ø tion are classified as preproduction tests.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction Ø 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: Shall be as follows; a lot shall be all product produced in a single production run from the Ø same batches of raw materials under the same fixed conditions, mixed with vehicle, packaged in aerosol cans, and presented for vendor's inspection at one time. The cans in a lot may be delivered separately under the basic lot approval as long as lot identity is maintained.

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

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

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 Ø 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 procedures shall not be shipped prior to receipt of reapproval.