



AEROSPACE MATERIAL SPECIFICATION

AMS-I-83387™

REV. B

Issued 1999-06
Reaffirmed 2007-02
Revised 2009-07
Stabilized 2016-01

Superseding AMS-I-83387A

Inspection Process, Magnetic Rubber

RATIONALE

AMS-I-83387B stabilizes this document because it represents mature technology which is not expected to change and thus no further revisions are anticipated.

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1. SCOPE

1.1 Form

This specification covers both the material and the examination process of an inspection material in the form of a dispersion of magnetic particles in a controlled viscosity rubber base that cures at room temperature by addition of one or more curing agents. The test object is magnetized with the uncured rubber covering the area of interest. The magnetic particles then migrate to the leakage field caused by the discontinuity. As the rubber cures, discontinuity indications remain in place on the rubber. The product may be supplied in a variety of viscosities and colors.

1.2 Application

Magnetic Rubber Inspection is a nondestructive inspection technique used for detecting cracks or flaws on or near the surface of ferromagnetic materials. Its principal applications are in certain problem areas, such as: Areas having limited visual or mechanical accessibility; Coated surfaces; Complex shapes or poor surface conditions; and, Inspection for defects that require magnification for detection and interpretation.

1.3 Safety-Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may or may not 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 issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2825	Material Safety Data Sheets
AMS3167B	Solvents, Wipe for Cleaning Prior to Application of Primer and Top Coat Materials, or Sealing Compounds
AMS2644	Inspection Material, Penetrant

2.2 ASTM Publications

Available from ASTM, 100 Barr Harbor Drive, West Coshohocton, PA 19428-2949, Tel: 610-832-9585, www.astm.org.

ASTM D 2196	Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer
ASTM E 1444	Magnetic Particle Testing

2.3 ASNT Publications

Available from ASNT, P.O. Box 28518, 1711 Arlingate Lane, Columbus, OH 43228-0518, Tel: 800-222-2768 (inside USA and Canada) or 614-274-6003 (outside USA), www.asnt.org

SNT-TC-1A	Personnel Qualification and Certification in Nondestructive Testing
ANSI/ASNT Standard CP-189	Qualification and Certification of Nondestructive Testing Personnel

2.4 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

MIL-HDBK-6870A	Inspection Program Requirements, Non Destructive for Aircraft and Missile Materials and Parts
A-A-59281A	Cleaning Compound, Solvent Mixtures

2.5 NAS Publications

Available from Aerospace Industries Association of America, Inc., 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS 410	NAS Certification and Qualification of Nondestructive Test Personnel
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3. REQUIREMENTS

3.1 Materials

When specified on the engineering drawing, contract, or purchase order, this specification applies to the inspection of ferromagnetic materials and ferromagnetic materials which have been plated with electrolytic or electro-less platings, painted, flame spray coated, or covered with other coatings. (Material performance expectations thru coatings shall be verified by use of representative reference parts in accordance with ASTM E 1444). The material shall be a liquid room-temperature vulcanizing rubber filled with magnetic particles. After stirring or shaking, the operator shall visually observe the product to ensure a uniform color and a uniform blend free of skins, lumps and gels or coarse particles. There shall be no separation of ingredients which cannot be readily re-dispersed. When components are mixed, a smooth uniform consistency shall result.

3.2 Properties

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

3.2.1 Viscosity

The viscosity of the uncatalyzed product shall be +/- 10% of the value reported by the manufacturer, determined in accordance with ASTM D 2196 at 25 degrees C (77 degrees F).

3.2.2 Cure Times

The cure time of the product, following addition of curing agents, shall be +/- 50% of the value reported by the manufacturer, determined in accordance with 4.4.1.

3.2.3 Undispersed Particle Size

After mixing and curing the product, there shall be no undispersed particle larger than 0.005 in. (0.13 mm), determined in accordance with 4.4.2.

3.2.4 Magnetic Response

The product shall exhibit satisfactory magnetic response, determined in accordance with 4.4.3.

3.3 Equipment

Equipment other than that specified herein may be used, subject to approval of the procuring activity.

3.4 Magnetizing Apparatus

Any use of the stationary magnetic inspection equipment shall conform to the requirements of ASTM E 1444. The equipment shall be maintained in a manner to insure uniform, controlled inspection operations. All portable permanent and AC-DC electromagnets shall be capable of reliably providing uniform, controlled magnetic field strengths as required in the testing of each part. Each magnetizing apparatus shall be capable of inducing in the piece under inspection a magnetic flux of suitable intensity in the desired direction.

3.5 Microscope

Replica viewing equipment shall consist of a microscope or lens capable of a minimum of 7X magnification, used in conjunction with a high intensity lamp for replica illumination.

3.6 Gauss Meter

A portable Gauss Meter capable of measuring accurately values up to 1000 Gauss shall be used to determine proper field strength in holes and on surfaces to be inspected. The device shall be equipped with both transverse and axial probes. Dial or similar type meters of suitable range may be used if capable of providing transverse and axial measurements.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein. The user reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of Tests

Tests for all technical requirements are acceptance tests and shall be performed on each lot.

4.3 Sampling and Testing

Sufficient product shall be selected at random from each lot to perform all required tests.

4.3.1 A lot shall be all product produced in a single production run from the same batches of raw material, under the same fixed conditions, and presented for vendor's inspection at one time.

4.4 Test Methods

4.4.1 Cure Time

Transfer 20 grams of freshly mixed material to a suitable container and stabilize at 25 degrees C $\pm$ 3 (77 degrees F $\pm$ 5). Add curing agents in accordance with (Table 1) instructions. Stir thoroughly using a wooden tongue depressor or any suitable nonferrous stirrer and pour into a 38 mm nonferrous dish. Cure time is measured starting at the time of the addition of curing agents and ending when both top and bottom surfaces of the material are tack free.

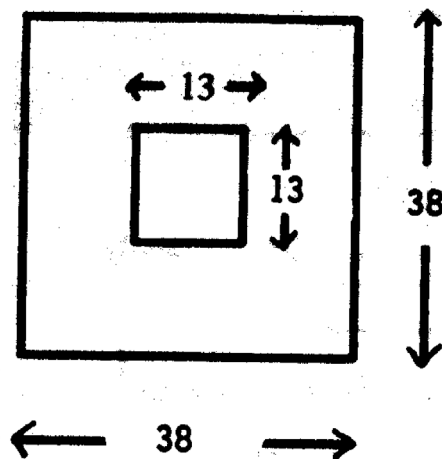
4.4.2 Un-dispersed Particle Size

The lower surface of the cured material (See 4.4.1) shall be viewed under 10 to 100X magnification. The size of un-dispersed particles shall be measured with a calibrated eye piece micrometer. There shall be no observed particle size in the cured replica larger than 0.005 in. (0.13mm).

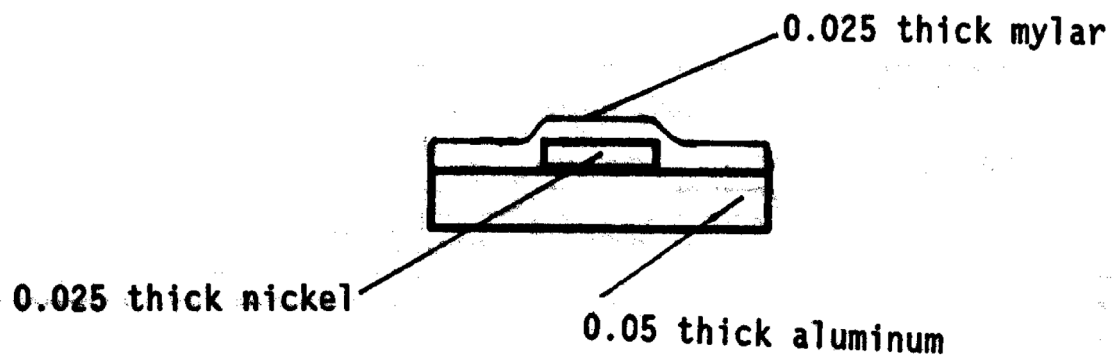
4.4.3 Magnetic Response

Prepare a magnetic discontinuity as follows:

- 4.4.3.1 Cut a piece of 0.025 mm $\pm$ 0.003 thick nickel foil into a 13 by 13 mm square. Place the nickel foil in the center of a 38 by 38 mm piece of 0.05 mm $\pm$ 0.005 thick aluminum foil and cover the entire surface of the aluminum foil with 0.025 mm $\pm$ 0.003 thick mylar tape (See Figure 1). Place the prepared foil in the center of a 76 mm $\pm$ 8 by 152 mm $\pm$ 15 sheet of 0.625 mm $\pm$ 0.06 thick aluminum sheet with the nickel foil side up. Tape down with 0.025 mm $\pm$ 0.0003 thick mylar tape, covering the entire surface of the aluminum sheet (See Figure 2).
- 4.4.3.2 Place the standard discontinuity on a DC electromagnet yoke so that the position of the nickel foil is midway between the poles. Adjust the magnetic field intensity at the position of the nickel foil to 100 gauss $\pm$ 5 (0.01T $\pm$ 0.0001). Place nonferrous cup reservoir over the nickel foil and seal with putty (See Figure 3).
- 4.4.3.3 Prepare 20 grams of freshly mixed material and add curing agents in accordance with Table 1 instructions. Note exact time of addition of curing agents. At exactly 30 seconds before the expiration of the pot life (Table 1) with the magnet "on", pour the mixture into the reservoir. After a 30-second interval, turn the magnet "off" and allow the material to cure. Following cure, remove the casting and examine under a microscope at 7 to 10X magnification. The detection of two dark lines (corresponding to the two edges of the nickel foil lying perpendicular to the magnetic lines of force) indicates satisfactory magnetic response (See Figure 4). Alternate methods of determining proper field strength, magnetic response, are found in ASTM E-1444-05, Tool Steel Ring Specimens for System Performance Test, AS5371 Standard Notched Shims or Flexible Laminated Strips.
- 4.4.3.3.1 The purpose of the delay between addition of curing agents and magnetization is to measure the magnetic response of the material near the expiration of pot life.



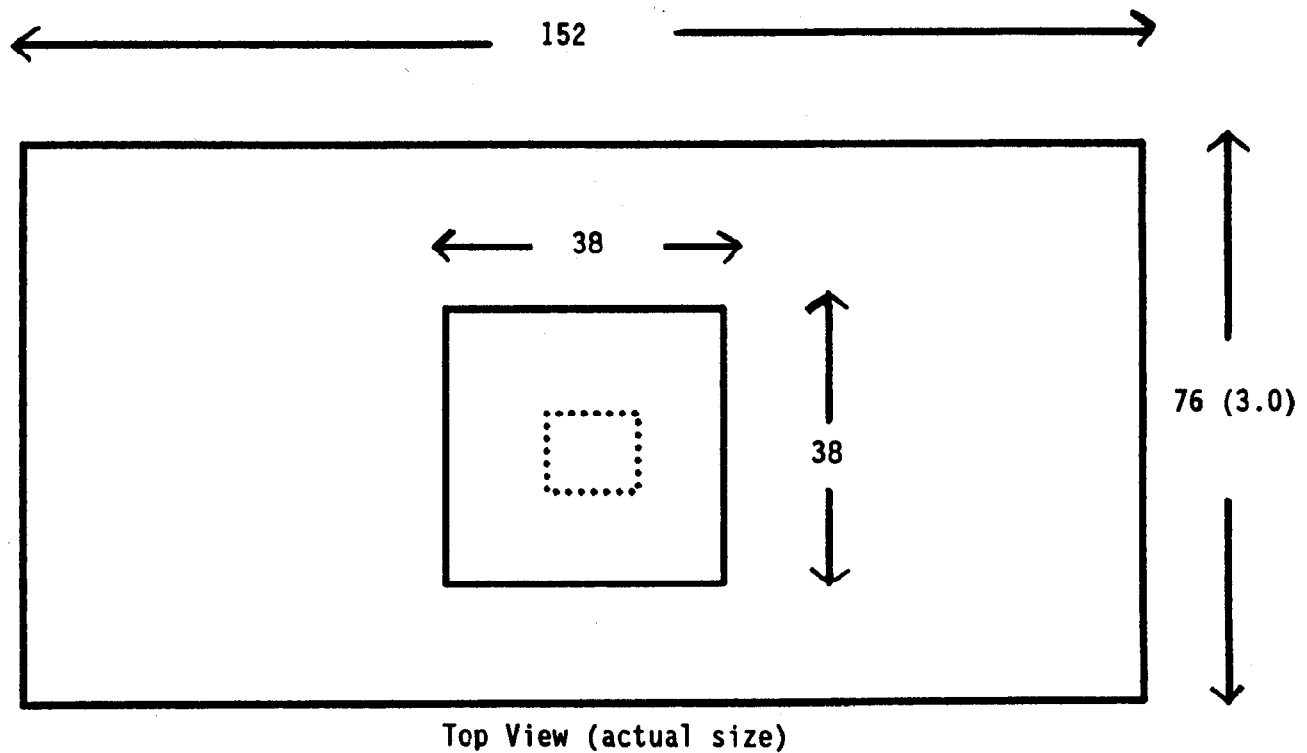
Top View (actual size)



Side View (thickness enlarged)

Dimensions are in millimeters

**FIGURE 1 – PREPARATION OF MAGNETIC DISCONTINUITY – STEP 1
(Taping Nickel Foil to Aluminum Foil)**



Dimensions are in millimeters

Single dimensions are in millimeters

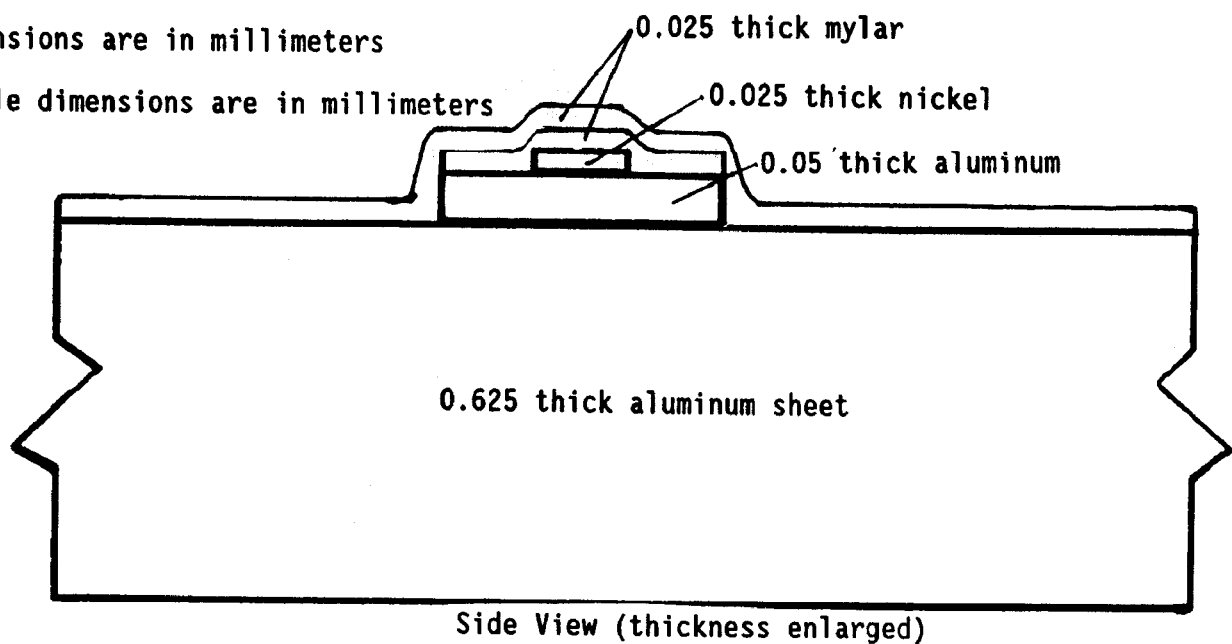


FIGURE 2 – PREPARATION OF MAGNETIC DISCONTINUITY – STEP 2
(Taping Foil Assembly to Aluminum Sheet)