

SAE-AMS3819

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# AEROSPACE MATERIAL SPECIFICATION

**SAE** AMS 3819A

Issued JUL 1987  
Revised JUL 1998

Superseding AMS 3819

Submitted for recognition as an American National Standard

## CLOTHS, CLEANING For Aircraft Primary and Secondary Structural Surfaces

### 1. SCOPE:

#### 1.1 Form:

This specification covers both woven and nonwoven absorbent materials supplied in the form of cloths.

#### 1.2 Application:

These products have been used typically in cleaning smooth or textured, metallic and nonmetallic surfaces preparatory to processing operations which are sensitive to residual surface contamination. Cloths are not intended for use on transparencies.

#### 1.3 Classification:

Cloths covered by this specification are classified as follows:

Class 1 Virgin cloth, composed of 100% cotton fibers.

Class 2 Virgin cloth, composed of 100% synthetic or blended synthetic/natural fibers.

Grade A For use in cleaning operations where low residual surface contamination levels are exceptionally critical.

Grade B For use in cleaning operations where low residual surface contamination levels are required.

1.3.1 Grade A cloths may be substituted for Grade B at any time for processing operations.

1.3.2 Unless purchaser specifies a specific type cloth, either type may be supplied.

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**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 publications shall be the issue in effect on the date of the purchase order.

**2.1 ASTM Publications:**

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 740 Methyl Ethyl Ketone  
ASTM D 1117 Testing Nonwoven Fabrics  
ASTM D 1193 Reagent Water  
ASTM D 1776 Conditioning Textiles for Testing  
ASTM D 1836 Commercial Hexanes  
ASTM D 2257 Extractable Matter in Yarn  
ASTM D 3776 Mass per Unit Area (Weight) of Woven Fabric  
ASTM E 70 pH of Aqueous Solutions With The Glass Electrode  
ASTM E 168 General Techniques of Infrared Quantitative Analysis

**2.2 U.S. Government Publications:**

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-C-38736 Compound, Solvent, For Use In Integral Tanks

**3. TECHNICAL REQUIREMENTS:****3.1 Material:**

3.1.1 Class 1 cloths shall be composed of 100% virgin cotton fibers, with or without added binders.

3.1.2 Class 2 cloths shall be composed of 100% synthetic or blended synthetic, cotton, or cellulose materials, with or without added binders, which remain stable up to 400 °F (204 °C).

**3.2 Construction:**

Cloths shall be oriented into a planar assembly by woven or nonwoven techniques to yield a dry cloth weight of 1.8 to 6.0 ounces per square yard (61 to 203 g/m<sup>2</sup>).

**3.3 Binder:**

Binding materials shall be water insoluble and shall not exceed 5% of the dry cloth weight.

**AMS 3819A****SAE****AMS 3819A****3.4 Color:**

Cloths shall be unbleached white.

**3.5 Cleanliness:**

Cloths shall be visibly clean and free of discoloration, embedded particles, oils, greases, and other nonspecification materials, determined in accordance with 4.5.2.

**3.6 Workmanship:**

Cloths shall be manufactured by the best available commercial practices and shall meet all technical requirements of this specification.

3.6.1 Cloths shall be free of broken, starched, stiffened, or napped fibers, and free of uneven, ragged, or frayed edges. Class 1 cloths shall be scoured to remove natural oils.

3.6.2 Cloths shall be free of silicone oils and residues, determined in accordance with ASTM E 168. Infrared analysis shall be made on samples prepared from either ASTM D 740 or ASTM D 1836 extractant referenced in 3.7.7.

**3.7 Properties:**

Cloths shall conform to the following requirements (tests shall be performed on the cloths supplied, and in accordance with specified test methods insofar as practicable):

3.7.1 Weight: Cloth weight shall be within  $\pm 10\%$  of the preproduction cloth weight, determined in accordance with ASTM D 3776.

3.7.2 Water Absorption: Cloths shall absorb not less than 400% of the dry cloth weight, determined in accordance with ASTM D 1117 (large samples).

3.7.3 Water Absorption Rate: Shall be not more than 45 seconds, determined in accordance with 4.5.3.

3.7.4 Linting: Cloths shall lint not more than 10 milligrams per square foot. For acceptance tests, linting shall be determined using the procedure described in 4.5.4.1. For preproduction tests, linting shall be determined using the procedure described in 4.5.4.2.

3.7.5 Cloth Integrity: Specimens tested for linting properties as in 3.7.4 shall not tear on the screen of the U.S. Standard No. 40 sieve as a result of the 25 circumferential stroke linting test.

3.7.6 Fiber/Binder Integrity: Cloths shall leave no visible residue on the glass surfaces after testing in accordance with 4.5.5.

3.7.7 Extractable Matter: Cloths shall meet the requirements of Table 1, determined in accordance with ASTM D 2257.

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Table 1 - Determination of Extractable Matter

Extractant	Extractable Matter	Extractable Matter
	Percent Maximum	Percent Maximum
	Grade A	Grade B
ASTM D 1193, Type IV	0.25	0.50
ASTM D 1836	0.25	0.50
ASTM D 740	0.25	0.50
MIL-C-38736	0.25	0.45

3.7.8 pH of Water Extract: The pH of the water extract shall be 6.0 to 7.5, as determined in accordance with ASTM E 70.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer or supplier of the cloths shall supply all samples and shall be responsible for performing the required tests. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the cloths conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: The determination of Weight (3.7.1), Linting (3.7.4), Cloth Integrity (3.7.5), Extractable Matter using extractants from ASTM D 1193 and MIL-C-38736 (3.7.7), and pH (3.7.8) are acceptance tests and shall be performed on each lot of cloth material.

4.2.2 Preproduction Tests: All technical requirements of this specification are production tests and shall be performed prior to, or on the initial shipment of cloths by the manufacturer or supplier, when a change in material and/or processing requires reapproval as required in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 Qualification: For direct U.S. Military procurement and for procurement on U.S. Military Contracts, the material shall be a product that has been tested, has passed the qualification tests of 4.2 (See 8.3) has been listed or is approved for listing on the applicable U.S. Military Qualified Products List (QPL).

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient cloths shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

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- 4.3.1.1 A lot shall be all cloths of the same type and grade produced in one continuous production run and presented for the manufacturer's or supplier's inspection at one time. An inspection lot shall not exceed 5000 pounds (2268 kg).
- 4.3.1.2 A statistical sampling plan, acceptable to the purchaser 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 both purchaser and manufacturer or supplier.
- 4.4 Approval:
- 4.4.1 Sample cloths shall be approved by the purchaser before cloths for production use are supplied, unless the purchaser waives such approval. Results of tests on production cloths shall be essentially equivalent to those of the approved sample.
- 4.4.2 The manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection on production cloths which are essentially the same as those used on the approved sample cloths. If necessary to make any change in materials, in type of equipment for processing, or in manufacturing procedures, the manufacturer shall submit for reapproval a statement of the proposed changes in materials and/or processing, and when requested, sample cloths. Production cloths made by the revised procedure shall not be shipped prior to receipt of approval.
- 4.5 Test Methods:
- Tests to determine conformance to the requirements of this specification shall be conducted as follows:
- 4.5.1 Test Conditions: Except where otherwise specified herein, all cloths shall be preconditioned in accordance with ASTM D 1776 prior to testing. Where an environmental chamber is utilized for preconditioning, the test area environment shall be maintained at 65 to 85 °F (18 to 29 °C) and a relative humidity of 50 to 70%.
- 4.5.2 Cleanliness: Not less than ten cloths shall be examined under 5X magnification and an impinging light source with an illuminance of 750 to 850 foot candles (8073 to 9149 lux), measured at a distance of 6 inches (152 mm). Acceptability of all ten cloths shall be reported as pass or fail.
- 4.5.3 Water Absorption Rate: A full-size cloth, up to 10 inches (254 cm) square, shall be marked in 1 inch (25.4 mm) increments along the centerline of its width and parallel with the fabric or fiber axis. The ends parallel with the width shall be suitably restrained by metal tabs sized to cover approximately 0.25 inch (6.4 mm) of the cloth along the width. By grasping one of the restrained ends, lower the cloth in a free hanging (vertical) state into a suitable receptacle filled with approximately 0.50 inch (12.7 mm) of tap water up to a point below the 1 inch (25.4 mm) marker. Begin timing the rate of water rise when the water level reaches the 2-inch (50.8 mm) marker. Report the rate of water rise between the 2-inch and 3-inch (50.8 and 76.2 mm) markers as the average of five samples.

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4.5.3.1 If desired, a suitable coloring agent may be added to the water to impart contrast on the cloth to assist in the determination of water absorption rate.

4.5.4 Linting:

4.5.4.1 Acceptance Testing: Cloth linting shall be determined using the average weight of lint obtained from the testing of ten cloth samples. A new cloth shall be used for each of the ten weight determinations. Each sample is to be tested shall be securely wrapped on a cylindrical mandrel of the type shown in Figure 1, so as to prevent wrinkles or folds at the contact surface. The cloth may be secured with a rubber ring or with tape. Tape may also be used to conceal any open edges of the cloth sample. The cylindrical mandrel shall weigh 450 to 470 grams, with a contact surface diameter of 2.0 inches  $\pm$  0.1 (50.4 mm  $\pm$  0.25) and all corner transitions radiused at 0.5 inch (12.7 mm). Other equipment shall be one 8-inch (203 mm) diameter, No. 40 (425  $\mu$ m) U.S. Standard sieve with drop pan which has been solvent washed and dried to constant weight at 150 °F  $\pm$  2 (65 °C  $\pm$  1) for 1 hour; one analytical balance with a rated sensitivity of 0.1 milligram; aluminum foil approximately 9 inches (228 mm) in diameter, sufficient to line the drop pan.

4.5.4.2 Procedure: After weighing the aluminum foil to the nearest 0.1 mg ( $W_1$ ) using the analytical balance, place the foil within the drop pan and install the No. 40 sieve. Wrap two cloth plies securely around the mandrel so as to prevent wrinkles and folds at the contact surface. Place the contact surface of the wrapped mandrel on the sieve screen, and while maintaining the mandrel in a fixed orientation, move the mandrel around the circumference of the sieve in a continuous motion for 25 complete revolutions. Remove the cloth plies and examine for tearing. Without disassembling the sieve, repeat the procedure nine additional times using new cloth plies for each repetition. Upon completion of ten sample tests, carefully disassemble the sieve from the drop pan and remove the aluminum foil with collected lint from the drop pan. Weigh the aluminum foil and lint to the nearest 0.1 mg using the analytical balance. Calculate linting according to Equation 1:

$$\frac{144}{A} \times \frac{W_2 - W_1}{10} = \text{Linting in mg/square feet} \quad (\text{Eq. 1})$$

where:

A = contact surface area of bar in square inches

$W_1$  = weight of aluminum foil

$W_2$  = weight of aluminum foil plus lint generated

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- 4.5.4.3 **Preproduction Testing:** Cloth linting shall be determined using the average weight of lint obtained from the testing of ten cloth samples. A new cloth shall be used for each of the ten weight determinations. Each sample to be tested shall be securely wrapped on a cylindrical mandrel of the type shown in Figure 1, so as to prevent wrinkles or folds at the contact surface. The cloth may be secured with a rubber ring or with tape. Tape may also be used to conceal any open edges of the cloth sample. The cylindrical mandrel shall weigh 450 to 470 grams, with a contact surface diameter of 2.0 inches  $\pm$  0.1 (50.4 mm  $\pm$  0.25) and all corner transitions radiused at 0.5 inch (12.7 mm). Other equipment shall be one 8-inch (203 mm) diameter, No. 40 (425  $\mu$ m) U.S. Standard sieve with drop pan which has been solvent washed and dried to constant weight at 150 °F  $\pm$  2 (65 °C  $\pm$  1) for 1 hour; one analytical balance with a rated sensitivity of 0.1 milligram; aluminum foil approximately 9 inches by 9 inches (228 mm by 228 mm), sufficient to line the drop pan.
- 4.5.4.4 **Procedure:** The cylindrical mandrel, with cloth sample installed, shall be placed on the pivot of a linting test apparatus of the type shown in Figure 2. The apparatus is designed to impart a force equal to the weight of the mandrel normal to the surface of the No. 40 sieve and drop pan assembly. The sieve and drop pan assembly shall be solvent washed and dried to constant weight at 150 °F  $\pm$  2 (65 °C  $\pm$  1) for 1 hour prior to testing. One 9 inches by 9 inches piece of aluminum foil shall be weighed to the nearest 0.1 milligram prior to installation in the drop pan. The aluminum foil will act as the collection medium for any lint passing through the sieve assembly.
- Using the test apparatus, each cloth sample shall be subjected to 25 complete revolutions of the sieve assembly. The power supply with counter can be programmed to rotate the sieve assembly a specific number of turns, after which it will automatically shut down. After installation of a new cloth sample, the counter will be reset to initiate testing. After all ten samples have been subjected to the linting test, disassemble the sieve and drop pan. Carefully remove the aluminum foil from the drop pan so that any lint cannot escape the foil. Weigh the aluminum foil and lint to the nearest 0.1 milligram (W2). Calculate linting using Equation 1:
- 4.5.5 **Fiber/Binder Integrity:** Cut a 4 inch (101.6 mm) square sample of cloth and place it between two pieces of 0.25 inch (6.4 mm) thick clear high temperature glass plates such as Pyrex, which have been solvent washed and dried to constant weight at 150 °F  $\pm$  2 (65 °C  $\pm$  1) for 60  $\pm$  5 minutes. Place the sandwiched cloth in a circulating air oven which has been preheated to 400 °F  $\pm$  10 (205 °C  $\pm$  5). Hold the sample at temperature for not less than 2 hours, after which the oven shall be turned off. Allow the sample to cool to below 120 °F (49 °C) before removal from the oven. Separate and view the contacting surfaces of the glass for visible indications of deposited residue. Browning or discoloration of the cloth is acceptable. Observations shall be reported as "pass" or "fail".

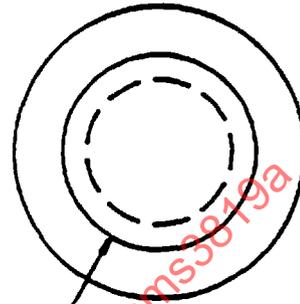
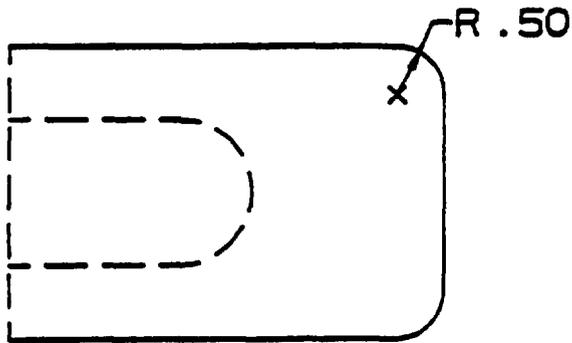
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SIDE VIEW

BOTTOM VIEW



MINIMUM LENGTH: 3"  
BORE TO ACHIEVE SPECIFIED WEIGHT

$\varnothing 2.00 \pm .01$   
CONTACT SURFACE

NOTES: WEIGHT: 450 - 470 GRAMS  
MATERIAL: ALUMINUM  
ALL DIMENSIONS IN INCHES

FIGURE 1 - Cylindrical Test Mandrel

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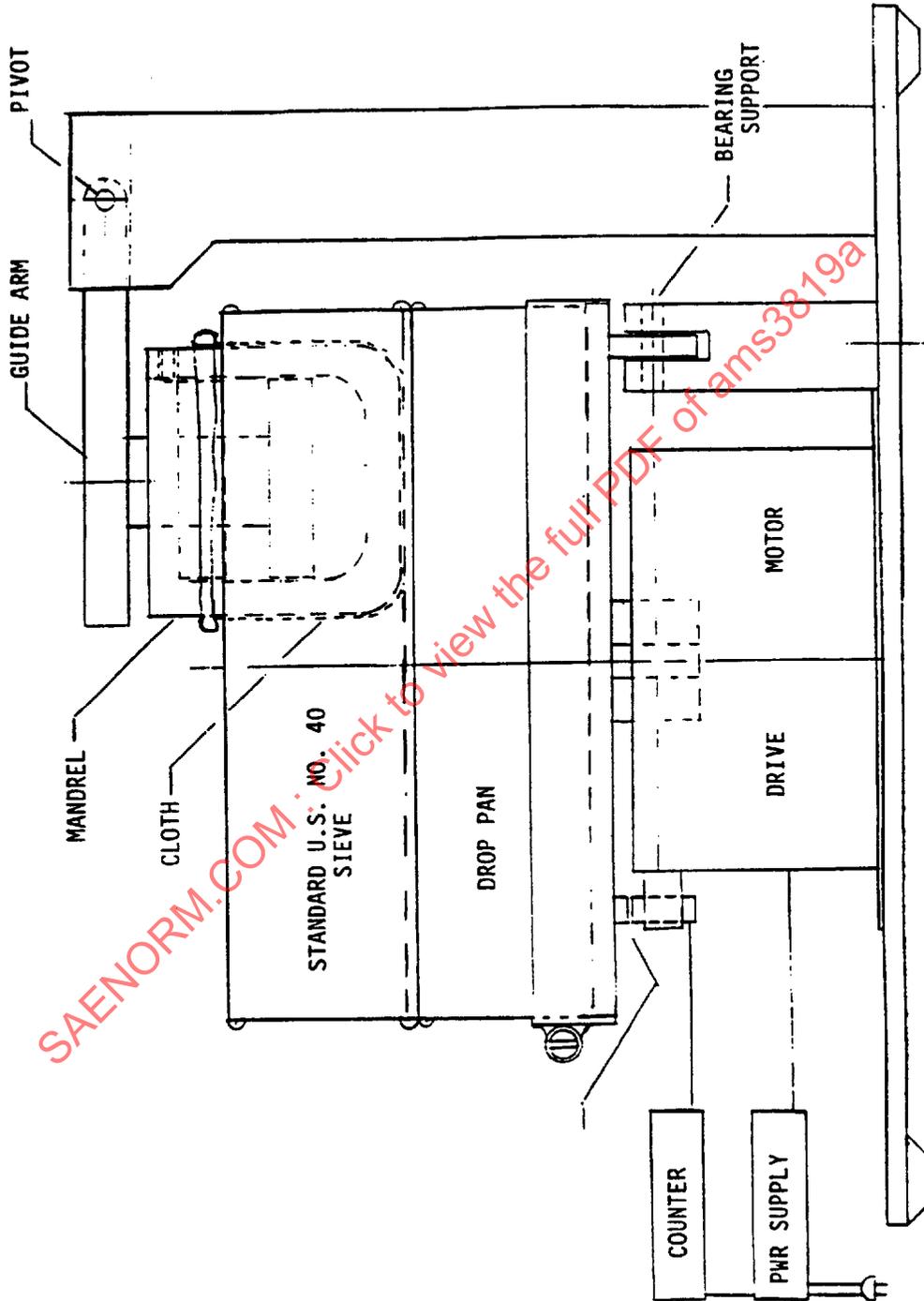


FIGURE 2 - Linting Test Apparatus