SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3819C

Issued JUL 1987
Revised AUG 2007

Superseding AMS 3819B

Cloths, Cleaning For Aircraft Primary and Secondary Structural Surfaces

RATIONALE

This specification is being revised to include a restructured classification system (with a new class of cloth), updated extractable matter limits, and additional changes associated with the five-year review.

1. SCOPE

1.1 Form

This specification covers both woven and nonwoven absorbent materials supplied either as dry cloths or presaturated cloths for solvent cleaning process applications.

1.2 Application

These cloths have been typically used in cleaning smooth or textured, metallic and nonmetallic surfaces preparatory to processing operations which are sensitive to residual surface contamination, but usage is not limited to such applications. Cloths qualified to this specification 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, with or without added binders.
Class 2 Virgin cloth, 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).
Class 3 Empty classification (formerly presaturated cloths - see Form 2).
Class 4 100% polyester knit without binders.

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

Form 1 Dry cloths (in individual wipes or rolls).
Form 2 Cloths contained in a presaturated wiping system, except that binders, surfactants, or other chemical treatments shall not be included (See 8.6). Solvents used in the presaturation process shall be designated and approved as acceptable by the purchaser.

Note: Purchaser should ensure that solvent and cloth used in presaturated wiping system are compatible and adequate for desired cleaning application.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

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

1.3.2 If no classification of cloth is specified, a Grade A, Form 1 cloth of either Class 1 or Class 2 shall be the default.

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 canceled 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.

AMS 3167	Solvents, Wipe for Cleaning Prior to Application of Primer and Top Coat Materials, or Sealing Compounds
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 329	Acetone
ASTM D 740	Methyl Ethyl Ketone
ASTM D 1117	Evaluating Nonwoven Fabrics
ASTM D 1193	Reagent Water
ASTM D 1776	Conditioning Testing Textiles
ASTM D 1836	Commercial Hexanes
ASTM D 2257	Extractable Matter in Textiles
ASTM D 3776	Mass per Unit Area (Weight) of Fabric
ASTM E 70	pH of Aqueous Solutions with the Glass Electrode
ASTM E 168	General Techniques of Infrared Quantitative Analysis

2.3 PRI Publications:

Available from Performance Review Institute, 161 Thorn Hill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org.

PD 2000	Procedures for An Industry Qualified Product Management Process
PRI QPL AMS 3819	Products Qualified Under AMS 3819

3. TECHNICAL REQUIREMENTS

3.1 Construction

Cloths shall be oriented into a planar assembly by woven or nonwoven techniques to yield a dry cloth weight of 1.0 to 6.0 ounces per square yard (34 to 203 g/m^2).

3.2 Binder

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

3.3 Color

Cloths shall be white or off-white.

3.4 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.

3.5 Workmanship

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

3.5.1 Cloths shall be free of broken, starched, stiffened, or napped fibers, and free of uneven, ragged, or frayed edges that result in excessive linting. Class 2, Form 1 or 2 cloths may contain uneven edges created by the separation (i.e. perforation attachment points) of individual sheets from perforated rolls.

3.5.2 Class 1 and Class 4, Form 1 cloths shall be scoured to remove natural oils.

3.5.3 Cloths shall be free of silicone oils and residues, determined in accordance with ASTM E 168. Infrared analysis to determine the presence of silicone shall be completed in accordance with 4.5.7 using samples prepared from the ASTM D 1836 hexane extractant as referenced in 3.6.6.

3.6 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):

3.6.1 Weight

Cloth weight shall be within ±10% of the qualification cloth weight, determined in accordance with ASTM D 3776.

3.6.2 Water Absorption

When tested for water absorptive capacity, cloths shall absorb not less than 400% of the dry cloth weight. Class 4 cloths shall be exempt from this requirement.

3.6.2.1 Water Absorptive Capacity

Cloths shall be tested in accordance with ASTM D 1117 and 4.5.3.

3.6.3 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 and 4.5.4.2. For qualification tests, linting shall be determined using the qualification test procedure described in 4.5.4.3 and 4.5.4.4.

3.6.4 Cloth Integrity

Specimens tested for linting properties as in 3.6.3 shall not tear on the screen of the U.S. Standard No. 40 sieve as a result of the 25 circumferential stroke linting test.

3.6.5 Fiber/Binder Integrity

Cloths shall leave no visible residue on the glass surfaces after testing in accordance with 4.5.5.

3.6.6 Extractable Matter

Cloths shall meet the requirements of Table 1, determined in accordance with 4.5.6.

TABLE 1 - DETERMINATION OF EXTRACTABLE MATTER

Extractant Specification	Extractant Chemical Name	Extractable Matter % Maximum Grade A	Extractable Matter % Maximum Grade B
ASTM D 1193, Type IV	Reagent Water	0.75	1.00
ASTM D 1836	Hexane	0.75	1.00
ASTM D 740	Methyl Ethyl Ketone	0.75	1.00
AMS 3167, Type 2 (See 8.7)	Wipe Solvent	0.75	1.00

3.6.7 pH of Water Extract

The pH of the water extract shall be 6.0 to 7.5, as determined in accordance with 4.5.8.

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 the performance of 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 specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Weight (3.6.1), linting (3.6.3), cloth integrity (3.6.4), extractable matter (3.6.6), and pH (3.6.7) are acceptance tests and shall be performed on each lot of cloth material.

4.2.2 Qualification Tests

All technical requirements of this specification are qualification tests and shall be performed prior to, or on the initial shipment of cloths by the manufacturer or supplier. When a change in approved product formulation, critical raw materials or suppliers, basic methods of manufacture, testing, or geographic location occurs, requalification of the revised material shall be required. A revised supplier designation shall be requested.

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.

4.3.1.1 A lot shall be all cloths of the same class and grade produced in one continuous production run and presented for the manufacturer's or supplier's inspection at one time. An inspection lot for woven cloth material shall not exceed 5000 pounds (2268 kg). An inspection lot for nonwoven cloth material shall not exceed 50,000 pounds (22,700 kg).

4.3.1.2 A statistical sampling plan, acceptable to the purchaser in lieu of sampling as in 4.3.1, may be used and the report of 4.6 shall state that such plan was used.

4.3.2 For Qualification Tests

As agreed upon by both purchaser and manufacturer or supplier.

4.4 Approval

4.4.1 All cleaning cloths supplied to this specification shall be listed, or approved for listing, on the qualified products list, PRI QPL AMS 3819, which can be found at www.eAuditNet.com. The qualified products list shall be in accordance with PD 2000.

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 Absorptive Capacity

The test specimen shall consist of a full-size cloth sample, up to 8 inches by 8 inches (203 mm by 203 mm), and consisting of six plies cut at approximately equally spaced intervals across the sample sheet on a line 45 degrees to the edge of the sheet. If the specimen is excessively bulky or weighs more than 2.73 ounce per square yard (92.6 g/m^2) or both, three plies may be used instead of six. Three test specimens shall be used for this test.

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 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 460 grams ± 10, with a contact surface diameter of 2.0 inches ± 0.1 (5.08 mm ± 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 µm) U.S. Standard sieve with drop pan which has been solvent washed using ASTM D 329 acetone, then dried to constant weight at 150 °F ± 2 (65 °C ± 1) for one 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 on the drop pan. The aluminum foil will act as the collection medium for any lint passing through the sieve assembly. 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 normal to the surface of the No. 40 sieve, move the mandrel around the circumference of the sieve in a continuous motion for 25 complete revolutions at approximately five revolutions per minute. 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 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:

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

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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4.5.4.4 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 on the drop pan. The aluminum foil will act as the collection medium for any lint passing through the sieve assembly. Wrap two cloth plies securely around the mandrel so as to prevent wrinkles and folds at the contact surface. Place the sieve assembly on the turntable of a linting test apparatus of the type shown in Figure 2. The cylindrical mandrel, with cloth sample installed, shall be placed on the pivot of the linting test apparatus. 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.

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. 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. After installation of a new cloth sample, the counter can be reset to initiate testing. Upon completion of ten sample tests, carefully disassemble 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 milligram (W_2). Calculate linting using Equation 1.

4.5.5 Fiber/Binder Integrity

Cut a 4 inch (102.0 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 ± 2 °F (65 ± 1 °C) for 60 ± 5 minutes. Place the sandwiched cloth in a circulating air oven which has been preheated to 400 ± 10 °F (205 ± 5 °C). Hold the sample at temperature for not less than two 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”.

4.5.6 Extractable Matter

Perform all procedures described in ASTM D 2257 using solvents listed in Table 1.

4.5.7 Silicone Greases and Oils

The absence of detectable silicone greases and oils shall be verified using Soxhlet extraction and Fourier Transform Infrared Spectroscopy (FTIR) analysis of cloth sample extractions using ASTM D 1836 hexane. Instructions specific to the hexane extraction procedure are:

Protect cloth samples, extraction apparatus and extract from contamination. Use silicon free gloves, tweezers or forceps to handle materials.

All glassware shall be cleaned using hot hexane before use. (Note: Hot hexane has been heated to and is maintained at 150 ± 2 °F (65 ± 1 °C).

After completion of soxhlet extraction, hexane shall be evaporated by placing flask containing extract in a vacuum oven set to the boiling point, which is approximately 156 °F (69 °C) for 0.5 to 1 hour.

Extractant shall be re-dissolved in fresh hexane.

Apply approximately three drops of re-dissolved extract to a sodium chloride (NaCl) disc. Allow hexane to evaporate, then obtain an infrared (IR) spectrum according to ASTM E 168.

The IR spectrum shall contain no evidence of a double-absorption (Si-O-Si) band between 1020-1 cm and 1100-1cm. A reference spectrum showing this band is shown in Figure 3.

4.5.8 pH of Water Extract

pH of the water extract shall be determined using ASTM E 70.

4.6 Reports

The manufacturer or supplier of cloths shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the cloths conform to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3819C, lot number, class, grade, form, manufacturer’s material designation, and quantity.

4.7 Resampling and Retesting

If any specimen used in the above tests fails to meet the specified requirements, disposition of the cloths may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the cloths represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Identification

5.1.1 Cloths of the same size and basic lot number shall be rolled, baled, or folded in quantities agreed upon by the purchaser and the manufacturer or supplier. Packaging shall be accomplished in such a manner as to ensure that the cloths, during shipment and storage, will be protected against damage from exposure to moisture, weather, or any other normal hazard.

5.1.2 A lot may be packaged in small quantities and delivered under the basic lot approval, provided that lot identification is maintained.

5.1.3 Each package shall be permanently and legibly marked with not less than the following information:

CLOTHS, CLEANING, FOR AIRCRAFT PRIMARY AND SECONDARY STRUCTURAL SURFACES
AMS 3819C
MANUFACTURER'S IDENTIFICATION _____
CLASS, GRADE, AND FORM _____
SOLVENT DESIGNATION (IF FORM 2) _____
LOT NUMBER _____
QUANTITY _____

5.1.4 Exterior shipping containers shall be permanently and legibly marked with not less than the following information in such a manner that the markings will not smear or be obliterated during normal handling:

CLOTHS, CLEANING, FOR AIRCRAFT PRIMARY AND SECONDARY STRUCTURAL SURFACES
AMS 3819C
PURCHASE ORDER NUMBER _____
MANUFACTURER'S IDENTIFICATION _____
CLASS, GRADE, AND FORM _____
SOLVENT DESIGNATION (IF FORM 2) _____
LOT NUMBER _____
NET WEIGHT _____

5.1.5 Containers of cloths shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the cloths to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT

A manufacturer or supplier shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Cloths not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES

8.1 A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.

8.2 Qualification of Cleaning Cloths

8.2.1 Awards will be made only for cloth wipes which are, prior to the award of a contract, qualified for inclusion in the applicable qualified products list (QPL) whether or not such products have been so listed to that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the cloth wipes that they propose to offer tested for qualification in order that they may be eligible to be awarded contracts or orders for the cloth wipes covered by this specification. The activity responsible for the QPL is the Performance Review Institute, 161 Thornhill Road, Warrendale, PA 15086-7527, phone (724) 772-1616, fax (724) 772-1699. Information pertaining to qualification of cleaning cloths may be obtained from that activity.

8.2.2 Qualification shall be approved every three years in accordance with PD 2000 and the instructions from the Performance Review Institute.

8.3 Terms used in AMS are clarified in ARP1917.

8.4 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.5 Purchase documents should specify not less than the following:

AMS 3819C
Classification (Class, Grade, and Form) and size of cloths desired
Quantity of cloths desired
Special packaging if required.

8.6 Form 2 Cloth Description

Form 2 cloths are presaturated with an approved solvent, and available in the following forms:

Perforated rolls of non-woven fabric wipers, dispensed from a canister. The canister is designed to minimize solvent evaporation. A roll of perforated and presaturated fabric wipers is installed in the canister and dispensed until depleted.

Folded woven, knit, or non-woven presaturated cloth wipers, packaged for dispensing from a flexible pouch.

8.7 For informational purposes, Dysol, Inc. DS-108 solvent in accordance with AMS 3167 Type 2 is recommended for use in the extractable matter test (See 3.6.6).