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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3846B

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Superseding AMS 3846A

CLOTH, QUARTZ
Finished for Resin Laminates

1. SCOPE:

1.1 Form: This specification covers high-purity silica in the form of woven cloth.

1.2 Application: Primarily as a reinforcing material for plastic laminates with finishes suitable for use with various resin matrices intended for service up to 315°C (599°F).

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 Aerospace Material Specifications 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

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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D123 - Terminology Relating to Textile Materials
ASTM D579 - Greige Woven Glass Fabrics
ASTM D1777 - Measuring Thickness of Textile Materials
ASTM D2408 - Finish Content of Woven Glass Fabric, Cleaned and After-Finished with Amino-Silane Type Finishes, for Plastic Laminates
ASTM D3775 - Fabric Count of Woven Fabric

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

2.3.1 Federal Standards:

FED-STD-4 - Glossary of Fabric Imperfections

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: The quartz cloth shall be woven from high-purity silica continuous-filament yarns.

3.1.1 Composition:

3.1.1.1 Silica Content: Shall be not less than 99.90% silicon dioxide, determined in accordance with 4.5.1.

3.1.1.2 Boron Content: Shall not exceed 100 ppm calculated as boric oxide or boron, determined by a procedure agreed upon by purchaser and vendor.

3.1.2 Weave: Shall be in accordance with Table I.

3.1.3 Finish: The finish shall be compatible with, and shall produce the required performance characteristics for, the resin system specified in the applicable impregnated quartz cloth or laminate specification.

3.1.3.1 When an aminosilane-base finish, such as A-1100 Type, is specified, the finish shall be 0.20 - 0.90% by weight, determined in accordance with 4.5.2.

3.1.4 Color: Shall be white.

3.2 Properties: Shall be as specified in Table I, determined by the following methods:

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Weight	ASTM D1910, small sample method
Nominal Thickness	ASTM D1777
Fabric Count	ASTM D3775
Breaking Strength	4.5.3

3.3 Quality: The cloth, as received by purchaser, shall be uniform in quality and condition, smooth, and free from foreign materials and from imperfections detrimental to usage of the cloth.

3.3.1 Imperfections: Acceptability of each roll of cloth shall be based on a defect point basis, with defects defined in FED-STD-4 and herein, and defect points assigned as specified in Table II. Definitions for terms used herein are given in ASTM D123.

3.3.1.1 Acceptability Limits: There shall be not more than 4 defect points in any one linear yard (0.9 linear m), not more than 50 critical defect points in any 100 yards (91 m), or not more than 100 total defect points in any roll of cloth.

3.3.1.2 Counting of Defects: Each occurence of all critical and noncritical defects listed in Table II shall be counted regardless of their proximity to each other. Where two or more defects occur in the same yard (metre) length, the critical defect shall be counted first.

3.3.1.3 Stain: Shall be defined as a spot or streak of discoloration of the surface from any source, such as dirt, oil, or water, covering more than one linear yard (0.9 linear metre).

3.3.1.4 Dirty Filling: Shall be defined as an area of cloth running from edge to edge containing a group of dirty filling yarns. Such dirty yarns may be either continuous or appear as flashes. In order to be considered dirty filling, there shall be more than 10 individual dirty yarns per linear inch (25.4 mm). Single dirty yarns or flashes comprising the group of yarns shall be longer than 1.5 inches (38 mm) to be considered dirty filling.

3.4 Tolerances: Shall conform to the following:

3.4.1 Width: Shall not deviate from the standard or specified width by more than the tolerance shown in Table III.

3.4.2 Weight: Shall be within ± 15% of the nominal weight specified in Table I.

3.4.3 Selvage Width: Shall not exceed 0.375 inch (9.52 mm).

3.4.4 Thickness: Shall be within ± 15% of the nominal thickness specified in Table I.

3.4.5 Fabric Count:

3.4.5.1 Warp: The average count of warp ends shall be within ± 2 ends from the nominal count specified in Table I.

3.4.5.2 Fill: The average count of filling picks shall be within ± 2 picks from the nominal count specified in Table I.

3.4.6 Length of Rolls: The nominal length of cloth on each roll shall be 100 yards (91 m). Each roll shall consist of one continuous piece of cloth.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the cloth shall supply all 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 the cloth conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests and shall be performed prior to or on the initial shipment of cloth to a purchaser, on each lot, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test 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: Each lot of cloth shall be sampled at random to provide sufficient cloth to perform all required tests. The number of determinations for each requirement shall be as noted below or in the applicable test procedure or, if not specified therein, not less than three; a lot shall be 1000 yards (914 m) of cloth or fraction thereof, all woven from the same warp yarns and on the same loom and all processed without significant changes in treater settings or finish batch.

4.3.1.1 Examination of Rolls: 100% yard by yard (metre by metre) visual examination shall be performed on all lots.

4.3.1.2 Tests of Woven Cloth: A 1-yard (0.9-m) sample shall be taken from each lot of cloth for test.

4.3.1.3 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 4.6.1 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 cloth shall be approved by purchaser before cloth for production use is supplied, unless such approval be waived by purchaser. Results of tests on production cloth shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, and methods of inspection on production cloth which are essentially the same as those used on the approved sample cloth. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and/or processing and, when requested, sample cloth. Production cloth made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Silica Content: Shall be determined in duplicate, as follows (This method does not separate boric oxide from silicon dioxide; See 3.1.1.2):

4.5.1.1 Cut a 1.5 gram sample into approximately 0.25 inch (6.4 mm) squares. Place into a previously ignited, cooled, and weighed platinum crucible, (W_1).

4.5.1.2 Ignite the crucible in a muffle furnace maintained at 1000°C ± 20 (1832°F ± 36) for 30 minutes ± 1. Cool to room temperature in a desiccator and reweigh the crucible with sample to the nearest 0.01 gram (W_2).

4.5.1.3 Add approximately 2 - 3 mL of 1:1 (by volume) sulfuric acid into the crucible, followed by 20 - 25 mL of 48% hydrofluoric acid. Add slowly and cautiously, drop by drop at first, until effervescence ceases.

4.5.1.4 Evaporate the acid in the crucible to apparent dryness on a hot plate in a fume hood.

4.5.1.5 Repeat 4.5.1.3 and 4.5.1.4 once.

4.5.1.6 Place the crucible containing the residue on a clay triangle and gently fume off the sulfuric acid over a Bunsen burner. Take care to avoid spattering.

4.5.1.7 When all fumes have been expelled, place the crucible in a muffle furnace maintained at 1000°C ± 20 (1832°F ± 36) for 30 minutes ± 1. Cool to room temperature in a desiccator and reweigh the crucible. Repeat burnout until constant weight is achieved (W_3).

4.5.1.8 Calculate silicon dioxide content using the following formula.

$$SiO_2, \% \text{ by wt} = \frac{(W_2 - W_1) - (W_3 - W_1)}{(W_2 - W_1)} \times 100$$

where, W_1 = weight of fired crucible

W_2 = weight of fired sample + crucible

W_3 = weight of residue + crucible

4.5.1.9 Report the average of all values for each sample.

4.5.2 Finish Content: When specified, the amount of aminosilane finish contained on the cloth shall be determined in duplicate, using the apparatus shown in Fig. 1, as follows (The method shown in ASTM D2408 is an acceptable alternate):

4.5.2.1 Weigh approximately 1.4-gram sample of cloth to the nearest 0.01 gram. Fold in all cut edges to prevent loss of sample and transfer to a clean nickel crucible.

4.5.2.2 Cover with approximately 3 grams potassium hydroxide (KOH) pellets and insert crucible into test tube. Assemble as shown in Fig. 1.

4.5.2.3 Preheat furnace to about 345°C (653°F). Immerse delivery tube into 50 mL of 0.3% boric acid plus three drops of methyl red. Adjust argon flow to about three bubbles per second.

4.5.2.4 Place test tube into furnace.

4.5.2.5 Allow approximately 50 minutes for complete reaction. During the first few minutes, the methyl red should turn yellow. Remove the Erlenmeyer flask and titrate the contents with 0.1 normal hydrochloric acid (HCl) to a faint pink end point.

4.5.2.6 Run a blank (empty crucible) through the procedure of 4.5.2.1 through 4.5.2.5.

4.5.2.7 Calculate the aminosilane finish using the following formulas:

$$\text{Nitrogen, \%} = \frac{(V-C) \times 1.4 \times N/HCl}{W}$$

$$\text{Aminosilane Finish \%} = \frac{(V-C) \times 22.11 \times N/HCl}{W}$$

where, V = Volume of 0.1 normal HCl for sample

C = Volume of 0.1 normal HCl for blank run

N/HCl = Normality of HCl used

W = Sample weight, grams

4.5.2.8 Report the average of all values for each sample.

4.5.3 Breaking Strength: Shall be determined in accordance with ASTM D579 except that five specimens shall be tested for each direction (warp and fill) and the individual and average values reported.

4.6 Reports:

4.6.1 The vendor of cloth shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the cloth conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3846B, fabric style number, vendor's material and finish designations, date of shipment, lot number, and quantity.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 3846B, fabric style number, contractor or other direct supplier of cloth, supplier's material and finish designations, and quantity. When cloth for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of cloth to determine conformance to the requirements of this specification and shall include in the report either a statement that the cloth conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.6.3 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the cloth may be based on the results of testing double the number of specimens for each lot. If a failure occurs in the retest, the number of specimens shall be redoubled. Any failure during the second retest shall be cause for rejection of the cloth 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 Cloth shall be supplied in rolls wound on suitable cores not less than 3 inches (76 mm) in diameter.

5.1.2 Each roll shall be identified with not less than the following information, by a label attached on the inside of the core, using characters of such size as to be legible and which will not be obliterated by normal handling:

CLOTH, QUARTZ, FABRIC STYLE _____ FINISH NUMBER _____
AMS 3846B
MANUFACTURER'S IDENTIFICATION _____
LOT NUMBER _____
QUANTITY _____

5.1.3 Packaging shall be accomplished in such a manner as to ensure that the cloth, during shipment and storage, will be protected against damage from exposure to moisture, weather, or any other normal hazard.

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

CLOTH, QUARTZ, FABRIC STYLE _____ FINISH NUMBER _____
AMS 3846B
YARDAGE _____
WIDTH _____
PURCHASE ORDER NUMBER _____
MANUFACTURER'S IDENTIFICATION _____
LOT NUMBER _____
WEIGHT OF PACKAGE _____

5.1.5 Packages of cloth 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 cloth to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.6 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.1, 5.1.3, and 5.1.5 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Cloth not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.

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

8.3 For direct U.S. Military procurement, purchase documents should specify not less than the following:

Title, number, and date of this specification
Style and finish number of cloth desired
Width of cloth desired
Quantity of cloth desired
Applicable level of packaging (See 5.1.6).

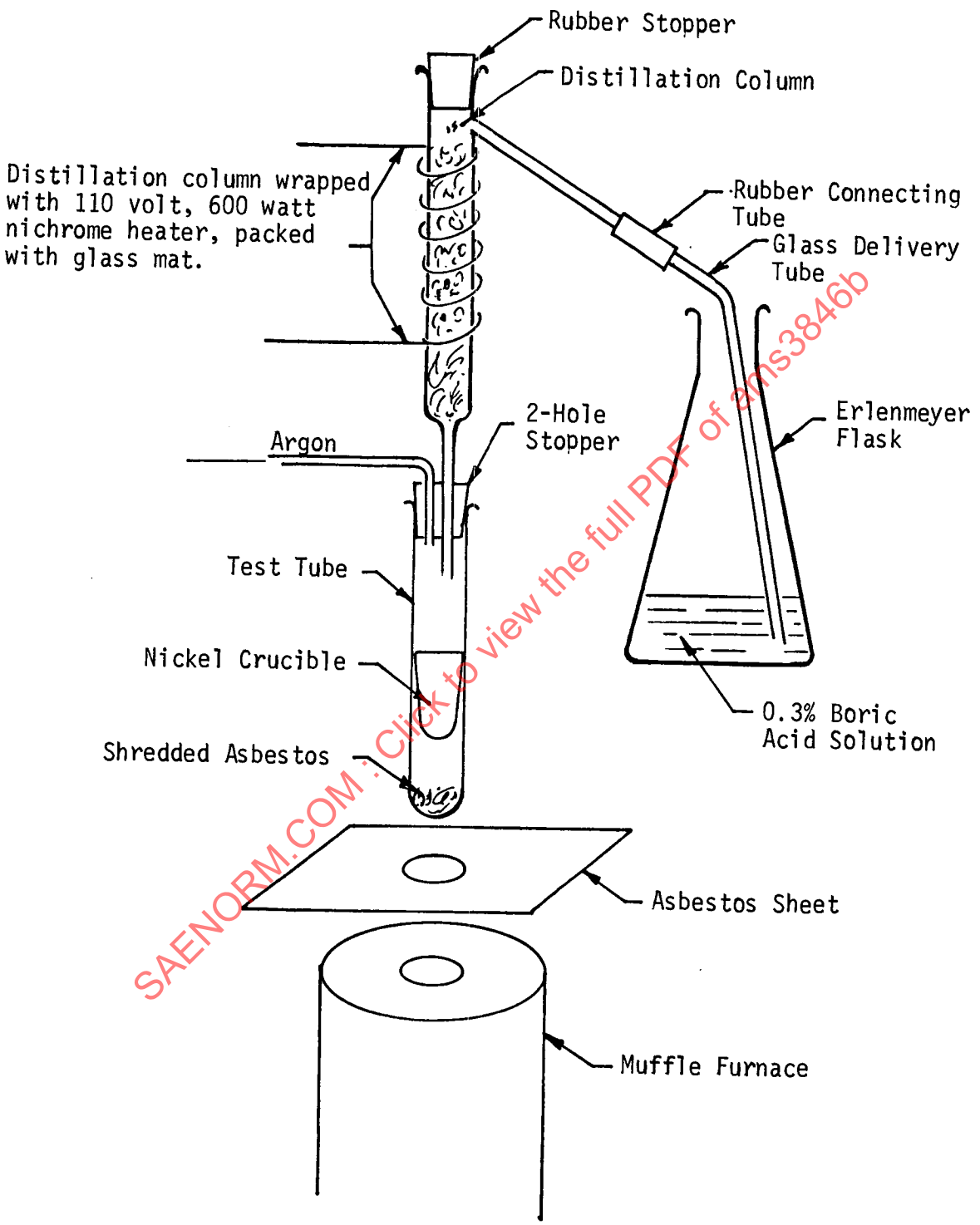
8.4 Cloth meeting the requirements of this specification has been classified under Federal Supply Classification (FSC) 8305.

8.5 This specification is under the jurisdiction of AMS Committee "CC"

TABLE I

CONSTRUCTION AND PROPERTIES OF FINISHED CLOTH

Fabric Style	Fabric Count per Inch (25.4 mm) Warp	Fill	Weave	Nominal Weight Oz/Sq Yd	g/m^2	Nominal Thickness Inch	mm	Breaking Strength Warp x Fill Minimum pounds Force per Inch	Average kN/m
503	50	40	Plain	3.3	112	0.005	0.13	65 x 50	11.4 x 8.8
527	42	32	Plain	5.6	190	0.009	0.23	125 x 100	21.9 x 17.5
570	38	24	5H Satin	19.5	661	0.027	0.69	325 x 300	56.9 x 52.5
581	57	54	8H Satin	8.4	285	0.011	0.28	175 x 170	30.6 x 29.8
593	49	46	5H Satin	7.0	237	0.010	0.25	135 x 135	23.6 x 23.6
594	20	10	Leno	2.40	81.4	0.008	0.20	50 x 25	8.8 x 4.4



APPARATUS FOR ANALYSIS OF QUARTZ FINISH

FIGURE 1