SAE LAND SEA AIR SPACE

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AEROSPACE MATERIAL SPECIFICATION

AMS 3846

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Revised

CLOTH, QUARTZ
Finished for Resin Laminates

1. SCOPE:

1.1 Form: This specification covers high-purity silica (99.90%) 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 elevated temperature service up to 600° F (316° C).

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., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

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

ASTM D123 - Definition of Terms Relating to Textile Materials
ASTM D579 - Woven Glass Fabrics
ASTM D1777 - Measuring Thickness of Textile Materials
ASTM D1910 - Construction Characteristics of Woven Fabrics
ASTM D2408 - Woven Glass Fabric, Cleaned and After-Finished with Amino-Silane Type Finishes for Plastic Laminates

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

2.3.1 Federal Standards:

FED-STD-4 - Glossary of Fabric Imperfections

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 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.

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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. Conformance to these requirements shall be determined by the following methods:

Weight	ASTM D1910, small sample method
Nominal Thickness	ASTM D1777
Fabric Count	ASTM D1910
Breaking Strength	ASTM D579

3.3 Quality: The product shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from imperfections detrimental to fabrication, appearance, or performance of parts.

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.

3.3.1.1 Acceptability Limits: There shall be not more than 4 defect points in any one linear yd (0.9 linear m), not more than 50 "critical defect points" in any 100 yd (91.4 m), or not more than 100 total defect points in any roll of cloth.

3.3.1.2 Counting of Defects: Each occurance 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 (0.9 m) 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 meter).

3.3.1.4 Dirty Filling: Shall be defined as an area of fabric 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 must be longer than 1.5 in. (38 mm) to be considered dirty filling.

3.4 Tolerances: Unless otherwise specified, 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 in. (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 yd (91.4 m), unless otherwise specified. Each roll shall consist of one continuous piece of material.

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 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the product 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 or routine control tests.

4.3 Sampling:

4.3.1 Lot: For the purposes of sampling and inspection, a lot shall be 1,000 yd (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.

4.3.2 Frequency of Sampling:

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

4.3.2.2 Tests of Woven Fabric: A 1 yd (914 mm) sample shall be taken from each lot of cloth for test.

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 production material which are essentially the same as those used on the approved sample material. If any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures which could affect quality or properties of the material, vendor shall submit samples for reapproval unless purchaser grants written approval after review of a detailed statement of materials and processing used on the approved sample and those proposed. No production material made by the revised procedure shall be shipped prior to receipt of approval of such procedure.

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 g sample into approximately 0.25 in. (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 min. ± 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 cm^3 of 1:1 (by volume) sulfuric acid into the crucible, followed by 20 - 25 cm^3 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 min. ± 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 in crucible

W_3 = weight of residue in 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 a sample of cloth approximately 1.4 g to the nearest 0.01 gram. Fold in all cut edges to prevent loss of sample and transfer to the clean nickel crucible.

4.5.2.2 Cover with approximately 3 g 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 cm^3 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 min. for complete reaction. During the first few minutes, the methyl red should turn yellow. Remove the Erlenmeyer flask and titrate the contents with N/100 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 N/100 HCl for sample

C = Volume of N/100 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 the product shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, material specification number, 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 three copies of a report showing the purchase order number, material specification number, fabric style number, contractor or other direct supplier of material, supplier's material and finish designations, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include 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 product 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 product 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 in. (76 mm) in diameter.

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

CLOTH, QUARTZ, FABRIC STYLE_____ FINISH NUMBER_____
AMS 3846
MANUFACTURER'S MATERIAL DESIGNATION_____
LOT NUMBER_____
QUANTITY_____

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

5.1.4 Each package shall be permanently and legibly marked to give the following information:

CLOTH, QUARTZ, FABRIC STYLE_____ FINISH NUMBER_____
AMS 3846
YARDAGE_____
WIDTH_____
PURCHASE ORDER NUMBER_____
MANUFACTURER'S IDENTIFICATION_____
LOT NUMBER_____
WEIGHT OF PACKAGE_____

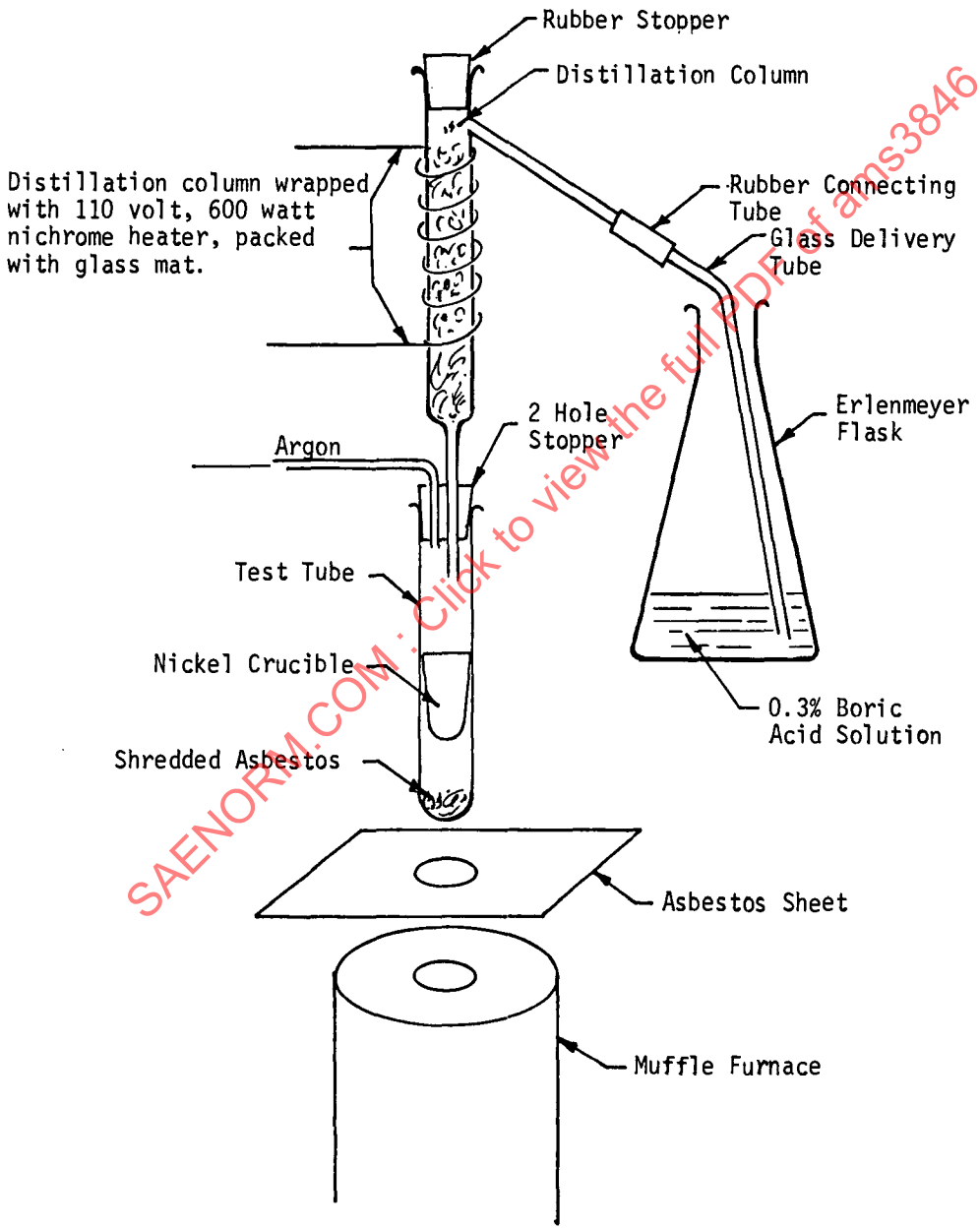
5.1.5 Packages shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

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

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Definitions: For definition of terms, refer to ASTM D123.



APPARATUS FOR ANALYSIS OF QUARTZ FINISH

FIGURE 1

TABLE I

CONSTRUCTION AND PROPERTIES OF FINISHED CLOTH

Fabric Style	Fabric Count per Inch (25.4 mm) Warp	Fill	Weave	Nominal Weight Oz per Sq Yd	(g/m^2)	Nominal Thickness Inch	(mm)	Breaking Strength, Min Avg lb per inch	(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)