AEROSPACE MATERIAL SPECIFICATION

AMS3908	REV. A

Issued 1986-04
Revised 1992-01
Reaffirmed 2014-08

Superseding AMS3908

Cloth, Aramid, (Para)
Plain Weave, Thermally Stable

RATIONALE

AMS3908A has been reaffirmed to comply with the SAE five year review policy.

1. SCOPE:

1.1 Form:

This specification covers a thermally stable aramid fabric in the form of cloth.

1.2 Application:

This product has been used typically for flight clothing but usage is not limited to such applications.

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 1424 Tear Resistance of Woven Fabrics by Falling-Pendulum (Elmendorf) Apparatus

2.2 U.S. Government Publications:

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

PPP-P-1133 Packaging of Synthetic Fiber Fabrics
FED-STD-4 Glossary of Fabric Imperfections
FED-STD-191 Textile Test Methods

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS3908A

2.2.1 Other Documents: Available from Federal Trade Commission, Washington, DC 20580.

Textile Fiber Products Identification Act, Rules and Regulations

2.3 AATCC Publications:

Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.

Technical Manual of the AATCC, Method 76-1262 Electrical Resistivity of Fabrics

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The cloth shall be woven from thermally stable aramid fibers. The denier shall be nominally 1.3 per filament, cut to a staple length of 1-1/2 to 2 inches (38 to 51 mm); a vendor's certificate of conformance shall be acceptable for determining conformance to these requirements.

3.1.1 Yarn: Shall be two-ply for both warp and filling, determined visually.

3.2 Properties:

Cloth shall conform to the following requirements; tests shall be performed on the cloth supplied and in accordance with the specified test methods, insofar as practicable:

3.2.1 Color: Shall match Sage Green 1565. The color shall be obtained by the use of melt spun solution dyed fibers.

3.2.1.1 Sage Green 1565 is a manufacturer's identification number for that color.

3.2.1.2 Matching: The color shall match the standard sample under artificial light having a color temperature of 7500 °K and shall be a good approximation to the standard sample under incandescent lamplight at 2800 °K.

3.2.1.3 Colorfastness: The dyed and finished cloth shall show colorfastness to light and to laundering equal to or better than the standard sample when tested as specified in 3.2.5.11 and 3.2.5.12.

3.2.2 Weave: Shall be a plain weave, determined visually.

3.2.3 Width: Shall be 45 inches ± 0.25 (1143 mm ± 6.4), inclusive of salvages.

3.2.4 Nonfibrous Material: Prior to application of the antistatic finish, the cloth shall contain no more than 1.0% starch and protein including the chloroform-soluble and water-soluble material, determined in accordance with FED-STD-191, Method 2611.

3.2.5 Finishing: Cloth shall be desized, scoured, calendered, heat set, and given a durable antistatic finish to meet the requirements, shown in Table 1, determined in accordance with specified test methods of FED-STD-191, except as otherwise specified herein:

TABLE 1 - Requirements and Test Methods

Paragraph	Property	Requirement	Test Method
3.2.5.1	Weight, minimum	4.5 ounces/square yard (153 g/m^2)	5041
3.2.5.2	Yarns per inch (25.4 mm), minimum		5050
3.2.5.2.1	Warp	54	
3.2.5.2.2	Filling	41	
3.2.5.3	Breaking Strength, minimum		5104
3.2.5.3.1	Ravel Strip Warp	72 pounds force/inch (12,609 N/m)	
3.2.5.3.2	Ravel Strip Filling	53 pounds force/inch (9282 N/m)	
3.2.5.4	Tearing Strength, Tongue, minimum		ASTM D 1424
3.2.5.4.1	Warp and Filling	65 pounds force (289 N)	
3.2.5.5	Air Permeability at 0.5 Inch (13 mm) Water Pressure, minimum	25 cubic feet/minute/square foot (7.6 m^3/minute/m^2)	
3.2.5.6	Flame Resistance (In warp direction only)		5903
3.2.5.6.1	Flame Time, maximum	1 second	
3.2.5.6.2	Glow Time, maximum	1.5 seconds	
3.2.5.6.3	Char Length, maximum	2.0 inches (51 mm)	
3.2.5.7	Thermal Shrinkage (In warp direction only)		4.5.1
3.2.5.7.1	Average of 5 samples, maximum	5%	
3.2.5.7.2	Individual Sample, maximum	10%	

TABLE 1 - Requirements and Test Methods (Continued)

Paragraph	Property	Requirement	Test Method
3.2.5.8	Dimensional Stability (Shrinkage) After 15 cotton launderings, maximum		5660
3.2.5.8.1	Warp	4.0%	
3.2.5.8.2	Filling	1.5%	
3.2.5.9	Antistatic Finish, average of 3 determinations to the nearest 1.0×10^{11} ohms per square		
3.2.5.9.1	Before laundering	5×10^{13} ohms/square	AATCC 76-1262
3.2.5.9.2	After cotton laundering	5×10^{13} ohms/square	5556
3.2.5.10	pH		5.0 to 8.02811

3.2.5.11 Colorfastness to Light: Shall be equal to or better than the standard sample, determined in accordance with FED-STD-191, Method 5660 except that supplier's submissions shall be compared with the standard sample after six hours and then evaluated.

3.2.5.12 Colorfastness to Laundering: Shall be equal to or better than the standard sample, determined in accordance with FED-STD-191, Method 5041.

3.2.5.13 Curling: Finished cloth shall lie flat, without distortion, and shall show no evidence of curling, determined in accordance with 4.5.2.

3.2.6 Compliance with Textile Fiber Products Identification Act: Each roll of cloth not labeled or ticketed in accordance with the Textile Fiber Products Identification Act shall be counted as a defect. A lot shall be unacceptable if two or more such defects occur.

3.3 Quality:

Cloth, as received by purchaser, shall be clean, evenly woven, and free from foreign materials and from imperfections detrimental to usage of the cloth.

3.3.1 Acceptability of each lot of cloth shall be based on imperfections as defined in FED-STD-4. The cloth shall not contain more than 50 demerit points per 100 square yards (84 m^2) when examined and scored in accordance with 4.3.1.3. No two individual rolls shall contain more than 75 demerit points per 100 square yards (84 m^2).

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of cloth shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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 Acceptance Tests:

Tests for the following requirements are acceptance tests and shall be performed on each lot:

Weight:	(3.2.5.1)
Breaking Strength:	(3.2.5.3)
Tearing Strength:	(3.2.5.4)
Air Permeability:	(3.2.5.5)
Quality:	(3.3)

4.2.1 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of cloth to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1.1 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 and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient cloth 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 cloth produced in a single production run under the same fixed conditions and presented for vendor's inspection at one time.

4.3.1.2 The sample unit shall be 5 continuous yards (4.6 m), full width of the finished cloth except for determining the nonfibrous material content, when the sample shall be 9 inches (229 mm) full width of the cloth prior to application of the antistatic finish. Lot shall be unacceptable if one or more sample units fail to meet any specified requirement. Sample size shall be as shown in Table 2.

TABLE 2 - Sample Size

Lot Size Yards		Lot Size Meters		Sample Size
	Up to 800, incl		Up to 732, incl	2
Over	800 to 22,000, incl	Over	732 to 20,117, incl	3
Over 22,000		Over 20,117		5

4.3.1.3 Yard-by-Yard (Meter-by-Meter) Examination: Each roll in the sample shall be examined on the face side only. When the total length in the roll does not exceed 100 yards (91 m), the entire roll shall be examined. When the total length in the roll exceeds 100 yards (91 m), only 100 yards (91 m) need be examined. All imperfections, as defined in FED-STD-4, Section III, which are visible at normal inspection distance of 3 feet (1 m), shall be scored and assigned demerit points as listed in 4.3.1.3.4 except as follows:

4.3.1.3.1 Only coarse yarns that exceed twice the normal yarn diameter shall be scored.

4.3.1.3.2 Mixed filling (shade bar) shall be scored only when resulting from wrong ply, wrong twist in the yarn, or off shade yarn.

4.3.1.3.3 No linear yard (meter) [increments on the measuring device of the inspection machine] within the sample shall be penalized more than 4 demerit points. The sample size shall be 20 rolls selected from 20 containers or one roll from each container when the lot consists of less than 20 containers. If only one roll exceeds 75 demerit points per 100 square yards (84 m^2), a second sample of 20 rolls, or one roll from each container when the lot consists of less than 20 containers, shall be examined only for fabric imperfections. The lot shall be unacceptable if one or more rolls in the second sample exceeds 75 demerit points per 100 square yards (84 m^2). Demerit point computation for lot quality and individual roll quality shall be as follows:

4.3.1.3.3.1 In inch-pound units:

$$\frac{\text{Total points scored in sample} \times 3600}{\text{Width of cloth, inches, x total length, yards, inspected}} = \text{Points per 100 Square yards} \quad \text{(Eq. 1)}$$

4.3.1.3.3.2 In SI units:

$$\frac{\text{Total points scored in sample} \times 100{,}000}{\text{Width of cloth, mm, x total length, m, inspected}} = \text{Points per 100 } m^2 \quad \text{(Eq. 2)}$$

4.3.1.3.4 Demerit Points: Shall be assigned as shown in Table 3.

TABLE 3 - Demerit Point Scoring

Imperfection Size	Points
3 inches (76 mm) and under in any dimension	1
Over 3 to 6 inches (76 to 152 mm), incl, in any dimension	2
Over 6 to 9 inches (152 to 229 mm), incl, in any dimension	3
Over 9 inches (229 mm) in any dimension	4
Any of the following imperfections per each yard (m):	
Baggy, ridgy, or wavy cloth	4
Width less than specified	4
Uneven weaving	4

4.3.1.4 Examination for Length:

4.3.1.4.1 Individual Rolls: During the yard-by-yard (meter-by-meter) examination, each roll in the sample shall be examined for length. Any length found to be less than the minimum specified or more than 2 yards (1.8 m) less than the length marked on the ticket shall be a defect with respect to length. The lot shall be unacceptable if two or more rolls in the sample are defective in respect to length.

4.3.1.4.2 Total Length in Sample: The lot shall be unacceptable if the total of the actual length of the rolls in the sample is less than the total of the lengths marked on the ticket.

4.3.1.5 Examination for Shade: During the yard-by-yard (meter-by-meter) examination, each roll in the sample shall be examined for shade. Any roll in the sample off shade, shaded side to side, side to center, or end to end shall be cause for rejection of the entire lot represented.

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, processes, 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 ingredients 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 Linear Thermal Shrinkage:

4.5.1.1 Five samples, 4 x 4 inches (102 x 102 mm) , shall be used for this test. Lines shall be marked on each sample 0.5 inch (13 mm) from each edge perpendicular to the direction in which the shrinkage is to be measured. The sample shall be mounted on a 6-inch (152 -mm) square corrosion-resistant steel plate, having a 3.5-inch (89-mm) square opening in the center, and having two pins or hooks 2.5 inches (64 mm) apart fixed to one side of the plate (Figure 1), centered on a line parallel to one edge of the plate opening and 0.25 inch (6.4 mm) into the opening. A second set of pins or hooks, also 2.5 inches (64 mm) apart, shall be attached to a 10-gram weight attached to a wire leader and thread.

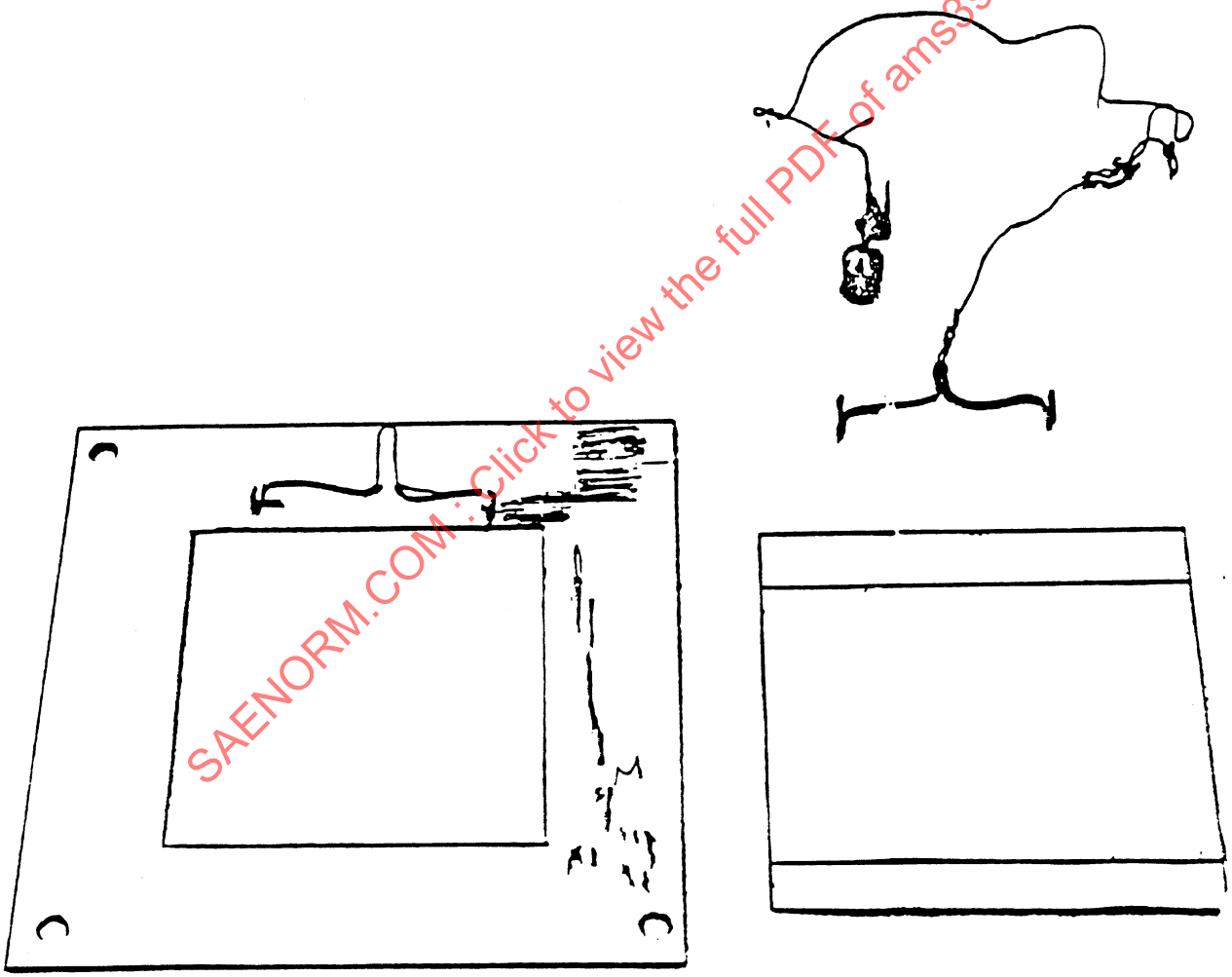

FIGURE 1 - Sample Mount for Thermal Shrinkage

4.5.1.2 The sample shall be mounted by inserting the pins or hooks of the mounting plate through the sample along one of the marked lines so that the sample is centered over the opening in the mounting plate. The other set of pins or hooks shall be inserted through the marked line near the opposite edge of the sample giving a sample length of 3 inches (76 mm). If the sample has a face and back (one side calendered), the face side shall be towards the flame.

4.5.1.3 The mounted sample shall be positioned over a 4-inch (102-mm) diameter shuttered opening such that the center of the closed shutter plate is directly beneath the center point of the mounted sample. The weight shall be attached to the pins or hooks on the free edge and the supporting thread and weight placed over a pulley to provide constant tension to the sample during exposure. A Meker burner shall be placed at the center and below the shutter plate so that the top of the burner is 1.8 inches (46 mm) below the plane of the mounted sample. The burner flame shall be adjusted to obtain a heat flux of approximately 0.05 BTU/square inch/second (1.8 cal/cm^2/second) at the height of 1.8 inches (46 mm) above the top of the burner. The heat flux shall be measured with a suitable calorimeter.

4.5.1.4 Set the heat source at the proper heat flux level. With the shutter closed, place the mounting plate holding the sample over the exposure opening. Drape the thread connecting the weight to the fill-edge pins or hooks over the pulley, allowing the weight to hang free. Expose the sample to the test source for 6.0 seconds ± 0.2 by using a suitable shutter and timing device. After removal of the sample from the test plate, the distance between the marked lines at the center of the sample shall be measured, using precision calipers, to the nearest 0.02 inch (0.5 mm). No attempt shall be made to flatten or otherwise straighten the exposed sample prior to measurement.

4.5.1.5 Calculate the shrinkage results as follows:

$$\frac{Lo - Ls}{Lo} \times 100 = \% \text{ linear shrinkage} \qquad \text{(Eq. 3)}$$

Where: Lo = Original sample length [3 inches (76 mm)]
Ls = Sample length after exposure

4.5.2 Curling: Two specimens of cloth, 1.5 x 6 inches (38 x 152 mm) shall be cut, one having the long dimension parallel to the filling and the other with the long dimension parallel to the warp. Both specimens shall be placed on a flat surface for at least 5 minutes and then examined for visual evidence of curling.

4.6 Reports:

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. This report shall include the purchase order number, lot number, AMS 3908A, vendor's material designation, quantity, and weight.