AN AMERICAN NATIONAL STANDARD

SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3673A

Issued 1 JUL 1986
Revised 1 APR 1991

Superseding AMS 3673

Submitted for recognition as an American National Standard

CLOTH, GLASS
ALUMINUM FACE, SILICONE RUBBER BACK

1. SCOPE:

1.1 Form: This specification covers one type of glass cloth coated on one face with aluminum and the other face with silicone rubber.

1.2 Application: Primarily for use as a thermal curtain for protection of personnel and equipment from short-time exposure to high intensity thermal radiation.

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

2.1 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.1.1 Federal Specifications:

PPP-P-1136 - Packaging of Coated (Plastic, Rubber) and Laminated Fabrics

2.1.2 Federal Standards:

FED-STD-4 - Glossary of Fabric Imperfections
FED-STD-191 - Textile Test Methods

2.1.3 Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-1487 - Glossary of Cloth Coating Imperfections

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Base Cloth: The warp and filling yarns used in the manufacture of the base cloth shall be 100% continuous filament glass yarns.

3.1.2 Coated Cloth: The cloth shall consist of a base fabric of glass yarn which has been evenly and uniformly coated on one surface with a suitably-compounded silicone rubber. On the opposite surface shall be a highly-reflective layer of vacuum distilled aluminum directly adhered to the warp face by means of a curable, highly-flexible, solvent resistant adhesive bonding composition.

3.2 Properties: Cloth shall conform to the following requirements, determined in accordance with specified test methods of FED-STD-191 except as otherwise specified herein:

3.2.1 Base Cloth: Shall be as follows:

3.2.1.1	Construction, ends and picks per inch (25.4 mm)	64 x 60	5050
3.2.1.2	Thickness, maximum	0.008 inch (0.20 mm)	5030
3.2.1.3	Weight, maximum	6.70 ounces/square yard ($227.2\ g/m^2$)	5041
3.2.1.4	Breaking Strength, minimum		5102
	Warp	130 pounds force/inch (22,766 N/m)	
	Filling	90 pounds force/inch (15,761 N/m)	
3.2.1.5	Weave	Crowfoot Satin	Visual

3.2.2 Coated Cloth: Shall be as follows:

3.2.2.1	Weight	16 ounces/square yard ± 2 ($542\ g/m^2 \pm 68$)	5041

AMS 3673A		SAE	AMS 3673A
3.2.2.2	Thickness	0.0150 inch ± 0.0015 (0.381 mm ± 0.038)	5030
3.2.2.3	Width	As Ordered	5020
3.2.2.4	Breaking Strength (Cut Strip), minimum		5102
	Warp	150 pounds force/inch (26,269 N/m)	
	Filling	150 pounds force/inch (26,269 N/m)	
3.2.2.5	Tear Strength, minimum		
	Warp	3.0 pounds force (13 N)	5134
	Filling	3.0 pounds force (13 N)	
3.2.2.6	Cold Crack		4.5.1
	Rubber Coating		
	Warp and Filling	No Cracking	
	Aluminum Coating		
	Warp and Filling	No Cracking	
3.2.2.7	Coating Adhesion, minimum	4.0 pounds force/inch (701 N/m)	5970
3.2.2.7.1	Adhesive shall be cured in accordance with FED-STD-191, Method 5970, except that the cure cycle shall be 48 hours ± 1 at 25°C ± 3 (77°F ± 5).		
3.2.2.8	Resistance to Blocking		5872
	Cloth heated for 2 hours ± 0.1		
	Aluminum to Rubber	No Blocking	
	Aluminum to Aluminum	No Blocking	
	Rubber to Rubber	No Blocking	
3.2.2.9	Stiffness, maximum		5202
	Warp	0.015 inch-pound (0.0017 N·m)	
	Filling	0.015 inch-pound (0.0017 N·m)	
3.2.2.10	Thermal Radiation Resistance		4.5.2
	Thermal Response, maximum		
	First Exposure	2.0°F x ft^2 per BTU (0.84°C x m^2/k cal)	
	Second Exposure	2.1°F x ft^2 per BTU (0.88°C x m^2/k cal)	
	Third Exposure	2.1°F x ft^2 per BTU (0.88°C x m^2/k cal)	

3.2.2.11 Abrasion Resistance Thermal Response after Abrasion, maximum		4.5.3
First Exposure	3.0°F x ft^2 per BTU (1.26°C x m^2/k cal)	
Second Exposure	3.1°F x ft^2 per BTU (1.30°C x m^2/k cal)	
Third Exposure	3.1°F x ft^2 per BTU (1.30°C x m^2/k cal)	
3.2.2.12 Flame Resistance, maximum		5903
Flame Time	10 seconds	
Glow Time	2 seconds	
3.2.2.13 Visible Damage	No burning, blistering, or delamination	Visual

3.3 Quality: The cloth, as received by purchaser, shall be evenly woven, and free from foreign materials and from imperfections detrimental to usage of the cloth.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of cloth shall supply all samples Ø 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 Classification of Tests:

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

4.2.1.1 Weight (3.2.1.3), breaking strength (3.2.1.4), and weave (3.2.1.5) of the base cloth.

4.2.1.2 Weight (3.2.2.1), breaking strength (3.2.2.4), tear strength (3.2.2.5), cold crack (3.2.2.6), thermal radiation resistance (3.2.2.10), flame resistance (3.2.2.12), and quality (3.3) of the coated cloth.

4.2.2 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.

4.2.2.1 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 and Testing: Shall be as follows:
Ø

4.3.1 For Acceptance Tests: Except as specified in 4.3.1.6, sufficient cloth shall be taken 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 for the base cloth shall be 2.5 yards (2.3 m) full width. The sample size (number of units) shall be as shown below. The lot size shall be expressed in units of 1 linear yard (1 linear m). The lot shall be unacceptable if one or more sample units fail to meet any specified requirements.

Lot size		Sample Size
Yards	Meters	
Up to 800, incl	Up to 732, incl	2
Over 800 to 2000, incl	Over 732 to 1829, incl	3
Over 2000	Over 1829	5

4.3.1.3 Yard-by-Yard (Meter-by-Meter) Examination:

4.3.1.3.1 Base Cloth: The sample unit for the base cloth shall be 0.25 yard (0.2 m) full width. A sample shall be taken from each lot. A lot of cloth shall consist of 2000 yards (1829 m), or fraction thereof. The lot shall be unacceptable if the sample fails to meet any requirement specified. The sample shall be examined on the face side only for all imperfections as defined in FED-STD-4, Section I. All imperfections which are noticeable at the normal inspection distance of 3 feet (1 m) shall be scored and assigned demerit points as specified in 4.3.1.3.2. The lot shall be unacceptable if the points per 100 square yards (84 m^2) of the total examined exceed 20. Point computation for lot quality shall be as follows:

4.3.1.3.1.1 In inch/pound units:

$$\frac{\text{Total points scored in sample} \times 3600}{\text{Width of cloth, inch,} \times \text{total length inspected, yard}} = \text{Points per 100 square yards}$$

4.3.1.3.1.2 In SI units:

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

4.3.1.3.2 Demerit Points: Shall be assigned as follows:

Imperfection	Points
For imperfections 3 inches (76 mm) or under in any dimension	1
For imperfections over 3 to 6 inches (76 to 152 mm), incl, in any dimension	2
For imperfections over 6 to 9 inches (152 to 229 mm), incl, in any dimension	3
For imperfections over 9 inches (229 mm) in any dimension	4

4.3.1.3.3 Coated Cloth: All coated cloth shall be examined on both sides. The visual imperfections shall be scored for imperfections as classified in Table I. The visual imperfections shall be counted regardless of their proximity to each other, except where two or more imperfections represent a single local condition of the cloth; in which case, the imperfection shall be counted only once in a single yard (metre). The same yard (metre) shall be given a through-lighting inspection for pinholes and areas of missing film. The through-lighting equipment shall be as specified in MIL-STD-1487. The sample unit shall be 1 linear yard (1 linear m). The inspection level shall be in accordance with MIL-STD-105, Level II.

Ø

TABLE I

CLASSIFICATION OF IMPERFECTIONS FOR COATED CLOTH

Imperfection	Description
Aluminum Side	
Abrasion Marks	Where aluminum is missing from fabric.
Coating	Improperly adhering to fabric.
Unmetallized Spots	Any unmetallized spots.
Silicone Rubber Side	
Blisters or Loose Coating	Over 0.250 inch (6.35 mm) square or 4 under 0.250 inch (6.35 mm) square per 5 running yards (4.6 m).
Creases	Creased area is uncoated.
Cuts	All sizes.
Light Area	Coating missing under 1 inch (25 mm) square in area. Over 1 inch (25 mm) square is a critical imperfection.
Lumps and Foreign Matter	Over 0.250 inch (6.35 mm) square or 4 under 0.250 inch (6.35 mm) square per 5 running yards (4.6 m).

TABLE I (Continued)

CLASSIFICATION OF IMPERFECTIONS FOR COATED CLOTH

Imperfection	Description
Pinholes	All sizes.
Splice Marks and Coating Impressions	All sizes when coating is missing and under 1 inch (25 mm) square in area. Over 1 inch (25 mm) square in area is a critical imperfection.
Stains	Oil and dirt stains over 1 inch (25 mm) square in area or 5 stains under 1 inch (25 mm) square in 5 running yards (4.6 m).
Streaks	Coating missing under 1 inch (25 mm) square in area. Coating missing over 1 inch (25 mm) square in area is a critical imperfection.
Strike-through	All strike-through marks of coating compound to aluminum face of cloth are imperfections.
Tears	All sizes.

4.3.1.4 Examination for Length: The roll shall be examined for gross length. Any gross length found to be less than the specified minimum length or any gross length found to be more than 2 yards (1.8 m) below the gross length marked on the piece ticket shall be considered an imperfection with respect to length.

4.3.1.5 Ø When a statistical sampling plan has 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 shall state that such plan was used.

4.3.1.6 For direct U.S. Military procurement, sampling shall be in accordance with MIL-STD-105.

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 cloth.

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 or processing, 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 Cold Crack: A 1 x 4 inch (25 x 102 mm) specimen with the long direction warpwise and a 1 x 4 inch (25 x 102 mm) specimen with the long dimension fillingwise shall be exposed for 4 hours ± 0.1 at -55°C ± 1 (-67°F ± 2) in a jig assembly as specified in Figure 1. While still at this temperature, the specimen shall be bent sharply, aluminum side out, over a 0.125 inch (3.18 mm) diameter rod so that the back of the specimen touches within 0.125 inch (3.18 mm) distance directly behind the rod. An additional set of specimens shall be tested with the rubber side to the outside of the bend. The specimen shall be examined visually for evidence of cracking, stiffening, flaking, or separation of either coating from the cloth.

4.5.2 Thermal Radiation Resistance: This test is to determine the resistance to multiple exposures from a high energy source of intense thermal radiation. The aluminum surface shall be irradiated at a level of 6.0 to 6.5 cal/cm^2/second. The temperature of the silicone rubber coated surface shall be measured by a thermocouple connected to a recording device capable of recording temperature as a function of time. Three specimens from each sample shall be tested. Each specimen shall have a thermocouple attached to the silicone coated face, immediately opposite the aluminum face to be tested, with a suitable adhesive. The sample shall be exposed for 10 seconds. The temperature rise, as a function of time during the exposure period, shall be recorded. The exposure shall be repeated three successive times on the same specimen allowing the specimen to cool to ambient temperature between exposures.

4.5.2.1 Thermal Response: The results of the test shall be reported as thermal response. Thermal response is defined as the rate of temperature rise of the silicone coated side of the cloth divided by the radiant energy flux.

4.5.3 Abrasion Resistance: This test is to determine the effect of abrasion of the aluminum face on the thermal radiation resistance of the material. Three specimens in each direction, 10 x 6 inches (254 x 152 mm) shall be abraded. A rectangle of cloth of the same material shall be used as the abradant. The corresponding cloth direction of the specimen to be tested shall be used. FED-STD-191, Method 5304, shall be used with the following exceptions: After step 4.5.3.3, the abraded portion of the specimen shall be irradiated in accordance with 4.5.2 and thermal response calculated in accordance with 4.5.2.1.

4.5.3.1 The test specimen shall be mounted aluminum face up on the oscillating cylinder section rather than the specimen holding arm.

4.5.3.2 The abradant shall be placed in the specimen holding arm with the aluminum face down.

4.5.3.3 The specimen shall be subjected to 60 continuous abrasion cycles at a tension of 2 pounds force (8.9 N) and under a load of 2 pounds (0.9 kg).

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 3673A, vendor'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 cloth 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 cloth represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Cloth shall be furnished in rolls of 80 to 120 yards (73 to 110 m) in length. There shall be no more than 3 pieces in each roll and each piece shall contain not less than 40 yards (37 m).

5.1.2 Each roll of cloth shall have a durable label or tag legibly marked with not less than the following information and attached so as to remain in place until all cloth has been removed from the roll:

CLOTH, COATED, GLASS, Aluminum Face, Silicone Rubber Back
AMS 3673A
WEIGHT PER SQUARE YARD (SQUARE METRE) _____
MANUFACTURER'S IDENTIFICATION _____
LOT NUMBER _____
DATE OF MANUFACTURE _____
QUANTITY _____

5.1.3 Individual rolls of cloth shall be wrapped in a suitable protective film and packaged in an exterior shipping container so that the rolls, during shipment and storage, will be protected from exposure to moisture, weather, or any other normal hazard.