

MIL-C-5646F  
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SUPERSEDING  
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MILITARY SPECIFICATION

CLOTH, AIRPLANE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers mercerized cotton cloth intended for use in the integral surface coverings of airplanes and as a base for a modified butyl rubber coated cloth.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

Federal

PPP-P-1134                      Packaging and Packing of Cotton and  
Cotton-Synthetic Fiber Blend Fabrics  
(Excluding Duck Fabrics)

Military

MIL-D-5549                      Dope; Cellulose-Acetate-Butyrate, Clear  
for Aircraft Use

FSC 8305

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## STANDARDS

Federal

FED-STD-191                      Textile Test Methods

Military

MIL-STD-105                      Sampling Procedures and Tables for Inspection by Attributes

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2                      Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

Federal Trade Commission

Rules and Regulations Under the Textile Fiber  
Products Identification Act

(Application for copies should be addressed to the Federal Trade Commission, Washington, D.C. 20580.)

American Society for Testing and Materials

ASTM-D377                      Methods of Test for Small Amounts of  
Copper and Manganese in Textiles

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.)

## 3.        REQUIREMENTS

3.1                      Material. The cloth shall be made from 2-ply combed yarn spun from cotton of a suitable staple length to assure conformance of the finished cloth to this specification. The yarn shall be mercerized under tension. Piece mercerization shall not be acceptable.

\*        3.2                      Finish. Finishing shall consist of washing, framing, and medium-cold calendering. Calendering shall be sufficient to lay any nap present and to provide a smooth, even surface. Care should be taken to avoid excessive roll pressure on the cloth.

\* 3.3 Color. The color shall be natural unless otherwise specified.

3.4 Physical properties. The finished cloth shall conform to the requirements in Table I when tested as specified in 4.4.

TABLE I - Physical Properties

Characteristic	Requirement
Weave	Plain (one up and one down)
Weight, ozs./sq. yd. (max.)	4.5
Yarns per inch	
Warp	82 $\pm$ 2
Filling	82 $\pm$ 2
Breaking strength, lbs. (min.) (Ravel strip method)	
Warp	80
Filling	80
Elongation, % (max.) (under 70 lbs. tension)	
Warp	16.0
Filling	11.0
Bursting strength, lbs./sq. in. (min.)	170

3.5 Width. The width of the finished cloth, inclusive of selvage, shall be as specified in Table II (see 6.2).

TABLE II - Width and Tolerance of Finished Cloth

Width (inches)	Tolerance (inches)
36	$\pm$ 1/2
60	$\pm$ 1
90	$\pm$ 1-1/2

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3.6 Length of roll. The finished cloth shall be furnished in rolls containing the lengths specified in Table III.

TABLE III - Roll Lengths

Width (inches)	Roll Length (yards)
36	500 to 600
60	250 to 300
90	175 to 200

3.6.1 Length of cut. The length of a single cut of the finished cloth shall be not less than 40 yards except that 10 percent of the total yardage of one width under any contract or order may be short lengths of from 10 to 25 yards, and 10 percent may be from 25 to 40 yards. No length shorter than 10 yards will be accepted. Short lengths shall be rolled together, and the roll shall be properly labeled to indicate that it is composed of short lengths.

3.7 Nonfibrous material. The finished cloth shall not contain more than 2.0 percent starch and protein, including chloroform and water-soluble material, when tested as specified in 4.4.

3.8 Copper and manganese. The finished cloth, when used as base cloth for coating, shall contain not more than 0.003 percent copper and 0.0015 percent manganese when tested as specified in 4.4.

\* 3.9 pH - The pH value of the water extract of the finished cloth shall be not less than 5.0 nor more than 8.5 when tested as specified in 4.4.

3.10 Compatibility with dope. The finished cloth shall be compatible with aircraft dope as specified in 4.4.1. The dope shall dry within 45 minutes when applied to the finished cloth.

3.11 Fiber identification. Each roll shall be labeled, ticketed, or invoiced for fiber content in accordance with the Rules and Regulations under the Textile Fiber Products Identification Act.

3.12 Workmanship. The finished cloth shall conform to the quality established by this specification. The occurrence of defects shall not exceed the applicable acceptable quality levels.

#### 4. QUALITY ASSURANCE PROVISIONS

\* 4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Certificate of compliance. Where certificates of compliance are submitted, the Government reserves the right to test such items to determine the validity of the certification.

4.2 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.2.1 Component and material inspection. In accordance with 4.1 above, components and materials shall be tested in accordance with all the requirements of referenced specifications, drawings and standards unless otherwise excluded, amended, modified or qualified in this specification or applicable procurement documents. In addition, the supplier shall submit a certificate of compliance stating that mercerized combed cotton yarns were the only yarns used in the weaving of the cloth.

4.2.2 Examination of the end item. Defects found during this examination shall be classified in accordance with 4.2.2.1 through 4.2.2.3.

\* 4.2.2.1 Yard-by-yard examination. The required yardage of each roll shall be examined and the visual defects classified as listed in Table IV. All defects found shall be counted regardless of their proximity, one to another, except where two or more defects represent a single local condition of the cloth, in which case only one defect shall be counted for each warpwise yard or fraction thereof in which it occurs. The unit of product for this examination shall be 1 linear yard. The sample size for the yard-by-yard-examination shall be determined in accordance with MIL-STD-105, Inspection level II; and the Acceptable Quality Level (AQL) shall be 2.5 major defects and 6.5 total defects per 100 units. The lot size shall be expressed in units of one yard each. The number of rolls sampled shall be in accordance with Table V and approximately an equal number of yards shall be examined in each roll.

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TABLE IV - Classification of Defects

Defects	Major	Minor
Hole, cut or tear, including selvage	X	
Smash, any	X	
Broken or missing yarns		
Three or more contiguous regardless of length	X	
Two contiguous, 2 inches or more missing	X	
Two contiguous, less than 2 inches, or single 2 inches or more missing		X
Fine filling bar or light place, clearly visible <u>1/</u>	X	
Thin place, open place, crack or hitchback opening at widest point three or more yarn diameters, or sequence of openings resulting in a weak spot	X	
Thin place, open place, crack or hitchback opening clearly visible <u>1/</u> , but opening at widest point less than three yarn diameters		X
Floats or skips - multiple, 1/2 inch or more in combined warp and filling directions, or harness skips	X	
Floats or skips - multiple, less than 1/2 inch in combined warp and filling directions, or single floating over 2 inches or more		X
Heavy filling bar, heavy place, coarse or additional yarns, clearly visible <u>1/</u> thickening of cloth		X
Slough-off, jerked-in filling, slugs, slubs or gouts in either direction more than three times the thickness of normal yarn	X	

TABLE IV (Continued)

Defects	Major	Minor
Slough-off, jerked-in filling, slugs, slubs or gouts in either direction clearly visible <u>1</u> / but not more than three times the thickness of normal yarn		X
Kinks - single, more than 1 inch in length, or multiple 1 inch or less in length		X
Spot, Stain, or streak - clearly visible <u>1</u> / (Count regardless of cause, i.e., not restricted to rust, oil or grease). However, a rim or light detergent mark, where a stain has been removed, shall not be classified a defect	X	
Mixed filling, finishing mark, clearly visible at 6 feet distance		X
Wrinkle or crease - embedded	X	
Knot - oversized, extending from surfaces of cloth		X
Wrong draw, reed mark - clearly visible <u>1</u> /		X
Temple mark - resulting in pin holes or frayed fibers, clearly visible <u>1</u> /		X
Baggy ridgy, or wavy cloth, clearly visible <u>1</u> /	X	
Tender or weak place - any	X	

1/ Clearly visible at normal examination distance of 3 feet.

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4.2.2.2 Overall examination. Each defect listed below shall be counted not more than once in each roll examined. The unit of product shall be one roll. The sample size or number of rolls selected as samples, and the maximum number of defects acceptable, shall be shown in Table V.

## OVERALL DEFECTS

Color (when specified) off shade, shaded side to side, blotchy, mottled, two-sided

Finish not as specified in 3.2

Overall uncleanness; objectionable odor

Excessive neppiness

Uneven weaving for more than 20 yards 1/

Selvage tight, wavy, scalloped, cut or broken, curled, folded, rolled, slack or loopy, continuously or intermittently over more than half the piece. 1/  
(Beaded selvage or thickening limited to outer reinforcing ends, and no more than two times the thickness of the selvage shall not be classified as a defect.)

Width, less than minimum specified

1/ Intermittently or continuously

TABLE V - Examination of Roll

Lot Size in Yards	Sample Size (rolls)		Acceptance Number	
	36-Inch Width	60" and 90"	36-Inch Width	60" and 90"
Up to 1,200 <u>1/</u>	2	3	0	0
1,201 to 3,200	3	5	0	0
3,201 to 10,000	5	7	0	0
10,001 to 35,000	7	10	0	0
35,001 to 150,000	10	15	0	1
150,001 and over	15	25	1	2

1/ If a lot contains fewer than three pieces, each piece in the lot shall be examined for overall defects.

#### 4.2.2.3 Examination for length.

4.2.2.3.1 Individual rolls. During the yard-by-yard examination, each roll in the sample shall be examined for length. Any length found to be less than the minimum specified, or more than two yards less than the length marked on the ticket, shall be considered 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.

4.2.2.3.2 Total yardage in sample. The lot shall be unacceptable if the total of the actual lengths of rolls in the sample is less than the total of the lengths marked on the tickets.

4.2.2.4 Examination for noncompliance with the Rules and Regulations Under the Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for conformance to the Rules and Regulations under the Textile Fiber Products Identification Act. Each roll not labeled in accordance with this act shall be a defect. The lot shall be unacceptable if two or more of these defects occur.

\* 4.3 Examination of preparation for delivery requirements. An examination shall be made in accordance with the provisions of PPP-P-1134 to determine whether packaging, packing, and marking meet the requirements of Section 5.

\* 4.4 Testing of the end item. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in Table VI shall be followed. The physical and chemical values specified in Section 3 apply to the results of the determinations made on a sample unit for test purposes as specified in the applicable test method. The sample unit shall be 2 continuous yards, full width, of the finished cloth. The lot size shall be expressed in units of 1 yard each. The lot shall be unacceptable if one or more sample units fail to meet any requirement specified. All test reports shall contain the individual values utilized in arriving at the final result. The sample size shall be as follows:

<u>Lot size (yards)</u>	<u>Sample size</u>
800 or less	2
801 to 22,000, inclusive	3
22,001 and over	5

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TABLE VI - Test Methods

Characteristic	Requirement Reference	Test Method	No. of Determinations Per Individual Sample Unit	Results Reported As
Material	3.1	1200 <u>1</u> /	1	Pass or fail
Ply	3.1	Visual	1	Pass or fail
Weave	Table I	Visual	1	Pass or fail
Mercerization	3.1	Microscopic	1	Pass or fail
Finish	3.2	<u>1</u> /	1	Pass or fail
Yarns per Inch	Table I	5050	5	Avg of the 5 dets. to nearest whole no.
Breaking Strength (Ravel Strip Method)	Table I	5104	5	Avg of the 5 dets. to nearest 1.0 pound
Bursting Strength	Table I	5122	10	Avg of the 10 dets. to nearest scale division
Elongation	Table I	5104 <u>2</u> /	5	Avg of the 5 dets. to nearest 1.0 percent
Weight	Table I	5041	5	Avg of the 5 dets. to nearest 0.1 ounce/sq.yd.
Nonfibrous Material	3.7	2611	2	Avg of the 2 dets. to nearest 0.1 percent
Copper and manganese content	3.8	ASTM-D377	2 copper 2 manganese	To nearest .001 percent copper .0001 percent manganese

TABLE VI (Continued)

Characteristic	Requirement Reference	Test Method	No. of Determinations Per Individual Sample Unit	Results Reported As
pH	3.9	2811	2	Avg of the 2 dets. to nearest 0.1 pH
Compatibility with dope	3.10	4.4.1	1	Pass or fail

1/ A supplier's certificate of compliance shall be acceptable.

2/ The length elongated shall be measured from a baseline on the chart to the point at which the curve intersects the 70-pound load ordinate, with the baseline passing through the point where the curve leaves the zero load ordinate.

\* 4.4.1 Compatibility with dope. The test shall be performed under conditions of temperature and humidity specified in FED-STD-191. A coat of dope (at package consistency) conforming to MIL-D-5549 shall be spread smoothly on a plate glass panel, using a doctor blade with a clearance of 0.008 inch. Allow the dope to dry for 30 minutes (+15 seconds). If a hard, dry, transparent film results, the dope should be considered as conforming to the applicable specification requirements. A specimen of the finished cloth shall then be drawn taut and smooth by hand over the open end of a lipped beaker. Fasten the cloth in position with a heavy rubber band, drafting tape, or other suitable method of attachment. The beaker shall have a diameter of 4 inches. Seven millimeters of dope shall be spread uniformly over the surface of the taut cloth. The dope shall be at package consistency. The doped specimen shall then be allowed to dry 45 minutes (+15 seconds). Examine the specimen for dryness and compatibility with dope.

\* 5. PREPARATION FOR DELIVERY

5.1 Put-up and packaging. Put-up and packaging shall be level A, B or C as specified (see 6.2).

5.1.1 Levels A and C. The cloth shall be put-up and packaged in accordance with the applicable requirements of PPP-P-1134.

5.2 Packing. Packing shall be level A, B or C as specified (see 6.2).

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5.2.1 Levels A, B and C. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1134.

5.3 Marking. In addition to any special marking required by the contract or order, shipments shall be marked in accordance with the applicable requirements of PPP-P-1134.

## 6. NOTES

6.1 Intended use. The cloth is intended for use in covering control surfaces, fuselages, and wings of airplanes and as the base for a modified butyl rubber coated fabric used in the manufacture of protective clothing which is resistant to rocket fuels and oxidizers.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification
- (b) Width (see 3.5)
- (c) Quantity in yards
- (d) Levels of packaging and packing (see 5.1 and 5.2)

6.3 The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and suppliers are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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Army - GL

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Review:  
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