

MIL-C-18387F

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Superseding

MIL-C-18387E

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MILITARY SPECIFICATION

CLOTH, TWILL, COTTON, FIRE RETARDANT TREATED

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

1. SCOPE

1.1 This specification covers fire retardant treated cotton twill 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 this specification to the extent specified herein.

SPECIFICATIONS

Federal

P-S-683

V-T-276

CCC-T-191

PPP-P-1134

Sour, Laundry (Fluoridated)

Thread, Cotton

Textile Test Methods

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

Military

MIL-D-12182

Detergent, Laundry, Powdered, Flaked, or Granular

STANDARDS

Federal

FED-STD-No. 4

Glossary of Fabric Imperfections

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

FSC 8305

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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).

3. REQUIREMENTS

3.1 Standard sample. The finished cloth shall match the standard sample for shade and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.3).

3.2 First article inspection. When specified (see 6.2), before production is commenced, 1 yard of the desized, mercerized dyed cloth and 5 continuous yards full width of the finished cloth shall be submitted or made ready for the contracting officer or his authorized representative for inspection. The treatment used for the finished cloth shall be identified in sufficient detail for recognition as an approved type. The preproduction sample shall be manufactured by the supplier in the same facilities to be used for the manufacture of the production items. The approval of the preproduction samples authorizes the commencement of production but does not relieve the supplier of responsibility for compliance with all applicable provisions of this specification.

3.3 Formula approval. The prospective supplier or his finishing plant shall submit with his bid to the contracting officer for approval, a list of materials which will be used, stipulating amounts, grades and the standards of all materials including solvents and the manufacturer's name. This list is for the information of the Government only. Approval of the quantitative formula submitted shall in no way absolve the supplier from complying with the performance requirements of this specification (see 6.4).

3.4 Materials. The cloth shall be made from cotton which has been cleaned, carded, drawn, and spun into two ply yarns for both warp and filling.

3.5 Construction and physical properties. The finished cloth shall conform to the requirements of table I when tested as specified in 4.5.

Table I. Construction and Physical Properties

Characteristic	Requirement
Weight of desized, mercerized dyed cloth prior to treatment, ounces/sq yd	4.4 ± 0.2
Increase in weight after treatment and finishing operation, percent	18 minimum to 28 maximum
Yarns per inch, minimum	
Warp	105
Filling	100
Yarn ply	2
Breaking strength, grab, pounds, minimum	
Warp	95
Filling	60
Tearing strength, pounds, minimum	
Initial	
Warp	6.0
Filling	6.0
After 15 launderings	
Warp	3.0
Filling	3.0
Air permeability, cu ft air/minute/sq ft at 1/2 inch water pressure	18 to 60
Shrinkage in laundering, percent, maximum	
Warp	2.0
Filling	2.0
Acidity, pH	5.5 to 9.0
Sewability, seam efficiency, percent, minimum	80
Stiffness of cloth, cantilever bending load, pound, maximum	0.005

3.6 Weave. The weave shall be a 3 up and 3 down right-hand steep twill.

3.7 Finish

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3.7.1 Cloth preparation.- Prior to treatment, the cloth shall be desized and mercerized. The starch and protein content including chloroform-soluble and water-soluble material of the finished cloth shall not exceed 2.0 percent when tested as specified in 4.5.

3.7.2 Fire retardancy. Before and after 15 launderings, the treated cloth shall show not more than 2.0 seconds average flame time, not more than 2.0 seconds average glow time, and not more than 5.5 inches average and 6.5 inches single determination char length when tested as specified in 4.5.

3.8 Color. Unless otherwise specified by the procuring activity, the cloth color shall match one of the following listed colors.

List of Colors

Shade No. Olive Green 107
Shade No. Sage Green 1524
Shade No. Orange 338
Shade No. Khaki 1

The use of dyes or substances containing elementary sulfur compounds capable to oxidation of sulfuric acid is prohibited. The dyed and finished cloth shall contain no more labile sulfur than that shown by the standard sample when tested as specified in 4.5.

3.8.1 Matching. The color of the finished cloth shall match the standard sample under natural (north sky) daylight or artificial daylight having a color temperature of 7500° Kelvin and shall be a good approximation to the standard sample under incandescent lamp-light at 2800° Kelvin.

3.8.2 Colorfastness. Unless otherwise specified, the dyed and finished cloth shall show fastness to light, salt water and soap, perspiration, laundering and crocking equal to or better than the standard sample when tested as specified in 4.5.

3.8.2.1 When a standard sample is not referenced as a standard for colorfastness the dyed and finished cloth shall show "good" fastness to light (40 standard fading hours), salt water and soap, perspiration, laundering, and crocking when tested as specified in 4.5.

3.9 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.

3.10 Dimensions of finished cloth

3.10.1 Width. The width shall be as specified by the procuring activity and shall be the minimum width inclusive of selvages.

3.10.2 Length. Unless otherwise specified, the cloth shall be in one continuous piece of not less than 40 yards. Each length shall be put up on rolls as specified in PPP-P-1134.

3.11 Workmanship. The finished cloth shall conform to the quality established by this specification. The demerit points per 100 square yards when calculated as specified in section 4 shall not exceed the established maximum point values.

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 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 check test such items to determine the validity of the certification.

4.2 Inspection

4.2.1 Quality conformance inspection. The examinations and tests comprising quality conformance inspection shall be as specified in 4.3, 4.4 and 4.5.

4.2.2 First article inspection. The sample of finished cloth submitted in accordance with 3.2 shall be visually examined for appearance, color and finish, and shall be tested for applicable physical and chemical properties. Tests shall be in accordance with methods specified in 4.5.

4.3 Examination of the end item

4.3.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only. When the total yardage in the roll does not exceed 100 yards, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects as defined in section I of Fed. Std. No. 4, which are clearly noticeable at normal inspection distance (3 feet) shall be scored

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and assigned demerit points as listed in 4.3.1.1, except that only those slubs and knots which exceed the limits shown in figures 1, 2 and 3 shall be scored. No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll within the sample shall be penalized more than 4 points. The sample size shall be 20 rolls selected from 20 containers. The lot shall be unacceptable if the points per 100 square yards of the total yardage examined exceeds 35 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 53 points. If no individual rolls exceeds 53 points per 100 square yards, the lot shall be acceptable with respect to this characteristic. If one roll exceeds 53 points per 100 square yards, a second sample of 20 rolls shall be examined only for individual roll quality examination. The lot shall be unacceptable if one or more rolls in the second sample exceeds 53 points per 100 square yards. For individual quality, examination of local type defects only shall be scored. Overall type defects shall be scored only in determining compliance with the lot average quality requirements. Point computation for lot quality and individual roll quality shall be as follows:

$$\frac{\text{Total points scored in sample} \times 3600}{\text{Contracted width of cloth (inches)} \times \text{total yards inspected}} = \text{Points per 100 square yards.}$$

4.3.1.1 Demerit points. Demerit points shall be assigned as follows:

- For defects 3 inches or less in any dimension - one point
- For defects exceeding 3 inches, but not exceeding 6 inches in any dimension - two points
- For defects exceeding 6 inches, but not exceeding 9 inches in any dimension - three points
- For defects exceeding 9 inches in any dimension - four points.

NOTE: The following defects, when present, shall be scored four points for each yard in which they occur:

- Finish - too stiff or boardy
- Overall uncleanness, objectionable odor

Uneven weaving^{1/}
 Selvage curled, folded, rolled, slack, or loopy^{1/}
 Off shade, shaded side to side, side to center or end to end
 Mottled, poor penetration
 Baggy, ridgy or wavy cloth
 Width, less than specified.

^{1/} Intermittently or continuously.

4.3.2 Examination for length

4.3.2.1 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 2 yards less than the length marked on the ticket shall be considered a defect with respect to length. The lot shall be unacceptable if 2 or more rolls in the sample are defective in respect to length.

4.3.2.2 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 ticket.

4.3.3 Examination for shade. During the yard-by-yard 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 by the sample.

4.3.4 Examination for compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for compliance with 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 2 or more of these defects occur.

4.4 Examination of preparation for delivery requirements. Examination shall be made in accordance with the provisions of PPP-P-1134 to determine that packaging, packing and marking requirements of section 5 of this specification are complied with.

4.5 Testing of the end item. The methods of testing specified in CCC-T-191, wherever applicable, and as listed in table II 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 except the lot average shall apply for the weight of the finished cloth.

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The sample unit shall be 5 continuous yards, full width of the finished cloth and 1/4 yard of the cloth prior to flame resistant treatment. The sample size (number of sample units) shall be as shown below. The lot size shall be expressed in units of 1 yard. For all requirements except lot average, the lot shall be unacceptable if one or more sample units fail to meet any test requirements specified. For lot average requirements, the lot shall be unacceptable if the average of all determinations made on the sample units fail to meet any test requirement specified.

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

Table II. Test Methods

Characteristics	Requirement Reference	Test Method	No. Det. Per Indiv. Unit of Product	Results Reported As
Weave	Para 3.6	Visual	1	Pass or fail
Weight, ounces per sq. yd. (Untreated)	Table I	5041	5	Avg of 5 det to nearest 0.1 ounce
Increase in weight (Untreated to treated), percent	Table I	5041	5	Avg of all det to nearest 0.1 ounce
Yarns per inch Warp	Table I	5050	5	Avg of 5 det to nearest whole number
Filling	Table I	5050	5	
Yarn ply Warp & Filling	Table I	Visual	1	Pass or fail
Breaking strength, lb Warp	Table I	5100	5	Avg of 5 det to nearest 1.0 pound
Filling	Table I	5100	5	
Tearing strength, lb Initial Warp	Table I	5132	5	Avg of 5 det to nearest 0.1 pound
Filling	Table I	5132	5	

Table II. Test Methods (Continued)

Characteristics	Requirement Reference	Test Method	No. Det. Per Indiv. Unit of Product	Results Reported As
After 15 launderings	Table I	<u>1</u> /5556		
Warp	Table I	5132	5	Avg of 5 det to nearest 0.1 pound
Filling	Table I	5132	5	
Shrinkage in laundering, percent				
Warp	Table I	5556	3	Avg of 3 det to nearest 0.1 percent
Filling	Table I	5556	3	
Air permeability, cu ft of air/minute/sq ft at 1/2 inch water pressure	Table I	5450	5	Avg of 5 det to nearest 0.1 cu ft
Sewability, percent	Table I	5110	7	Avg of 7 det to nearest 0.1 cu ft
Stiffness	Table I	5202	10	Avg of 10 det to nearest 0.001 pound
Acidity	Table I	2811	2	Avg of 2 det to nearest 0.1 pH
Finish				
Identification of mercerization	3.7.1	Microscopic examination for swelling of cotton fiber	1	Pass or fail
Starch and protein content including chloroform-soluble and water-soluble material	3.7.1	2611	2	Avg of 2 det to nearest 0.1 percent

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Table II. Test Methods (Continued)

Characteristics	Requirement Reference	Test Method	No. Det. Per Individ. Unit of Product	Results Reported As
Sewability (seam efficiency)	Table I	<u>2</u> /5110	7	Avg of 7 det to nearest 1.0 percent
Fire retardancy				
Initial				
Flame time, sec.	3.7.2	5903	5	Avg of 5 det to nearest 1/5 second
Glow time, sec.	3.7.2	5903	5	Avg of 5 det to nearest 1/5 second
Char length, inch	3.7.2	5903	5	Avg of 5 det to nearest 0.1 inch
After laundering	3.7.2	<u>1</u> /5556		
Flame time, sec.	3.7.2	5903	5	Avg of 5 det to nearest 1/5 second
Glow time, sec.	3.7.2	5903	5	Avg of 5 det to nearest 1/5 second
Char length, inch	3.7.2	5903	5	Avg of 5 det to nearest 0.1 inch
Colorfastness				
Fastness to light (40 standard fading hours)	3.8.2	5660	1	Pass or fail
Crocking	3.8.2	5651	1	do.
Salt water & soap	3.8.2	5632	1	do.
Perspiration	3.8.2	5680	1	do.
Laundering	3.8.2	5610	1	do.
Sulfur dyes	3.8	2020	1	do.

1/ Cotton laundering procedures.

2/ The needle size shall be 0.040 ± 0.001 inch across the blade at the eye. The needle thread shall be ticket No. 40, 3 ply and the looper thread shall be ticket No. 60, 3 ply. The thread shall conform to type IAl of V-T-276.

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5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C as specified (see 6.2) and shall be packaged in accordance with PPP-P-1134.

5.2 Packing. Packing shall be level A, B or C as specified (see 6.2) and shall be packed in accordance with PPP-P-1134.

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

6. NOTES

6.1 Intended use. The cloth covered by this specification is intended for use in flight clothing.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number and date of this specification.
- b. Quantity and width required.
- c. Color.
- d. Selection of applicable levels of packaging and packing (see 5.1 and 5.2).
- e. Whether first article inspection is required (see 3.2)
- f. Formula approval (see 3.3).

6.3 Standard sample. For access to standard shade samples, address the procuring activity issuing the invitation for bids.

6.4 Approval of flame resistant treatments for use under this specification is the responsibility of the Air Force Materials Laboratory, Attn: MANF, Wright-Patterson Air Force Base, Ohio 45433, and is based on extensive tests, including those for toxicity, which are not set forth in this specification.

Custodians:
 Air Force - 11
 Army - GL
 Navy - AS

Preparing Activity:
 Air Force - 11
 Project No. 8305-0766

Review activities:
 Air Force - 45, 82, 85
 Army - MD
 Navy -

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LIMITS OF ACCEPTABILITY

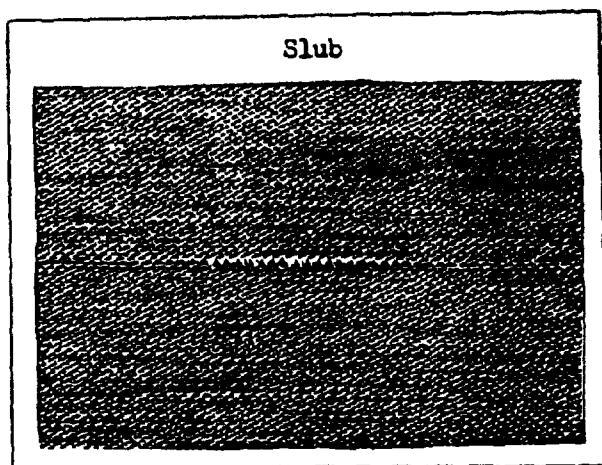


FIGURE 1

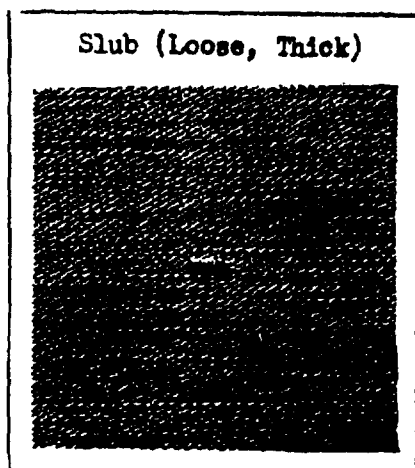


FIGURE 2

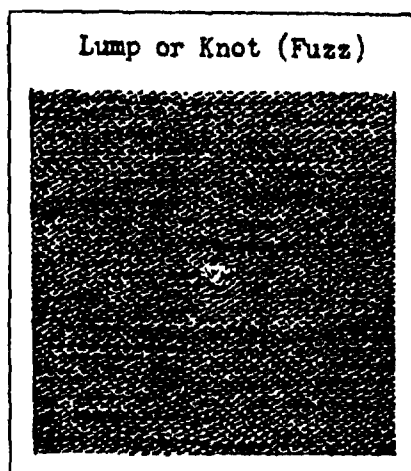


FIGURE 3

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3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION <i>(Mark one)</i> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify)</i> _____
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>	
5. PROBLEM AREAS	
a. Paragraph Number and Wording.	
b. Recommended Wording:	
c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER <i>(Last, First, MI) – Optional</i>	b. WORK TELEPHONE NUMBER <i>(Include Area Code) – Optional</i>
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code) – Optional</i>	8. DATE OF SUBMISSION <i>(YYMMDD)</i>