

INCH-POUND

MIL-C-44396(GL)
6 February 1990

MILITARY SPECIFICATION

CLOTH, TWILL, PARA-ARAMID

This specification is approved for use by the Natick Research, Development and Engineering Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type of para-aramid twill weave cloth.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

PPP-P-1133 - Packaging of Synthetic Fiber Fabrics

MILITARY

MIL-T-87128 - Thread, Para-Aramid, Intermediate Modulus

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 8305

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STANDARDS

FEDERAL

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

FEDERAL TRADE COMMISSION

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies are available from the Federal Trade Commission, Pennsylvania Avenue at Sixth Street, N.W., Washington, DC 20580-0001.)

2.2 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

Chromatic Transference Scale

(Application for copies should be addressed to the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 2261 - Tearing Strength of Woven Fabrics by the Tongue (Single Rip)
Method (Constant-Rate-of-Extension Tensile Testing Machine)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

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(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 Standard sample. The finished cloth shall match the standard sample for shade and appearance and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.4).

3.3 Material. (See 6.5)

3.3.1 Yarn. The yarn shall be composed of para-aramid fiber, and spun into 2-ply yarn for both the warp and the filling.

3.4 Color. The color of the finished cloth shall be green matching the Government furnished standard sample.

3.4.1 Matching. The color of the finished cloth shall match the standard sample when viewed under filtered tungsten lamps that approximate artificial daylight and that have a correlated color temperature of 7500 ± 200 °K, with illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2300 ± 200 °K.

3.4.2 Colorfastness. The finished cloth shall show fastness to laundering, light, and perspiration equal to or better than the standard sample or equal to or better than a rating of "good". The finished cloth shall show fastness to crocking equal to or better than the standard sample or shall have an AATCC Chromatic Transference Scale rating of not lower than 3.5. Testing shall be as specified in 4.4.3.

3.5 Physical requirements. The physical requirements for the finished cloth shall be as specified in table I when tested as specified in 4.4.3.

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TABLE I. Physical requirements

Characteristic	Requirement	
	Min	Max
Weight, oz./sq. yd.	7.8	8.3
Yarns per inch		
Warp	50	---
Filling	44	---
Air permeability, ft. ³ /min./ft. ²	15	65
Breaking strength, pounds		
Warp	500	---
Filling	500	---
Tearing strength, pounds		
Warp	85	---
Filling	95	---

3.5.1 Weave. The weave shall be a ²/₁ right hand twill.

3.5.2 Width. The width of the finished cloth shall be as specified (see 6.2) and shall be the minimum acceptable width inclusive of the selvage when fly-shuttle looms or shuttleless looms with a tuck-in selvage are used. For all other shuttleless looms, the width measurement shall be made between the last warp yarn on each side excluding the protruding fringe(s).

3.6 Finish. The cloth shall be desized and scoured.

3.7 Nonfibrous material. The total chloroform soluble and water soluble material content of the scoured cloth shall not exceed 1.0 percent when tested as specified in 4.4.3.

3.8 pH. The pH value of the water extract of the finished cloth shall be no less than 4.0 nor more than 8.0 when tested as specified in 4.4.3.

3.9 Curling. The finished cloth shall lie flat without distortion and show no evidence of curling when tested as specified in 4.4.3.

3.10 Dimensional stability. The cloth shall not shrink or elongate more than 2.0 percent in either the warp or filling direction when tested as specified in 4.4.3.

3.11 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 70 percent when tested as specified in 4.4.3.

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3.12 Length and put-up. For Government procurement only, unless otherwise specified (see 6.2), the cloth shall be furnished in continuous lengths, each not less than 40 yards. The cloth shall be put-up on rolls as specified in 5.1.

3.13 Face identification. The face of the cloth shall be the warp effect side. The face of the cloth shall be identified by stamping the word "FACE" at each end of the roll.

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

3.15 Workmanship. The finished cloth shall conform to the quality of product established by this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Certificates of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When a first article is required (see 3.1 and 6.2), it shall be examined for the defects specified in 4.4.2 through 4.4.2.4 and tested for the characteristics specified in 4.4.3.

4.4 Quality conformance inspection.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.2 End item visual examination.

4.4.2.1 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 on the face side only. All defects as defined in section III of FED-STD-4 that are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.4.2.1.1 except as follows:

- a. Only coarse yarns that exceed twice the normal yarn diameter shall be scored.
- b. Mixed filling (shade bar) shall be scored only when resulting from wrong ply, variation of twist in the yarn, or off shade yarn.
- c. Only knots and slubs that exceed limits shown in figure 1 of FED-STD-4 shall be scored.

No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll within the same shall be penalized more than four 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 50 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 75 points. If one roll exceeds 75 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 75 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

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

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4.4.2.1.1 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

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

- Baggy, ridgy, or wavy cloth
- Width less than specified
- Uneven weaving

4.4.2.2 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade and appearance. If any roll in the sample is off shade, shaded side to side, shaded side to center, or shaded end to end, or if any roll does not have the same appearance as the standard sample, it shall be cause for rejection of the entire lot represented by the sample.

4.4.2.3 Length examination. 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 two or more rolls in the sample are defective with respect to length or if the total of the actual lengths of rolls in the sample is less than the total of lengths marked on the ticket.

4.4.2.4 Roll identification examination. During the yard-by-yard examination, each roll in the sample shall be examined for identification defects. The lot shall be unacceptable if two or more rolls in the sample are not labeled or ticketed in accordance with The Textile Fiber Products Identification Act, or if the face stamping is missing from either or both ends, or if the face stamping is on the wrong side.

4.4.3 End item testing. The cloth shall be tested for the characteristics listed in table II. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in table II shall be followed. The physical and chemical values specified in Section 3 apply to the determinations made on the sample unit for test purposes as specified in the applicable test method. All test reports shall contain the individual values utilized in expressing the final results. The sample unit shall be 5 yards full width. The lot shall be unacceptable if one or more sample units fail to meet any requirement specified. The sample size shall be in accordance with the following:

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

TABLE II. End item tests

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>
Fiber identification	3.3.1	<u>1</u> /
Yarn ply	3.3.1	Visual
Colorfastness to:		
Laundering	3.4.2	5610
Light	3.4.2	5660 <u>2</u> /
Perspiration	3.4.2	5680
Crocking	3.4.2	5651
Weight, oz./sq. yd.	3.5	5041
Yarns per inch	3.5	5050
Air permeability	3.5	5450
Breaking strength, lbs.	3.5	5100
Tearing strength, lbs.	3.5	ASTM D 2261
Weave	3.5.1	Visual
Nonfibrous material	3.7	2611
pH	3.8	2811
Curling	3.9	4.5.1
Dimensional stability: after 15 launderings	3.10	5556 <u>3</u> /
Seam efficiency	3.11	5110 <u>4</u> /

1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement.

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- 2/ Except that the supplier's submission shall be compared with the standard sample after 10 hours and evaluated.
- 3/ Cotton laundering procedure.
- 4/ The needle shall measure 0.049 ± 0.001 inch across the blade of the eye. The thread for the needle and looper shall be letter size FF, 3 ply, in accordance with MIL-T-87128.

4.4.4 Packaging inspection. The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the requirements of PPP-P-1133.

4.5 Methods of inspection.

4.5.1 Curling test. Two specimens of cloth, 1.0 to 1.5 inches wide by 6.0 inches long shall be cut, one having the long dimension parallel to the warp and the other with the long dimension parallel to the filling. Both specimens shall be placed on a flat surface for at least 5.0 minutes and then visually examined for evidence of curling.

5. PACKAGING

5.1 Put-up and preservation. Put-up and preservation shall be level A or Commercial, as specified (see 6.2).

5.1.1 Levels A and Commercial. The cloth shall be put-up on rolls and preserved in accordance with the applicable requirements of PPP-P-1133.

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

5.2.1 Levels A, B, and Commercial. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1133.

5.3 Marking. In addition to any special marking required by the contract or purchase order, shipments shall be marked in accordance with the applicable requirements of PPP-P-1133.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The cloth is intended for use in the manufacture of the Parachutist's Rough Terrain Suit.

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- c. When a first article is required (see 3.1, 4.3, and 6.3).
- d. Width of cloth required (see 3.5.2).
- e. Put-up required if other than specified (see 3.12).
- f. Levels of preservation and packing (see 5.1 and 5.2).

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of FAR 52.209. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

6.4 Sample. For access to samples, address the contracting activity issuing the invitation for bids or request for proposal.

6.5 Material. The Para-Aramid subject cloth has been successfully manufactured to meet all requirements with the use of 17/2 warp and filling yarn, spun from 1.5 denier, 2-inch staple length, "Kevlar 100" fiber.

6.6 Supply source. The "Kevlar 100" fiber is available from the E.I. DuPont de Nemours Company, Inc., Wilmington, DE 19898.

6.7 Subject term (key word) listing.

Kevlar fiber
Suit, Rough Terrain
Synthetic fiber

Custodian:
Army - GL

Preparing activity:
Army - GL

Review activities:
Army - MD
DLA - CT

(Project 8305-A338)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-C-44396(GL)		2. DOCUMENT TITLE CLOTH, TWILL, PARA-ARAMID	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
3b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify) _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording			
b. Recommended Wording.			
c. Reason/Rationale for Recommendation			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		7b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
8. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

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NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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