

MIL-C-43989A  
19 September 1986  
SUPERSEDING  
MIL-C-43989(GL)  
12 December 1978

## MILITARY SPECIFICATION

### CLOTH, KNITTED, RASCHEL, ARAMID

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

#### 1. SCOPE

1.1 Scope. This document covers one type of raschel knitted aramid cloth.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

- \* 2.1.1 Documents. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

## SPECIFICATION

### FEDERAL

PPP-P-1133 - Packaging of Synthetic Fiber Fabrics

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-191 - Textile Test Methods

MILITARY

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

(Copies of documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

- \* 2.1.2 Other Government documents. The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

Rules and Regulations Under the Textile Fiber Products Identification Act

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

- \* 2.2 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 shall take precedence. Nothing in this document, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Standard sample. The dyed and finished cloth 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 Material.

- \* 3.2.1 Yarn. The yarn shall be multifilament aramid (see 6.5). The yarn shall not char at a temperature less than 675°F, when tested as specified in 4.2.3.

3.3 Color. The color of the finished cloth shall be Olive Green 106. The color shall be obtained by the use of dry spun solution-dyed fibers.

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- \* **3.3.1 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  $7000 \pm 500$  K with illumination of  $100 \pm 20$  foot candles. The color shall be a good approximation to the standard sample under incandescent lamplight at  $2300 \pm 100$  K.
- \* **3.3.2 Colorfastness.** The finished cloth shall show fastness to light equal to or better than the standard sample or equal to or better than a rating of "fair" after 6 standard fading hours, when tested as specified in 4.2.3. The finished cloth shall show fastness to laundering equal to or better than the standard sample or equal to or better than a rating of "good" when tested as specified in 4.2.3.
- \* **3.4 Physical requirements.** The finished cloth shall conform to the requirements specified in table I when tested as specified in 4.2.3.

TABLE I. Physical requirements

Characteristic	Requirement
Weight per sq yd, ounces	7.0 minimum to 10.0 maximum
Meshes per sq inch	50 minimum to 59 maximum
Breaking strength, pounds of force, minimum	
Wales	200
Courses	115
Ultimate elongation, percent, maximum	
Wales	95
Courses	125
Flame resistance:	
Flaming time, seconds, maximum	
Wales	2.0
Courses	2.0
Glow time, seconds, maximum	
Wales	25.0
Courses	25.0
Char length, inches, maximum	
Wales	3.5
Courses	3.5

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3.4.1 Knit. The cloth shall be of the mesh type knitted on a single needle bar Raschel utilizing three guide bars. Four ends per guide shall be used in knitting the cloth.

3.4.2 Width. The width shall be as specified (see 6.2), and shall be the minimum acceptable width inclusive of selvages.

3.5 Finishing. The cloth shall be designed, scoured, and heat set. The cloth shall be heat set to meet the requirements of 3.7 (see 6.4).

3.6 Nonfibrous material. The finished cloth shall contain no more than 1.0 percent starch and protein including chloroform-soluble and water-soluble material when tested as specified in 4.2.3.

3.7 Curling. The finished cloth shall lie flat, without distortion and shall show no evidence of curling when tested as specified in 4.2.3.

3.8 pH. The pH value of the water extract of the finished cloth shall be no less than 5.0 nor more than 8.0 when tested as specified in 4.3.

3.9 Length and put-up. 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 in full width rolls as specified in 5.1.

3.10 Fiber identification. Each roll shall be labeled and ticketed for fiber content in accordance with the Textile Fiber Products Identification Act.

3.11 Workmanship. The finished cloth shall conform to the quality of product established by this document, and 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 contractor is responsible for the performance of all inspection requirements 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 document where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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\* 4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this document shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirement in the document shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of 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 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.2.1 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 document or applicable purchase document.

4.2.2 Examination of the end item.

\* 4.2.2.1 Yard-by-yard examination. The cloth shall be examined for the defects listed in table II. The required yardage of each roll shall be examined, and defects clearly noticeable at normal inspection distance (3 feet) shall be classified as listed. The defects found shall be counted regardless of their proximity to each other, except when two or more defects represent a single local condition of the cloth, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each yard or fraction thereof in which it occurs. The lot size shall be expressed in units of yards. The sample unit shall be 1 linear yard. The inspection level shall be II and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 2.5 for major defects and 6.5 for total (major and minor combined) defects. The number of rolls from which the sample yardage is to be selected shall be as specified in table III. The sample yardage shall be apportioned equally among the selected rolls.

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TABLE II. Yard-by-yard examination defects

Defect	Classification	
	<u>Major</u>	<u>Minor</u>
Hole, cut, tear, break, or mend	X	
Run or dropped stitch	X	
Tuck stitch, pulled stitch, or needle streak		X
End out, loose or floated end	X	
Abrasion mark resulting in a weak area	X	
Thin or uneven cloth	X	
Fine or tight twisted yarn		X
Crease or wrinkle, embedded		X
Knots extending above surface of cloth		X
Edges frayed, raveled, rolled, folded, scalloped, or uneven		X
Shade bar, spot or stain		X
Slubs		X
Foreign matter		X

TABLE III. Sample size

Lot size (yards)	Sample size (rolls)	Acceptance number
Up to 1,200 <sup>1/</sup>	3	0
1,201 up to and including 3,200	5	0
3,201 up to and including 10,000	8	0
10,001 up to and including 35,000	13	0
35,001 up to and including 150,000	20	1
150,001 and over	32	2

<sup>1/</sup> If a lot contains fewer than three rolls, each roll in the lot shall be examined.

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4.2.2.2 Overall examination. The cloth shall be examined for the defects listed below. Each defect listed shall be counted not more than once in each roll examined. The sample size shall be the applicable number of rolls indicated in table III. Each roll in the sample shall be examined over its entire length. The lot shall be rejected if the total number of defects in the sample exceeds the acceptance number specified in table III.

Defects

Width less than specified  
 Overall uncleanness  
 Off shade or shaded end to end, side to side,  
 side to center, or throughout the roll  
 Not labeled in accordance with the Textile  
 Fiber Products Identification Act

\* 4.2.2.3 Length examination. Each roll of cloth used in the yard-by-yard examination shall be examined for the defects listed below. If the total number of defects in the sample rolls exceeds the applicable acceptance number specified in table III or if the total of the actual lengths of the sample rolls is less than the total of the lengths marked on the roll tickets, the lot shall be rejected.

Defects

Any gross length less than the specified minimum length.  
 Any gross length more than 2 yards less than gross length  
 marked on roll ticket.

4.2.3 End item testing. The cloth shall be tested for the characteristics listed in table IV. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in table IV, shall be followed. The physical and chemical values specified in section 3 apply to the average 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 shall be unacceptable if one or more sample units fail to meet any test requirement specified. The sample size shall be in accordance with the following:

<u>Lot size (yards)</u>	<u>Sample size (No. of sample units)</u>
800 or less	2
801 up to and including 22,000	3
22,001 and up	5

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TABLE IV. End item tests

Characteristic	Requirement paragraph	Test method
Yarn:		
Multifilament	3.2.1	<u>1/</u>
Identification	3.2.1	<u>1/</u>
No charring	3.2.1	<u>1/</u>
Colorfastness to:		
Light	3.3.2	5660
Laundering	3.3.2	5610
Weight	3.4	5041
Meshes per sq in	3.4	<u>2/</u>
Breaking strength	3.4	5100
Ultimate elongation:		
Wales	3.4	5100
Courses	3.4	5100
Flame resistance	3.4	5903
Type of knit	3.4.1	<u>1/</u>
Nonfibrous material	3.6	2611
Curling	3.7	4.3.1
pH	3.8	2811

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

2/ Five determinations per sample unit and the average reported to the nearest whole number.

4.2.4 Packaging inspection. The inspection shall be in accordance with the quality assurance provisions of PPP-P-1133.

#### 4.3 Methods of inspection.

4.3.1 Curling. Two specimens of cloth, 1 1/2 inches wide by 6 inches long, shall be cut, one with the long dimension parallel to the wales and the other with the long dimension parallel to the courses. Both specimens shall be placed on a flat surface for at least 5 minutes and then visually examined for evidence of curling.



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## 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 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 packing. 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

6.1 Intended use. The cloth is intended for use in the fabrication of survival vests.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this document.
- b. Width of cloth required (see 3.4.2).
- c. Length required if other than specified (see 3.7).
- d. Selection of applicable levels of preservation and packing (see 5.1 and 5.2).

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

6.4 Heat setting. A heat setting procedure that has given satisfactory results is as follows. Autoclave with steam at 30 pounds per square inch (psi) minimum for at least 40 minutes. The steam shall be drawn through the cloth by the application of a vacuum for a period of 5 minutes in order to adequately saturate the cloth with steam. The steam pressure shall be held at 30 psi minimum for approximately 20 minutes after which the steam is cut off and a vacuum placed on the material for 5 minutes. The steam shall then be reapplied for the remaining time of the autoclaving period followed by a vacuum for 5 minutes, to remove all moisture from the cloth. Care must be taken to avoid the presence of creases in the cloth and roll deformation since autoclaving will permanently set the cloth.

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6.5 Fiber identification. The requirements of the fabric can be met with "Nomex type 456 or 457" Aramid fiber manufactured by E. I. DuPont de Nemours Company, Wilmington, DE. Approval of other fiber is the responsibility of the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014, and is based on more extensive tests, including those for toxicity, which are not set forth in this document.

\* 6.6 Subject term (key word) listing.

Raschel knitted aramid cloth  
Survival vests

6.7 Changes from previous issue. The margins of this document 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 contractors are cautioned to evaluate the requirements of this document based on the entire content, as written, irrespective of the marginal notations and relationship to the last previous issue.

## Custodian:

Army - GL  
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Air Force - 99

## Preparing activity:

Army - GL  
Project No. 8305-0100

## Review activities:

Army - MD  
Air Force - 82, 11  
DLA - CT

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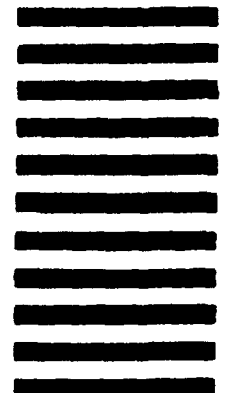
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(See Instructions - Reverse Side)

1 DOCUMENT NUMBER MIL-C-43989A		2 DOCUMENT TITLE Cloth, Knitted, Raschel, Aramid	
3a NAME OF SUBMITTING ORGANIZATION		4 TYPE OF ORGANIZATION (Mark one)  <input type="checkbox"/> VENDOR  <input type="checkbox"/> USER  <input type="checkbox"/> MANUFACTURER  <input type="checkbox"/> OTHER (Specify) _____	
b ADDRESS (Street City State, ZIP Code)			
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a Paragraph Number and Wording			
b Recommended Wording			
c Reason/Rationale for Recommendation			
6 REMARKS			
7a NAME OF SUBMITTER (Last First MI) - Optional		b WORK TELEPHONE NUMBER (Include Area Code) - Optional	
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