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MILITARY SPECIFICATION

CLOTH, PLAIN AND BASKET WEAVE, ARAMID

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

1. SCOPE

1.1 Scope. This specification covers the requirements for aramid cloth used in the manufacture of special clothing.

1.2 Classification. The cloth shall be of the following types and classes as specified (see 6.2 and 6.4).

Type I - 2 x 2 basket weave, 5 ozs.
Type II - Plain weave, 4.3 ozs.
Class 1 - Type 456 Fiber
Class 2 - Type 452 Fiber
Class 3 - Type 457 Fiber

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified (see 6.2), the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to the Air Force Wright Aeronautical Laboratories, MLSA, WPAFB, OH 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8305

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SPECIFICATIONS

FEDERAL

V-T-285	Thread, Polyester
PPP-P-1133	Packaging and Packing of Synthetic Fiber Fabric

STANDARDS

FEDERAL

FED-STD-4	Glossary of Federal Imperfections
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.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents form a part of this specification to the extent specified herein.

Rules and Regulations Under the Textile Fiber Products Identifications Act

(Copies may be obtained without charge from the Federal Trade Commission, Washington, D.C. 20580.)

Technical Manual of the American Association of Textile Chemists and Colorists

Method Number 76-1978 Electrical Resistivity of Fabrics

(Application for copies of the AATCC Manual should be addressed to the AATCC National Headquarters, P.O. Box 12215, Research Triangle Park, North Carolina 27709.)

2.1.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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3. REQUIREMENTS

3.1 Standard sample. The dyed and 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. This specification contains provisions for first article inspection and approval (see 4.2, 6.2 and 6.8).

3.3 Material.

3.3.1 Fiber. The fiber shall be non-melting aramid, 1.5 denier per filament, cut to a staple length of 1-1/2 to 2 inches. The fiber shall not char at temperature less than 675°F when tested as specified in 4.5.

3.3.2 Yarn. The yarn shall be spun into singles for Type I and 2 ply for Type II for both the warp and filling (see 6.4).

3.3.3 Fabric-Class 1. The flame from a Meker burner shall not pass from the flame contact side to the other side of the fabric due to the fabric breaking open when tested as specified in 4.5.2.

3.4 Color. The color of the Class 1, 2 and 3 cloths shall be Sage Green 1590, Sage Green 1565, and Olive Green 106 respectively. The color of each cloth shall be obtained by the use of dry spun solution dyed fiber.

3.4.1 Matching. The color of the finished cloth shall match the standard sample under artificial daylight having a correlated color temperature of 7000 ± 500 kelvin and shall be a good approximation to the standard sample under incandescent lamplight at 2850 ± 100 kelvin.

3.4.2 Colorfastness. The dyed and finished cloth shall show colorfastness to light and to laundering equal to or better than the standard sample when tested as specified in 4.5.

3.5 Physical requirements. The physical requirements of the finished cloth shall be as specified in Table I when tested as specified in 4.5.

3.5.1 Weave. The weave shall be a 2 x 2 basket weave for Type I and plain weave for Type II.

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3.5.2 Width. Unless otherwise specified (see 6.2), the width shall be 45 inches inclusive of selvages. When cloth has shuttleless loom selvages, the width of the cloth should be as specified (see 6.2) and shall be the minimum width of the woven cloth, excluding the selvages.

3.6 Finishing. The cloth shall be desized, scoured, heat set and given a durable antistatic finish (see 3.6.1). The cloth shall be heat set to meet the requirements of 3.6.3 and 3.8 (see 6.5 and 6.6).

TABLE I. Physical requirements.

Characteristics	Requirements Type I	Type II
Weight per sq. yd. (ounces) (minimum)	5.0	4.3
Yarns per inch (minimum)		
Warp	90	70
Filling	88	47
Breaking strength (lbs.) (minimum)		
(Ravel strip - Type I)		
(Grab - Type II)		
Warp	100	180
Filling	100	100
Tearing strength (lbs.) (minimum)		
Warp	15	12
Filling	15	8
Air permeability (minimum) cu. ft./min./ sq. ft. at 1/2-inch water pressure	100	25
Flame resistance		
Flaming time, seconds (maximum)	2	2
Glow time, seconds (maximum)	25	25
Char length, inches (maximum) average	3.5	3.5

3.6.1 Antistatic finish. The cloth shall be given a durable antistatic finish (see 6.5 and 6.6) so that the maximum resistivity of any one sample before laundering shall be 3.0×10^{11} ohms per square and the maximum resistivity of any one sample after five launderings shall be 8×10^{11} ohms per square when tested as specified in 4.5. Only those chemical treatments already approved by the appropriate medical service and so listed herein (see 6.5) or in the invitation for bids or request for proposal shall be considered acceptable for the related procurement.

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3.6.2 Nonfibrous material. Prior to the application of the antistatic finish the cloth shall contain no more than 1.0 percent starch and protein including chloroform-soluble and water-soluble material when tested as specified in 4.5.

3.6.3 Curling. When tested as specified in 4.5, the finished cloth shall lie flat, without distortion, and show no evidence of curling.

3.7 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 4.5.

3.8 Dimensional stability. The cloth shall not shrink more than 4.0 percent in the direction of the warp nor more than 1.5 percent in the direction of the filling, after fifteen launderings when tested as specified in 4.5. The preshrinkage process shall not be identified by name or trademark, either on the cloth or on the ticket or package.

3.9 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 80 percent when tested as specified in 4.5.

3.10 Length and put-up. Unless otherwise specified (see 6.2), the finished cloth shall be furnished in continuous lengths each not less than 40 yards. Each length shall be put-up in full width rolls as specified in PPP-P-1133.

3.11 Fiber identification. Each roll of cloth shall be labeled or ticketed 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 and grade of product established by this specification. The occurrence of defects shall not exceed the point level specified.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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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 First article inspection. The preproduction sample submitted in accordance with 3.2 shall be visually inspected for appearance, color and finish. The sample shall be tested for physical properties in accordance with the methods specified in 4.5.

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

4.3.1 Component and material inspection. In accordance with 4.1 above, components and materials shall be tested in accordance with all the requirements or referenced specifications, drawings, and standards, unless otherwise excluded, amended, modified or qualified in this specification or applicable purchase documents.

4.3.2 Examination of the end item. Examination of the end item shall be in accordance with the provisions of 4.3.2.1 through 4.3.2.4.

4.3.2.1 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. All defects as defined in Section III of FED-STD-4 which are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.3.2.1.1 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, wrong twist in the yarn, or off shade yarn.

c. Only knots and slubs which exceed limits shown on Sears Fabrics Defect Scales (see 6.7) "F" for slubs and "D" for knots 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 50 points. The lot shall be unacceptable if the points per 100 sqaure yards of

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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:

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

4.3.2.1.1 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

4.3.2.2 Examination for length.

4.3.2.2.1 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 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.

4.3.2.2.2 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.

4.3.2.3 Examination for shade. During the yard-by-yard examination, each roll in the sample shall be examined for shade. Any roll in the

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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.

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

4.4 Examination of preparation for delivery requirements. An examination shall be made in accordance with the provisions of PPP-P-1133, to determine that packaging, packing, and marking complies with the Section 5 requirements.

4.5 Testing of the end item. The methods of testing specified in FED-STD-191, wherever applicable as listed in Table II shall be followed. The physical and chemical values specified in Section 3, except where otherwise specified, 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 5 continuous yards, full width, of the finished cloth. The sample unit for determining non-fibrous material (3.6.2) shall be 1/4 yard full width of cloth prior to the application of the antistatic finish. All test reports shall contain the individual values utilized in expressing the final result. The lot size shall be expressed in units of 1 yard. The lot shall be unacceptable if one or more units fail to meet any requirement specified. The sample size (number of sample units) shall be as follows:

Lot size (yards)	Sample size
800 or less	2
801 thru 22,000	3
22,001 and over	5

4.5.1 Curling. Two specimens of cloth, 1-1/2 inches wide by 6 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 minutes and then visually examined for evidence of curling.

4.5.2 Flammability-Class 1. A circular fabric sample shall be rigidly held in a horizontal position between two metal plates with a six (6) inch diameter fabric exposure. One side of the fabric shall be exposed to a Meker burner in the center at a ninety (90) degree angle using natural gas (2 liters per minute flow rate) for 30 seconds with 2 inches distance between fabric and burner top.

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TABLE II. Test methods.

Characteristic	Requirement paragraph	Test method
Nylon		
Identification (non-melting, aramid)	3.3.1	1/
No charring	3.3.1	1/
Staple		
Denier	3.3.1	1/
Length	3.3.1	Visual 1/
Yarn		
Singles-Type I	3.3.2	Visual 2/
Ply-Type II	3.3.2	Visual 2/
Colorfastness to:		
Light	3.4.2	5660 6/
Laundering	3.4.2	5610
Weight	3.5	5041
Yarns per inch:		
Warp	3.5	5050
Filling	3.5	5050
Breaking strength:		
Warp	3.5	5100 & 5104
Filling	3.5	5100 & 5104
Tearing strength:		
Warp	3.5	5132
Filling	3.5	5132
Air permeability	3.5	5450
Flame resistance	3.5	5903
Weave	3.5.1	Visual 2/
Antistatic Finish		
Before laundering	3.6.1	5930 4/ 7/
After five launderings	3.6.1	5556 & 5930 3/ 4/ 7/
Nonfibrous material	3.6.2	2611
Curling	3.6.3	4.5.1
pH	3.7	2811
Dimensional stability		
After fifteen launderings	3.8	5556 3/
Seam efficiency	3.9	5110 5/

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

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Table II (Cont'd)

2/ One determination shall be made from each sample unit and the results reported as "pass" or "fail".

3/ Cotton laundering procedures.

4/ Average of three determinations to nearest 1.0X10" ohms per square.

5/ The needle shall measure 0.044 inch across the blade at the eye. The thread for the needle shall be size E, type I, class I, subclass A or B and the thread for the looper shall be size B, type I, class 1, subclass A or B of V-T-285.

6/ Except that the suppliers submission shall be compared with the standard sample after 6 hours and evaluated.

7/ AATCC Test Number 76-1978, Electrical Resistivity of Fabrics.

5. PACKAGING

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

5.1.1 Level A and C. The cloth shall be put-up and packaged in accordance with the applicable requirements of PPP-P-1133.

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

5.2.1 Levels A, B, and C. 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 order, shipments shall be marked in accordance with PPP-P-1133.

6. NOTES

6.1 Intended use. The cloth covered by this specification is intended for use in the fabrication of special flight, shipboard and ground combat clothing.

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6.2 Ordering data. Procurement documents should specify the following:

a. Title, number and date of this specification.

b. Type required (see 1.2).

c. First article (see 3.2 and 4.2).

d. Color of cloth required (see 3.4).

e. Width of cloth required when other than specified (see 3.5.2).

f. Length required if other than specified (see 3.10).

g. Selection of applicable levels of packaging and packing (see 5.1 and 5.2).

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

6.4 The type I cloth requirements were based on a construction using 24/1 warp and filling yarn and type II using 37/2 warp and filling yarn.

6.5 For type I fabric an in-loom construction of 86 ends X 86 picks reeded 2 per dent has been successful in the production of this fabric. The fabric was finished according to the following procedure:

a. Scour open width on continuous scouring range at 160°F in scouring solution of 1.0 g/l of TSP and detergent.

b. Dry at 300°F to set construction.

c. Pad on antistat solution: 6.6 percent Aston 123
2.7 percent Accelerator EN
pH-6.5

Wet pick up 50-60 percent

d. Dry at 300°F.

e. Another durable antistatic treatment is Aston 123 and Stanax (not Stanax 1166).

f. Calender-Schreiner-260 lines/inches at 27° under 30 tons pressure at 425°F at 12-18 yards/minute.

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g. Autoclave heat set using procedure below:

5 minutes pre-vacuum
20 minutes 30 psi steam
5 minutes vacuum
20 minutes 30 psi steam
5 minutes vacuum
Exhaust to air

6.6 For type II cloth a finishing procedure that has given satisfactory results is as follows:

a. Scour open width at 160°F using 0.5 g/l TSP and detergent in solution.

b. Dry to 300°F.

c. Pad on antistatic solution: 4.0 percent Aston 123
0.4 percent Eponite 100
0.05 percent Neutronyx 600
pH - 6.0

d. Dry at 300°F.

e. Calendar

(Schreiner - 260 lines/inch at 27°)
Run 30 tons pressure at 425°F. 12-18 yards/minute.

f. Autoclave heat set using procedure below:

5 minutes pre-vacuum
20 minutes at 30 psi steam
5 minutes vacuum
20 minutes at 30 psi steam
5 minutes vacuum
Exhaust to air

6.7 Sears Fabric Defect Scales are available from Sears Roebuck and Company, Department 733Q, "Fabrics Defect Replica Kit", Sears Tower, Chicago, IL 60607.

NOTE: Prior to calendering, do not stretch the fabric during drying, in either direction such that the warp is raised and the filling buried or vice-versa. The calendering to be uniform and develop a uniform

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sheen on the fabric must score or line both warp and fill. If the calender has a polish roll, this should be by-passed or not used. The calender should have a standard bottom roll with a Rockwell hardness of 80-84 and a Schreiner roll with a maximum line variation from the horizontal (up to 90°). The autoclaving should follow the calendering in sequence to set the effects of the calendering into the fabric. Each finisher should have a standard sample on hand showing the desired sheen in the finished fabric for comparison with and control of mill production. The calendering conditions to match the standard will be around 30 ton pressure at 425°F. The sheen should be checked after calendering and again after autoclaving until the required conditions on the mill's equipment are defined. The fabric selvage should not be sufficiently wide or thick to prevent the calendering from developing the desired sheen on the body fabric.

Custodian:
Air Force - 20
Army - GL
Navy - AS

Review Activity:
DLA - CT
Navy - NU

User:
Air Force - 45

Preparing Activity:
Air Force - 20

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

b. ADDRESS *(Street, City, State, ZIP Code)*

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

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional

8. DATE OF SUBMISSION *(YYMMDD)*

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