

MIL-C-81814B  
10 April 1978  
SUPERSEDING  
MIL-C-81814A  
1 September 1971

MILITARY SPECIFICATION

\* CLOTH, TWILL, ARAMID, HIGH  
TEMPERATURE RESISTANT

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

1. SCOPE

\* 1.1 This specification covers high temperature resistant  
aramid twill cloth and is intended for use in the manufacture of aeronautical  
clothing.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. 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

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

STANDARDS

FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections

Beneficial comments (recommendations, additions, deletions) and any pertinent  
data which may be of use in improving this document should be addressed to:  
Engineering Specifications and Standards Department (Code 93), Naval Air Engi-  
neering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization  
Document Improvement Proposal (DD Form 1426) appearing at the end of this  
document or by letter.

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FEDERAL (continued)

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.

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.)

TECHNICAL MANUAL OF THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS METHOD NUMBER 76-1969 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.)

3. REQUIREMENTS

3.1 Standard sample. The cloth shall match the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.3).

\* 3.2 Materials. The cloth shall be produced from a high temperature aramid filament yarn. The yarn shall not char at a temperature less than 357°C (675°F).

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

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\* 3.4 Color. Unless otherwise specified, the color of the finished cloth shall be USAF Sage Green Shade No. 1565. The color shall be obtained by the use of melt spun solution dyed fibers.

\* 3.4.1 Matching. The color shall match the standard sample under artificial daylight having a color temperature of 7500° Kelvin and shall be a good approximation to the standard sample under incandescent lamplight at 2800° Kelvin.

\* 3.4.2 Colorfastness. The dyed and finished cloth shall show fastness 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 (3.6) shall be as specified in table I when tested as specified in 4.5.

3.6 Finishing. The cloth shall be desized, scoured, heat set and given a durable antistatic finish (see 3.6.1).

3.6.1 Antistatic finish. The cloth shall be given a durable antistatic finish (see 6.4 and 6.5) so that the maximum resistivity of any one sample before laundering shall be  $3.0 \times 10^{11}$  ohms per square and the maximum resistivity of any sample after five launderings shall be  $8 \times 10^{11}$  ohms per square when tested as specified in 4.5. Only those chemical treatments already approved by the appropriate medical service and so listed in the invitation for bids or request for proposal shall be considered acceptable for the related procurement (see 6.5) when tested as specified in 4.5.

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. The finished cloth shall lie flat, without distortion, and show no evidence of curling when tested as specified in 4.5.

3.7 p<sup>H</sup>. The p<sup>H</sup> 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 Width. The width of the finished cloth shall be as specified which shall be the minimum acceptable width (inclusive of the selvage) (see 6.2).

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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. Each length shall be put up on rolls as specified in PPP-P-1133.

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

3.11 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 acceptable quality levels.

#### 4. QUALITY ASSURANCE PROVISIONS

\* 4.1 Responsibility for inspection. Unless otherwise specified in the contract the supplier 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.

4.2 Certificate of compliance. Where certificates of compliance are submitted in accordance with 4.5, they shall contain verifiable actual test and inspection data. The Government reserves the right to inspect and test the cloth to verify the validity of the certification.

4.3 Inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except when 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 of 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 (meter-by-meter) 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 (91.4m) the entire yardage in the roll shall

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be examined. When the total yardage in the roll exceeds 100 yards (91.4m), only 100 yards (91.4m) shall be examined. All defects as defined in Section III of FED-STD-4 which are clearly noticeable at normal inspection distance (3 feet) (0.9m) shall be scored and assigned demerit points as listed in 4.3.2.1.1 (except that only those slubs and knots which exceed the limits shown on figure 1 of FED-STD-4 shall be scored). No linear yard (0.9m) (increments of 1 yard (0.9m) 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 (83.6m<sup>2</sup>) of the total yardage examined exceeds 50 points. The lot shall be unacceptable if the points per 100 square yards (83.6m<sup>2</sup>) of two or more individual rolls exceed 75 points. If one roll exceeds 75 points per 100 square yards (83.6m<sup>2</sup>), 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 (83.6m<sup>2</sup>). Point computation for lot quality and individual roll quality shall be as follows:

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

$$\frac{\text{Total points scored in sample} \times 8361.2736}{\text{Contracted width of cloth (centimeters)} \times \text{total meters inspected}} = \text{Points per 83.6 sq meters}$$

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

- For defects 3 inches (7.6 cm) or less in any dimension - one point
- For defects exceeding 3 inches (7.6 cm), but not exceeding 6 inches (15.2 cm) in any dimension - two points
- For defects exceeding 6 inches (15.2 cm), but not exceeding 9 inches (22.8 cm) in any dimension - three points
- For defects exceeding 9 inches (22.8 cm) in any dimension - four points

NOTE: The end item examination shall also include the following additional defects:

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Color change or shade barre' equal to or greater than the guide sample (see 6.3)

Two or more contiguous missing picks

Two or more contiguous broken picks

Two or more contiguous strip backs

Two contiguous or more than three single tight ends across the width of one yard (0.9m).

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

The following conditions shall not be scored as defects:

Shade barre' and striation inherently characteristic of yarn variation

Single pick partially or completely missing

Single stripback in warp or fuzz ball no greater than that shown in figure 1 of FED-STD-4

Single tight end

Missing end less than one yard (0.9m) in length

#### 4.3.2.2 Examination for length.

4.3.2.2.1 Individual rolls. During the yard-by-yard (meter-by-meter) 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 (1.8m) 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.

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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 (meter-by-meter) 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.

4.3.2.4 Examination for compliance with Textile Fiber Products Identification Act. During the yard-by-yard (meter-by-meter) examination, each roll in the sample shall be examined for conformance to 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.

4.4 Examination of packaging requirements. An examination shall be made in accordance with the provisions of PPP-P-1133, to determine that packaging, packing and marking comply with the section 5 requirements of this specification.

4.5 Testing of the end item. The methods of testing specified in FED-STD-191, wherever applicable, as listed in Table III 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 (4.6m) full width, of the finished cloth and 1/4 yard (0.23m), full width, of the cloth prior to the application of the treatment. 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 (0.9m). 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 shown in Table II.

4.5.1 Curling. Two specimens of cloth, 1-1/2 inches (3.8 cm) wide by 6 inches (15.2 cm) 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.

## 5. PACKAGING

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

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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 flight clothing.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Color of cloth required (see 3.4).
- (c) Width of cloth required (see 3.8).
- (d) Length required if other than specified (see 3.9).
- (e) Selection of applicable levels of packaging and packing (see 5.1 and 5.2).

\* 6.3 Standard and guide samples. For access to standard and guide samples, address the procuring office issuing the invitation for bids.

6.4 The add-on treatment shall be the minimum that will adequately meet the requirements of this specification. Care should be exercised in controlling the add-on, as excessive add-ons tend to impair the flammability characteristics of the material.

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6.5 Experience has shown that the requirements for the durable antistatic treatment can be met with Aston 123, Onyx Chemical Co., 190 Warren St., Jersey City, N.J. 07302 and Stanaz, (not Stanaz 1166) Standard Chemical Products, Inc. Hoboken, N.J. 07030. Other products considered for this use must have the prior approval of the Contracting Officer.

6.6 Changes from previous issue. 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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Preparing Activity:  
Navy - AS  
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Review Activity:  
Air Force - 99  
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TABLE I. Physical properties.

Characteristics	Requirements
Denier/filament (nominal)	200/100
Turns per inch (2.5 cm)	
Warp	4 min - 8 max
Filling	4 min - 8 max
Yarns per inch (cm), min	
Warp	98 (39)
Filling	90 (35)
Weight, ozs, per sq. yd. (kg per m <sup>2</sup> )	5.2 min - 5.6 max (0.176 min-0.190 max)
Breaking strength, lbs, min (Newtons)	
Ravel strip method	
Warp	185(823)
Filling	160(712)
Tearing strength, lbs, min (Newtons)	
Tongue method	
Warp	13 (58)
Filling	13 (58)
Shrinkage after ten (10) launderings, percent, max	
Warp	2.0
Filling	2.0
Air permeability, cu ft air/min/ft <sup>2</sup> at 1/2 inch water, max (cm <sup>3</sup> .S <sup>-1</sup> .cm <sup>2</sup> at 124 Pa water)	12 (6)
Sewability, seam efficiency, percent, min	80
Flame resistance (warp direction only)	
Flaming time, seconds, max	1
Glow time seconds, max	14
Char length, inches, (cm) max	
Average	3.5 (8.9)
Single determination	4.0 (10.2)

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TABLE II. Sample Size.

Lot size (yards) (meters)	Sample size
800 (732) or less	2
801 (733) up to and including 22,000 (20,117)	3
22,001 (20,118) and over	5

TABLE III. Test methods.

Characteristics	Requirement paragraph	Test method
Identification	3.2	<u>1/</u>
Char point	3.2	<u>1/</u>
Denier	3.5	<u>1/</u>
Colorfastness to		
Light	3.4.2	5660
Laundering	3.4.2	5610
Weight	3.5	5041
Yarns per inch		
Warp	3.5	5050
Filling	3.5	5050
Turns per inch		
Warp	3.5	4052
Filling	3.5	4052
Breaking strength		
Warp	3.5	5104
Filling	3.5	5104
Tearing strength		
Warp	3.5	5134
Filling	3.5	5134
Air permeability	3.5	5450
Weave	3.3	Visual <u>2/</u>
Antistatic Finish		
Before laundering	3.6.1	<u>4/ 5/</u>
After laundering	3.6.1	5556 <u>3/ 4/ 5/</u>
Nonfibrous material	3.6.2	2611
Curling	3.6.3	4.5.1
pH	3.7	2811
Dimensional stability		
After ten launderings		
Warp	3.5	5556 <u>3/</u>
Filling	3.5	5556 <u>3/</u>
Seam efficiency	3.5	5110 <u>6/</u>

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TABLE III. Test methods. (Continued)

Characteristics	Requirement paragraph	Test method
Flame resistance Flame time Warp	3.5	5903
Glow time Warp	3.5	5903
Char length Warp	3.5	5903

- 1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirements.
- 2/ One determination shall be made from each sample unit and the results reported as "pass" or "fail".
- 3/ Cotton laundering procedure, no sour.
- 4/ AATCC Test Number 76-1969 Electrical Resistivity of Fabrics.
- 5/ Average of three determinations to nearest  $1.0 \times 10^{11}$  ohms per square.
- 6/ The needle shall measure 0.044 inch (plus or minus 0.001) across the blade at the eye. The thread for the needle shall be size E, Type I, class 1, 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.

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