|INCH-POUND|
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17 August 1990
SUPERSEDING
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10 April 1978

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 Scope. This specification covers high temperature resistant aramid twill cloth used in the manufacture of aeronautical clothing.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

* 2.1.1 Specifications and standards. The following specifications and standards form a part of this specification 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.f).

SPECIFICATIONS

FEDERAL

PPP-P-1133	Packaging of Synthetic Fiber Fabrics

Military

MIL-T-43636	Thread, Aramid

STANDARDS

FEDERAL

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8305

STANDARDS (Continued)

MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications, 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 and publications. The following other Government documents 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

* 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.f).

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

Technical Manual of the AATCC 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, NC 27709.)

(Nongovernment standards and other publications are normally available from the organizations which 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 specification and the references cited herein (except for related detail specifications, specification sheets or MS standards), 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 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.

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

* 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 no standard sample is available the cloth shall be equal to or better than a rating of "good" 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.

TABLE I. Physical properties.

Characteristic	Requirements
Denier/filament (nominal)	200/100
Turns per inch	
Warp	4 min - 8 max
Filling	4 min - 8 max
Yarns per inch, min	
Warp	98
Filling	90
Weight, ozs, per sq. yd.	5.2 min - 5.6 max
Breaking strength, lbs, min	
Ravel strip method	
Warp	185
Filling	160
Tearing strength, lbs, min	
Tongue method	
Warp	13
Filling	13
Shrinkage after ten (10) launderings, percent, max	
Warp	2.0
Filling	2.0

TABLE I. Physical properties (cont.).

Characteristic	Requirements
Air permeability, cu ft air/min/ft^2 at 1/2 inch water, max	12
Sewability, seam efficiency, percent, min	80
Flame resistance (warp direction only)	
After-flame time, seconds, max	1
After-glow time, seconds, max	14
Char length, inches max	
Average	3.5
Single determination	4.0

3.6 Finishing. The cloth shall be desized, scoured and heat set.

* 3.6.1 Antistatic finish. The cloth shall be given a durable antistatic finish (6.4 and 6.5) so that the maximum resistivity of any one sample before dry cleaning shall be 3.0×10^{11} ohms per square and the maximum resistivity of any sample after five dry cleanings 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 in the invitation for bids or request for proposal shall be considered acceptable for the related procurement (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 4.5.1.

3.7 Width. The width of the finished cloth shall be as specified which shall be the minimum acceptable width (inclusive of the selvage) (see 6.2c).

3.8 Length and put up. Unless otherwise specified (see 6.2d), 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.

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

3.10 Face identification. The face side of the cloth shall be identified by applying a stamping on that side of the cloth with the word "Face" at each end of the roll.

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 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 assure 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 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.

4.2 Classification of inspections. The inspections specified herein are classified as quality conformance inspections.

* 4.3 Quality conformance inspection. The quality conformance inspection shall consist of the inspections described in 4.3.2 through 4.3.3.4 and the end item tests of 4.5.

4.3.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with MIL-STD-105.

4.3.2 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.

4.3.3 Examination of the end item. Examination of the end item shall be in accordance with the provisions of 4.3.3.1 through 4.3.3.4.

4.3.3.1 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 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 4.3.3.1.1 (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 (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 square yards of two or more individual rolls exceed 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:

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

* 4.3.3.1.1 Demerit points. Demerit points shall be assigned as follows:

Defects 3 inches or less in any dimension	One point
Defects exceeding 3 inches, but not exceeding 6 inches in any direction	Two points
Defects exceeding 6 inches, but not exceeding 9 inches in any direction	Three points
Defects exceeding 9 inches in any dimension	Four points

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

Two or more contiguous missing picks.

Two or more contiguous broken picks.

Two or more contiguous strip backs.

Two continuous or more than three single tight ends across the width of one yard.

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 not seriously affecting appearance.

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 in length.

In addition, all twenty rolls of the inspection sample shall be examined for "tight selvage" by placing each roll on a table and partially unrolling the cloth. Two or more rolls with this condition can reject the entire lot.

4.3.3.2 Examination for length.

4.3.3.2.1 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 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 with respect to length.

4.3.3.2.2 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.

4.3.3.3 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.

4.3.3.4 Examination for compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for conformance to the Textile Fiber Products Identification Act or face stamping missing from either or both ends or face marking on wrong side. 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 preservation, 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 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 and 1/4 yard, 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. 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 III.

TABLE II. Test methods.

Characteristics	Requirement paragraph	Test method
Identification	3.2	1/
Char point	3.2	1/
Denier	3.5	1/
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 2/
Antistatic finish		
Before dry cleaning	3.6.1	4/ 5/
After dry cleaning	3.6.1	5556 3/ 4/ 5/
Nonfibrous material	3.6.2	2611

TABLE II. Test methods (continued).

Requirement Characteristics	Test paragraph	method
Curling	3.6.3	4.5.1
Dimensional stability		
After ten launderings		
Warp	3.5	5556 3/
Filling	3.5	5556 3/
Seam efficiency	3.5	5110 6/
Flame resistance		
After flame 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 the nearest 1.0×10^{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 and the looper shall be size B, MIL-T-43636.

TABLE III. Sample size.

Lot size (yards)	Sample Size
800 or less	2
801 up to and including 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.

5. PACKAGING

* 5.1 Preservation. Preservation shall be level A or C as specified (see 6.2 e).

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

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

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

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

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

* 6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification, including amendments.

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).

f. Issue of the DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).

* 6.3 Standard sample. For access to standard sample, address the procuring office issuing the invitation for bids (see 3.1).

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.

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, NJ 07302 and Stanaz, (not Stanaz 1166) Standard Chemical Products, Inc., Hoboken, NJ 07030. Other products considered for this use must have the prior approval of the Contracting Officer.

* 6.6 Subject term (key word) listing.

Aeronautical clothing
Aramid
Cloth
High temperature resistant
Twill

6 7 Changes from previous issue. The margins of this specification are marked with asterisks 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 irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Navy - AS
Air Force - 99

Review Activity:
Navy - NU
Air Force - 11, 82

Preparing Activity:
Navy - AS
(Project No. 8305-0163)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER: MIL-C-81814C
2. DOCUMENT DATE (YYMMDD): 17 Aug 1990

3. DOCUMENT TITLE: Cloth, Twill, Aramid, High Temperature Resistant

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
(1) Commercial
(2) AUTOVON

7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. NAME: Commanding Officer
NAEC, SESD Code 53

b. TELEPHONE (Include Area Code)
(1) Commercial: (201)323-1280
(2) AUTOVON: 624-1280

c. ADDRESS (Include Zip Code)
Lakehurst, NJ 08733-5100

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340