

MIL-C-24946
13 June 1988

MILITARY SPECIFICATION

CLOTH, TWILL, COTTON (FLAME RETARDANT TREATED)

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

1. SCOPE

1.1 Scope. This specification covers one type of cotton twill cloth which has been treated with a flame retardant finish.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks 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.

SPECIFICATIONS

FEDERAL

- V-T-276 - Thread, Cotton
- PPP-P-1134 - Packaging, Packing of Cotton and Cotton-Synthetic
Fiber-Blend Fabrics (Excluding Duck Fabrics)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Officer in Charge, Navy Clothing and Textile Research Facility, 21 Strathmore Road, Natick, MA 01760 by using the self-addressed standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8305

AMSC NA

DISTRIBUTION STATEMENT A. Approved for public release, distribution is unlimited.

MIL-C-24946

STANDARDS

FEDERAL

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

MILITARY

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

(Copies of specifications, standards, drawings, and publications required by contractors 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, drawings, and publications form a part of this specification to the extent specified herein.

LAWS AND REGULATIONS

Rules and Regulations Under the Textile Fiber Products Identification Act

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

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM 1424-83 - Tear Resistace of Woven Fabrics by Falling Pendulum
(Elmendorf) Apparatus

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

TECHNICAL MANUAL OF THE AMERICAN ASSOCIATION OF CHEMISTS AND COLORISTS

Method No. 8 Colorfastness to Crocking: Crockmeter Method

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

MIL-C-24946

2.3 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. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Standard sample. The 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). The standard sample is identified under piece no. 88131.

3.2 Formula approval. The prospective contractor or his finishing plant shall submit with his bid to the contracting officer for approval, a list of materials which will be used if contract is awarded. The list shall stipulate amounts, grades, and standards for all materials including solvents, and the manufacturer's name. This list is for the information of the Government and is not to be disseminated to the public. Approval of the quantitative formula submitted shall in no way absolve the contractor from complying with the performance requirements of this specification.

3.3 First article. When specified (see 4.3 and 6.2), the contractor shall furnish a sample for first article inspection and approval.

3.4 Material.

3.4.1 Yarn. Warp and filling shall be single yarns made from carded cotton (see 4.4.1 and 4.5).

3.5 Weave. The weave shall be a 3 up - 1 down left hand twill (see 4.5).

3.6 Preparation. The cloth shall be singed, desized, and mercerized (see 4.4.1 and 4.5).

3.7 Color. The color shall be Navy shade Blue 3384 and shall match the standard sample.

3.7.1 Matching. The color of the cloth shall match the standard sample when viewed under filtered tungsten lamps which approximate artificial daylight having a correlated color temperature at 7500 (+200) Kelvin with an illumination of 100 (+20) foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2300 (+200) Kelvin.

3.7.2 Colorfastness. The finished cloth shall show colorfastness to light (40SFH), perspiration, crocking, and laundering equal to or better than the standard sample when tested as specified in 4.5. As a limit of acceptability, or when no standard sample is available, the finished cloth shall show a minimum of "good" colorfastness to light (40SFH), laundering and perspiration, and 4 for dry crocking and 2 for wet crocking when tested as specified in 4.5.

MIL-C-24946

3.8 Physical requirements. The finished cloth shall conform to the physical requirements shown in Table I when tested as specified in 4.5.

Table I - Physical Requirements

Characteristics	Requirements	
Weight - oz/yd ² (g/m ²)	Desized	Finished
Minimum	4.6 (156)	6.0 (203)
Maximum	5.2 (176)	7.3 (247)
Yarns per inch (2.54 cm) - Minimum		
Warp		90
Filling		42
Breaking strength - lbs (Newtons) Minimum		
Warp		100 (445)
Filling		45 (200)
Tearing strength - lbs (Newtons) Minimum		
Warp		7.0 (31)
Filling		4.0 (18)
Stiffness in. lbs (N.m) Maximum		
Warp		0.010 (0.00113)
Filling		0.005 (0.00057)
Air permeability ft ³ /min/ft ² (cm ³ /sec/cm ²)		
Minimum		20 (10.16)

3.8.1 Width. The width of the finished cloth shall be as specified (see 6.2) and shall be the minimum acceptable width inclusive of selvages when fly shuttle looms or shuttleless with tuck-in selvalge looms 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.

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

3.10 Dimensional stability. The finished cloth shall not shrink nor elongate more than 2.0% in either the warp or filling when tested as specified in 4.5. The pre-shrinking process used shall not be identified by name or by trademark, either on the cloth, ticket, or package.

3.11 Treatment. The cloth shall be given an approved flame resistant treatment (see 6.5 and 6.6). The finished cloth shall have an average time of after flame of not more than 2.0 seconds, not more than 5.0 seconds average after-glow time and an average length of char of not more than 5.0 inches (12.5cm), both initially and after 25 launderings when tested as specified in 4.5.

3.12 pH. The pH value of the water extract of the finished cloth shall be no less than 5.0 nor more than 8.5 when tested as specified in 4.5.

MIL-C-24946

3.13 Non-fibrous material. The cloth, prior to treatment, shall contain no more than 2.0 percent starch and protein content including chloroform-soluble and water-soluble material, when tested as specified in 4.5.

3.14 Toxicity approval. Only those flame retardant treatments already evaluated and approved by the appropriate medical service in regards to toxicity and so listed in the invitation for bids or request for proposal shall be considered acceptable for the related procurement (see 6.5).

3.15 Length and put-up. Unless otherwise specified (see 6.2), the cloth shall be furnished in continuous lengths, each not less than 40 yards (36m). Each length shall be put-up in a roll as specified in PPP-P-1134.

3.16 Face identification. The face side of the cloth shall be identified by stamping "FACE" on that side of the cloth at each end of the piece and roll.

3.17 Fiber identification. Each piece shall be labeled or ticketed for fiber content in accordance with the Rules and Regulations under the Textile Fiber Products Identification Act.

3.18 Workmanship. The finished cloth shall conform to the quality established by this specification. The occurrence of defects shall not exceed the applicable quality/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 or order, the contractor may use his own or any other facilities suitable for 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.

4.1.1 Responsibility for compliance. All items must 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 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 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.

MIL-C-24946

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

1. First article inspection (see 4.3).
2. Quality conformance inspection (see 4.4).

4.3 First article inspection. When required (see 6.2), the first article of finished cloth submitted in accordance with 3.3 shall be visually inspected for color, and finished appearance, and shall be tested for chemical and physical properties in accordance with methods specified in 4.5.

4.4 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated.

4.4.1 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 procurement documents. A certificate of compliance may be submitted for the requirements of fiber identification of 3.4.1 and the preparation requirements of 3.6.

4.4.2 Examination of the end item. Examination of the end item shall be in accordance with 4.4.2.1 through 4.4.2.4.

4.4.2.1 Yard-by-yard examination. The required yardage of each roll in the sample shall be examined on face side only. When the total yardage in the roll does not exceed 100 yards (91.4m) the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards (91.4m), only 100 yards (91.4m) shall be examined. All defects are defined in Section 1 of FED-STD-4, which are clearly noticeable at normal inspection distance (3 feet) (0.91m) shall be scored and assigned demerit points as listed in 4.4.2.1.1, except that only the slubs and knots which exceed the limits shown on Sears Fabric Defect Scale (see 6.4), "D" or "3 1/2" for slubs and "C" for knots shall be scored. No linear yard (increments of 1 yard (0.91m) 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 in accordance with the following:

MIL-C-24946

<u>Lot Size (yards)</u>	<u>Sample Size (rolls) 1/</u>
3200 or less	8
3201 thru 10,000	13
10,001 and over	20

1/ Only one roll shall be taken from any shipping container, unless the number of shipping containers in the lot are less than the number of rolls required for sampling, in which case, all shipping containers shall be sampled.

The lot shall be unacceptable if the points per 100 square yards (83.6m^2) of the total yardage examined exceeds 28 points. The lot shall be unacceptable if the individual points per 100 square yards (83.6m^2) of two or more individual rolls exceeds 40 points. If one roll exceeds the point level per 100 square yards (83.6m^2), a second sample, the same size as the first sample, shall be examined only for individual roll quality examination. The lot shall be unacceptable if one or more rolls in the second sample exceeds 38 points per 100 square yards (83.6m^2). Point computation for lot quality and individual roll quality shall be as follows:

$$\frac{\text{Total points scored in sample} \times 3600}{\text{Contracted width of cloth (inches)} \times \text{Total yards inspected}} = \text{Points per 100 square yards } \left(83.6\text{m}^2\right)$$

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

For defects up to and including 3 inches (7.6cm) in any dimension	= one point
For defects exceeding 3 inches (7.6cm) but not exceeding 6 inches (15.2cm) in any dimension	= two points
For defects exceeding 6 inches (15.2cm) but not exceeding 9 inches (22.8cm) in any dimension	= three points
For defects exceeding 9 inches (22.8cm) in any dimension	= four points

NOTE: The following defects, when present, shall be scored 4 points for each yard (0.9m) in which they occur:

Baggy, ridgy or wavy cloth
 Width less than specified
 Non-uniformity of shade (poor dye penetration, mottled, streaky or cloudy)
 Excessive neppiness
 Objectionable odor
 Characteristics of finish, hand, and shade not equal to the standard sample

MIL-C-24946

4.4.2.2 Examination for length.

4.4.2.2.1 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 (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.

4.4.2.2.2 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 tickets. The rolls examined shall be those selected for the examination of individual rolls.

4.4.2.3 Examination for shade variation. During the yard-by-yard examination, each roll in the sample shall be examined for shade variations. Any roll in the sample exhibiting uneven shade, shade variation side to side, side to center, or end to end shall be cause for rejection of the entire lot represented by the sample.

4.4.2.4 Examination for face identification, non-identification of preshrinking process, and compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for defects listed below. The lot shall be unacceptable if two or more of the following defects are present in the sample:

Face identification missing from either or both ends
 Face identification on wrong side
 Preshrinkage process identified by name or trademark on cloth or ticket
 Not labeled or ticketed in accordance with the Rules and Regulations under the Textile Fiber Products Identification Act

4.4.3 Examination of packaging requirements. An examination shall be made in accordance with the provisions of PPP-P-1134 to determine whether packaging, packing, and marking comply with section 5 requirements.

4.5 Testing of the end item. 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 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 (4.5m), full width of finished cloth, and 1/4 yard (.2m) prepared (desized) cloth before treatment. The sample size shall be expressed in units of 1 yard (.91m). The lot shall be unacceptable if one or more sample units fail to meet any test requirement specified. All test reports shall contain the individual values utilized in expressing the final results.

MIL-C-24946

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

Table II - Test Methods

<u>Characteristic</u>	<u>Requirement Paragraph</u>	<u>Test Method</u>
Fiber identification	3.4.1	1200 <u>1/</u>
Yarn ply	3.4.1	Visual <u>2/</u>
Weave	3.5	Visual <u>2/</u>
Preparation requirements		<u>1/</u>
Colorfastness to:		
Light (SFH)	3.7.2	5660 <u>6/</u>
Laundering (after 3 cycles)	3.7.2	5610 <u>3/ 4/</u>
Perspiration	3.7.2	5680
Crooking	3.7.2	AATCC 8-1985
Weight		
Desized	3.8	5041
After FR treatment	3.8	5041
Yarns per inch		
Warp	3.8	5050
Filling	3.8	5050
Breaking strength		
Warp	3.8	5100
Filling	3.8	5100
Tearing strength		
Warp	3.8	ASTM 1424-83
Filling	3.8	ASTM 1424-83
Stiffness		
Warp	3.8	5202
Filling	3.8	5202
Air permeability	3.8	5450
Seam efficiency	3.9	5110 <u>5/</u>
Dimensional stability	3.10	5550
Flame resistance:		
Initial		
After flametime, sec.	3.11	5903
After glow time, sec.	3.11	5903
Char length, inch	3.11	5903
Following 25 launderings		
After flametime, sec.	3.11	5556 and 5903
After glow time, sec.	3.11	5556 and 5903
Char length, inch	3.11	5556 and 5903
pH	3.12	2811
Nonfibrous material	3.13	2611

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

MIL-C-24946

- 2/ One determination for each sample unit and the result reported as "pass" or "fail".
- 3/ The specimens must be dried after each of the 3 laundering cycles.
- 4/ Only the stain of the cotton fiber shall be rated when evaluating the color transfer cloth.
- 5/ The thread shall conform to type IAl of V-T-276. The needle size shall be 0.049 +0.001 inch, and the top (needle) thread shall be ticket No. 30, 3 ply, and the bottom (looper) thread shall be ticket No. 50, 3 ply.
- 6/ The calibration of the fadometer and the definition of AATCC Fading Units shall be according to AATCC Test Method 16-1982. Using the formula below, 16 to 22 AFU's are acceptable as 20 SFH's.

$$\text{AATCC Fading Units} = \frac{(E^*)(20)}{1.7}$$

where (E*) is the color difference in CIELAB* units of color difference.

5. PACKAGING

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

5.1.1 Level A or C. The cloth, put up as specified (see 3.14), shall be packaged in accordance with the applicable requirements of PPP-P-1134.

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-1134.

5.3 Marking. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with the applicable requirements of PPP-P-1134.

6. NOTES

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

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. When first article sample is required (see 3.3). The item will be tested and should be a first article sample. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, quantity, and testing and approval of the first article.
- c. Width required (see 3.8.1).
- d. Minimum and maximum lengths for cloth (see 3.15).
- e. Levels of packaging and packing required (see 5.1 and 5.2).

MIL-C-24946

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

6.4 Sears Fabric Defect Scales are available from Sears Roebuck and Company, Department 817, (Attn: 23-29), Sears Tower, Chicago, IL 60684 (see 4.4).

6.5 Only those treatments listed in the invitation for bids or request for proposal shall be considered acceptable for related procurement. Information on currently approved material may be obtained from Defense Personnel Support Center, Philadelphia, PA 19101 (see 3.11 and 3.14).

6.6 A cotton fire retardant treatment (FRT) with a precondensate of a tetrakis(hydroxymethyl) phosphonium salt cured in a gaseous ammonia atmosphere (precondensate/ammonia cure) has been found to meet the specification requirements (see 3.11).

6.7 Subject word (key word) listing.

Cloth, cotton
 Cloth, twill
 Clothing, protective
 Finish, flame retardant
 Treatment, flame retardant

Custodians:

Navy - NU
 Army - GL

Preparing Activity:

Navy - NU

Review Activity:

DLA - CT
 Army - MD

Project No. 8305-0218

User Activity:

Navy - MC, CG

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (**DO NOT STAPLE**), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO 12503 WASHINGTON D C

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Officer in Charge
Navy Clothing & Textile Research Facility
21 Strathmore Road (Code 50)
Natick, MA 01760-2490



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-C-24946		2. DOCUMENT TITLE CLOTH, TWILL, COTTON (FLAME RETARDANT TREATED)	
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) _____	
3b. 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)	