

MIL-C-44270  
16 March 1987

## MILITARY SPECIFICATION

### CLOTH, POLYESTER/COTTON, FOR HOSPITAL DUTY UNIFORM (HDU)

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

#### 1. SCOPE

1.1 Scope. This document covers requirements for three types of polyester/cotton blend cloth (see 6.1).

1.2 Classification. The cloth shall be of the following types (as specified, see 6.2):

Type I - 3.0 oz/sq yd, 80/20 polyester/cotton, broadcloth  
Type II - 5.5 oz/sq yd, 65/35 polyester/cotton, twill  
Type III - 7.0 oz/sq yd, 65/35 polyester/cotton, twill

#### 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.

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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MIL-C-44270

## SPECIFICATIONS

### FEDERAL

PPP-P-1134 - Packaging of Cotton and Cotton-Synthetic Blend  
Fabrics (Excluding Duck Fabrics)

### MILITARY

MIL-T-43548 - Thread, Polyester, Core: Cotton-, Rayon-, or  
Polyester-Covered

## STANDARDS

### FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections  
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

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

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

#### AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

##### Chromatic Transference Scale

Method 124 - Appearance of Durable Press Fabric After Repeated Home  
Launderings

MIL-C-44270

(Copies may be obtained from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 1424 - Tear Resistance of Woven Fabrics by Falling Pendulum  
(Elmendorf) Apparatus

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

(Technical society and technical association documents are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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

3.2 Materials.

3.2.1 Fibers. The fibers shall be polyester and cotton.

3.2.2 Yarns.

3.2.2.1 Type I. For type I, the warp yarns shall be a blend of  $65 \pm 5$  percent polyester and the remaining percentage carded and combed cotton, spun into singles yarn. The filling yarns shall be made from continuous multi-filament polyester yarn.

3.2.2.2 Types II and III. For types II and III, the warp and the filling yarns shall be a blend of  $65 \pm 5$  percent polyester and the remaining percentage carded and combed cotton, spun into singles yarn.

3.3 Color. The finished cloth shall be bleached optical white to match the standard sample, and shall be produced by chemical bleaching using a peroxygen-type agent and a fluorescent optical brightener with a resulting peak emission in the blue violet region. The hue of fluorescence shall be the same as that of the standard sample when tested as specified in 4.2.3.

3.3.1 Labile sulfur. The use of dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid is prohibited. The dyes shall be

## MIL-C-44270

chosen and applied so that the dyed cloth shall contain no more labile sulfur than shown by the standard sample or no more than a slight trace of labile sulfur when tested as specified in 4.2.3.

3.3.2 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  $7500 \pm 200$  K, with illumination of  $100 \pm 20$  candles, and shall be a good match to the sample under incandescent lamplight at  $2300 \pm 200$  K.

3.3.3 Colorfastness. The finished cloth shall show colorfastness to laundering (after three cycles), perspiration and light 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 physical requirements specified in table I when tested as specified in 4.2.3.

TABLE I. Physical requirements

Type	Weight oz/sq yd minimum	Yarns per inch minimum		Breaking strength pounds minimum		Tearing strength pounds minimum	
		Warp	Filling	Warp	Filling	Warp	Filling
I	2.5	110	68	100	60	---	---
II	4.6	118	48	140	70	5.0	5.0
III	6.8	116	47	170	120	5.0	4.5

3.4.1 Weave. For type I, the weave shall be plain. For types II and III, the weave shall be 2/1 left hand twill.

3.4.2 Width. The width of the cloth shall be specified (see 6.2) and shall be the minimum acceptable width exclusive of selvages.

3.5 Cloth preparation. The cloth shall be desized, scoured, mercerized, bleached, and heat set.

3.6 Nonfibrous materials. For type I the starch and protein content including chloroform-soluble and water-soluble material for the finished cloth, and prior to durable press treatment for types II and III, shall not exceed 2.25 percent when tested as specified in 4.2.3.

3.7 Dimensional stability. The finished cloth shall not shrink or elongate more than 2.0 percent in either the warp or the filling direction, when tested as specified in 4.2.3.

3.8 Finish, types II and III only. The types II and III cloths shall be given an approved precured durable press treatment (see 6.5).

## MIL-C-44270

3.9 Appearance rating, types II and III only. The types II and III cured cloths shall have an appearance rating of not less than 3.0 when tested after five launderings as specified in 4.2.3.

3.10 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 80 percent when tested as specified in 4.2.3.

3.11 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 4.2.3.

3.12 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 on rolls as specified in 5.1.

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

3.14 Workmanship. The finished cloth shall conform to the quality established by this document. The demerit points per 100 square yards when calculated as specified in section 4 shall not exceed the established maximum point value.

#### 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 the 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 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 Certificate of compliance. When certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification.

## MIL-C-44270

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 requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this document or applicable purchase document.

4.2.1.1 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 roll exceeds 100 yards, only 100 yards shall be examined. All defects, as defined in Section I of FED-STD-4, which are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.2.1.1.1 except that only those slubs and knots which exceed the limits shown on Sears Fabric Defect scales (see 6.6), E or 3 as applicable for slubs and B 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 four points. The sample size shall be in accordance with the following:

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

1/ No more than one roll shall be taken from any shipping container unless the number of shipping containers in the lot is less than the required number of rolls in which case all shipping containers shall be present in the sample.

The lot shall be unacceptable if the points per 100 square yards of the total yardage examined exceeds 30.0 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 45.0 points. If one roll exceeds 45.0 points per 100 square yards, a second sample of the size indicated above shall be examined only for individual roll quality. The lot shall be unacceptable if one or more rolls in the second sample exceeds the point level. Point computation for lot quality and individual roll quality shall be as follows:

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

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

For defects 3 inches or less in any dimension - one point

## MIL-C-44270

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:

Holes, cuts, or tears  
 Baggy, ridgy, or wavy cloth  
 Width less than specified  
 Overall uncleanness  
 Off shade  
 Excessive neppiness

4.2.1.2 Length examination. 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 2 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 or if the total of the actual lengths of rolls in the sample is less than the total of the lengths marked on the tickets.

4.2.1.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade and appearance. Any roll in the sample off shade; shaded side to side, side to center, or end to end; or not having the same appearance as the standard sample shall be cause for rejection of the entire lot represented by the sample.

4.2.1.4 Roll identification examination. During the yard-by-yard examination each roll in the sample shall be examined for identification of fiber content. The lot shall be unacceptable if two or more rolls in the sample are not labeled or ticketed in accordance with the Textile Fiber Products Identification Act.

4.2.3 End item testing. The cloth shall be tested for the characteristics listed in table II. 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 average results of the determinations made on a sample unit for test purposes as specified in the applicable test method. All test reports shall contain the individual values utilized in expressing the final result. The sample unit shall be 4 continuous yards, full width of the finished cloth and 1/4 yard of the cloth of the type II or III cloth prior to application of the durable press treatment. The lot shall be unacceptable if one or more units fail to meet any requirement specified. The sample size shall be as shown below.



## MIL-C-44270

<u>Lot size (yards)</u>	<u>Sample size (sample unit)</u>
800 or less	2
801 to 22,000 inclusive	3
22,001 and over	5

TABLE II. End item tests

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>
Polyester identification	3.2	1600 <u>1/</u>
Cotton identification	3.2	1200 <u>1/</u>
Fiber content	3.2	2535 <u>1/</u>
Yarn (single)	3.2	Visual <u>1/</u>
Hue of fluorescence	3.3	4.3.2
Labile sulfur	3.3.1	2020 <u>1/</u>
Colorfastness to:		
Laundering (after 3 cycles)	3.3.3	5610 <u>2/</u>
Perspiration	3.3.3	5680
Light	3.3.3	5660 <u>3/</u>
Weight	3.4	5041
Yarns per inch	3.4	5050
Breaking strength	3.4	5100
Tearing strength (types II and III only)	3.4	ASTM D 1424
Weave	3.4.1	Visual <u>4/</u>
Mercerization	3.5	<u>1/</u>
Nonfibrous material	3.6	2611
Dimensional stability	3.7	4.3.1
Approved treatment	3.8	<u>1/</u>
Appearance rating	3.9	4.3.1
Seam efficiency	3.10	5110 <u>5/</u>
pH	3.11	2811

- 1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement.
- 2/ The specimens shall be dried after each of the three laundering cycles.
- 3/ The exposure time shall be 40 hours.
- 4/ One determination per sample unit and the results reported as "pass" or "fail".
- 5/ The needle shall measure  $0.36 \pm 0.001$  inch across the blade at the eye. The polyester/cotton wrapped thread shall conform to MIL-T-43548. The needle thread shall be 50, 2 ply and the looper thread shall be 70, 2 ply.



## MIL-C-44270

4.2.4 Packaging inspection. The inspection shall be in accordance with the quality assurance provisions of PPP-P-1134.

4.3 Methods of inspection.

4.3.1 Appearance and dimensional stability after laundering testing.

4.3.1.1 Apparatus and materials. Apparatus and materials shall be as specified in AATCC Method 124.

4.3.1.2 Preparation of specimens. Three specimens 22 by 22 inches measured parallel to the warp and filling shall be cut from a portion of the cloth sample. One specimen shall be cut from each side of the sample unit to within 3 inches of the selvages and the third specimen shall be taken from the center. No two specimens shall contain the same filling yarns. The specimens shall be conditioned to equilibrium under Standard Conditions in accordance with FED-STD-191. The conditioned specimens shall be laid without tension on a flat surface, care being taken that the cloth is free from wrinkles or creases. Three distances, each a minimum of 18 inches, shall be measured and marked off parallel to each of the warp and filling directions of the specimen. Each pair of markings shall be a minimum of 6 inches from each other and not closer than 1 inch to the edges of the specimen. The distance may be marked with indelible ink and a fine pointed pen, or by sewing fine threads into the cloth, or by stamping. The samples shall then be laundered in accordance with 4.3.1.3.

4.3.1.3 Laundering. Place the three 22 by 22 inch specimens in the washer. The washing load shall be  $4 \pm 1/4$  pounds. Dummy pieces shall be added to the machine, along with the specimens to make up the  $4 \pm 1/4$  pound load. Fill to the full water level of the washer with water of a hardness not to exceed 50 parts per million and at a temperature of  $120^{\circ} \pm 5^{\circ}\text{F}$ . The rinse temperature shall be  $80^{\circ} \pm 5^{\circ}\text{F}$ . Add  $140 \pm 1$  grams of detergent. Set the washer for a 12-minute cycle on the "Permanent Press" setting. Allow the washing to proceed automatically through the final spin cycle. Remove the specimens immediately at the completion of the final spin and separate from the dummy pieces and each other if tangled. Place the complete washed load ( $4 \pm 1/4$  pounds) in the dryer and dry at the "Permanent Press" setting with a 10-minute cool down cycle. Operate the dryer until the load is dry and continue tumbling 5 minutes with the heat turned off (cool down cycle). Remove the load immediately after the machine stops. Repeat the wash and dry cycles for five complete cycles. Remove all the specimens and condition to equilibrium under standard conditions in accordance with FED-STD-191.

4.3.1.4 Appearance evaluation. Three trained observers shall evaluate each sample unit for appearance characteristics. The observers shall make their evaluations independent of each other. Each observer shall evaluate each specimen for appearance as it hangs on the viewing board while standing in front of the viewing board and 4 feet back from it. The overhead lighting shall be used. Mount each 22 by 22 inch specimen on the viewing board with the center of the specimen 5 feet from the floor. Place three dimensional plastic replicas on

## MIL-C-44270

each side of the specimen with the centers 5 feet from the floor, to facilitate comparative rating. The specimen shall be rated according to the appearance on the plastic replica that most nearly matches the appearance of the cloth. No estimated rating falling between the approved replicas shall be given. The average of the rating values assigned for appearance of the cloth by the observers rounded off to the nearest 0.1 rating shall be the rating for the specimen. Each rating value given by the observers for the appearance of the cloth shall also be reported.

4.3.1.5 Dimensional stability. After evaluation for appearance is made, the three 22 by 22 inch specimens shall be laid out without tension on a flat surface in the standard atmosphere. Care shall be taken that the specimens are free from wrinkles and creases. The previously measured distance marked on the specimens shall be measured in both the warp and filling directions. The dimensional stability of the specimens shall be calculated as follows:

$$\text{Dimensional change, percent} = \frac{A-B}{A} \times 100$$

Where A = Average of initial measurements (3 specimens)

B = Average measurements after laundering (3 specimens)

The dimensional change of the sample unit in the warp and filling directions shall be the average of the specimens tested in each direction respectively and shall be reported separately to the nearest 0.1 percent. The individual values used to calculate the average shall also be reported.

4.3.2 Determination of fluorescence test. A specimen of the sample unit and a specimen of the standard sample shall be compared under ultra-violet light in an otherwise completely dark room. The specimen shall be considered satisfactory if its hue of fluorescence is the same as the standard sample. One determination shall be performed on the sample unit and the results reported as "pass" or "fail".

## 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-1134.

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

5.2.1 Levels A, B, and Commercial. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1134.

## MIL-C-44270

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

## 6. NOTES

6.1 Intended use. The cloth is intended for use in Hospital Duty Uniform (HDU). The following are the intended uses for each type:

- Type I - Dress liner for the HDU
- Type II - Dress, pant suit top, and men's smock top for the HDU
- Type III - Slacks and trousers for the HDU

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this document.
- b. Type of cloth required (see 1.2).
- c. Width of cloth required (see 3.4.2).
- d. Length of other than specified (see 3.12).
- e. Selection of applicable levels of preservation and packing (see 5.1 and 5.2).

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

6.4 Yarn numbers. The cloth has been satisfactorily manufactured using the following yarn numbers for each type cloth:

- Type I - 40/1 cotton count warp yarn and 80 denier filling yarn
- Type II - 30/1 cotton count warp yarn and 20/1 cotton count filling yarn
- Type III - 25/1 cotton count warp yarn and 10/1 cotton count filling yarn

6.5 Durable press resin treatment. Approval of the durable press resin for utilization under this document is the responsibility of the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014 and is based on extensive tests, including those for toxicity which are not set forth in this document. Because of the time necessary to conduct full evaluation (approximately 6 months) only those treatments approved and so listed in the invitation for bids or request for proposals shall be considered acceptable for the related procurement.

6.6 Fabric defect scales. Fabric defect replica kits are available from Sears Roebuck and Co., Department 817 (ATTN: BSC 23-29), Sears Tower, Chicago, IL 60684.

6.7 Subject term (key word) listing.

Cloth  
Polyester/cotton  
Hospital Duty Uniform (HDU)

MIL-C-44270

**Custodians:**

Army - GL  
Navy - NU  
Air Force - 99

**Preparing activity:**

Army - GL  
Project No. 8305-0133

**Review activities:**

Army - MD  
Air Force - 82  
DLA - CT

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**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.

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