

MIL-C-44034C
28 March 1986

SUPERSEDING
MIL-C-44034B
28 August 1984

MILITARY SPECIFICATION

CLOTH, TWILL, CAMOUFLAGE PATTERN, COTTON AND NYLON FOR DESERT UNIFORM

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

1. SCOPE

1.1 Scope. This document covers blended cotton and nylon twill cloth which is dyed and overprinted with the prescribed camouflage print.

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

- Class 1 - Camouflage pattern for daytime desert uniform
- Class 1A - Camouflage pattern for daytime desert uniform, quarpel treated
- Class 2 - Grid pattern print for desert night parka

2. APPLICABLE DOCUMENTS

2.1 Government documents. Unless otherwise specified, the following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this document 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: 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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SPECIFICATIONS

FEDERAL

- P-S-683 - Sour, Laundry (Fluoridated)
- PPP-P-1134 - Packaging of Cotton and Cotton-Synthetic Fiber Blend Fabrics (Excluding Duck Fabrics)

MILITARY

- MIL-D-43362 - Detergent, Laundry (Anionic: A Standard for Testing)
- MIL-T-43548 - Thread, Polyester, Cotton-Covered and Rayon Covered

STANDARDS

FEDERAL

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

DRAWINGS

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER

Camouflage Pattern for Hot Dry Terrains for Application to Combat Uniforms - 48 inches (classes 1 and 1A)

U.S. ARMY NATICK RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER

- 2-1-1540 - Pattern for Nighttime Desert Grid - 45 inches (class 2)
- 2-1-1540A - Pattern for Nighttime Desert Grid - 60 inches (class 2)

(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 officer.)

OTHER GOVERNMENT DOCUMENTS

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. Unless otherwise specified, the following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this document to the extent specified herein.

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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

Chromatic Transference Scale

(Application for copies should be addressed to 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 (except for associated detail specifications, specification sheets or MS standards), 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 dyed and printed or dyed, printed, and treated cloth shall match the standard sample for shade and appearance and shall unless otherwise indicated (see 3.4.5), 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. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3, 6.2, and 6.4).

3.3 Material (see 6.10).

3.3.1 Cotton. The cotton shall be carded.

3.3.2 Nylon. The nylon shall be first quality, high tenacity, semi-dull staple having a nominal cut length of 1-1/2 inches and a round cross section with a nominal denier of 2.25 to 2.5. The use of any form of nylon waste is prohibited, such as undrawn fiber, mixtures of deniers, lusters or cross sections, and waste from any stage of fiber production: whether drawn, undrawn, or mixed or garnetted fiber. The contractor shall submit the fiber producer's certification that each lot of nylon staple used conforms to the requirements specified herein.

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3.3.3 Yarns. The warp and filling yarn shall be singles made from a blend of 50 ± 5 percent nylon and the remaining percentage cotton, based on the dry weight of the desized cloth. Testing shall be performed as specified in 4.4.3.

3.4 Color.

* 3.4.1 Classes 1 and 1A. The color of the cloth shall be a six color pattern as shown by the drawing "Camouflage Pattern for Hot Dry Terrains for Application to Combat Uniforms" and shall be obtained by roller or automatic screen printing using five or six rollers or screens as appropriate, for the Light Tan 379, Tan 380, Light Brown 381, Dark Brown 382, Black 383 and Khaki 384 areas of the pattern. The use of five rollers or screens is appropriate when the ground shade matches Light Tan 379. The dyeing of the ground shade (Light Tan 379) and the printing of the cloth shall be accomplished with organic colorants (see 6.6.1), to provide a match to each of the six shades of the patterns and to provide the spectral reflectance levels specified in table I. Each dyed and printed color area shall match the specific color on the standard sample (see 6.3). Resin bonded pigment printing will not be permitted.

3.4.2 Class 2. The cloth shall have a grid with rubble pattern as shown by Drawing 2-1-1540 (for 45 inch wide cloth) or 2-1-1540A (for 60 inch wide cloth) or by the standard sample (see 6.2 and 6.3). The grid with rubble pattern shall be obtained by screen or roller printing with a resin bonded Dark Green 425 colorant over Light Green 426 ground shade (see 6.6.2). The grid pattern bow shall not exceed 3 percent when tested as specified in 4.4.3.

3.4.3 Labile sulfur. The use of dyes and compounds containing sulfur capable of oxidation to sulfuric acid shall be chosen and applied such that the dyed cloth shall contain no more labile sulfur than shown by the standard sample when tested as specified in 4.4.3. When no standard sample is available, the dyed cloth shall show no more than a slight trace of labile sulfur as defined in the test method when tested as specified in 4.4.3.

* 3.4.4 Matching. Each color of the pattern of the finished cloth shall match the standard sample when viewed under filtered tungsten lamps which approximate artificial daylight having a correlated color temperature of 7000 ± 500 K, with illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2300 ± 100 K.

3.4.5 Colorfastness. The printed finished cloth shall show fastness to light, laundering (after three cycles), and perspiration equal to or better than the standard sample or equal to or better than the rating of "good" for each of the pattern areas when tested as specified in 4.4.3. The cloth shall show fastness to crocking equal to better than the standard sample or shall have an AATCC Chromatic Transference Scale rating not lower than 3.5 for all the pattern areas, except Black 383 which shall have an AATCC Chromatic Transference Scale rating not lower than 1.5, when tested as specified in 4.4.3.

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- * 3.5 Pattern execution, classes 1 and 1A. The pattern of the finished cloth shall match the standard sample with respect to design, colors, and registration of the respective areas. The warpwise pattern repeat of the dyed, printed and finished cloth shall be $16.75 + 1.25 - 1.75$ inches (see 6.11). Each pattern area shall show solid coverage; skitteriness exceeding that shown by the standard sample in any of the printed areas will not be acceptable.
- * 3.5.1 Spectral reflectance, classes 1 and 1A. The spectral reflectance of each color area, except Black 383, for the Daytime Desert Camouflage printed cloth shall conform to the requirements specified in table I, when tested as specified in 4.4.3.

TABLE I. Spectral reflectance requirements

Wavelengths nanometers	Reflectance values (percent)				
	Light Tan 379 ^{1/} (min)	Tan 380 and Khaki 384 (min) (max)		Light Brown 381 and Dark Brown 382 (min) (max)	
700	38	25	41	19	28
720	38	25	41	20	29
740	39	25	41	20	29
760	40	26	42	21	30
780	41	27	43	21	30
800	43	28	44	22	31
820	45	30	46	23	32
840	48	33	48	24	33
860	50	36	50	25	34

^{1/} Light Tan 379 has no specified maximum values.

- * 3.5.2 Spectral reflectance, class 2. The dyed and finished cloth shall have a composite measurement for spectral reflectance of 25 ± 5 percent when measured at 1 micrometer when tested as specified in 4.4.3.
- * 3.6 Physical requirements. The finished cloth shall conform to the requirements in table II when tested as specified in 4.4.3.

TABLE II. Physical requirements

Class	Wt. per sq. yd. minimum Ounces	Yarns per inch minimum		Breaking strength minimum		Tearing strength minimum		Air permea- bility (cu. ft./min/sq. max. ave. (see 6.17))
		Warp	Filling	Warp Pounds	Filling Pounds	Warp Pounds	Filling Pounds	
1&2	6.8	86	54	200	125	11	8	25.0
1A	7.0	86	54	190	115	10	7	10.0

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3.6.1 Weave. The weave shall be 2/1 left hand twill.

* 3.6.2 Width. The width of the cloth shall be as specified (see 6.2), and shall be the minimum acceptable width inclusive of selvage when fly shuttle looms or shuttleless with tuck-in selvage 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(s).

* 3.7 Finish. The cloth shall be dyed and overprinted with the warp effect side as the face. The cloth shall be closely singed, desized, mercerized, dyed, and printed. The class 1A cloth shall also be quarpel treated (see 3.7.2).

3.7.1 Non-fibrous material. The starch and protein content including chloroform-soluble and water-soluble material of the scoured and printed cloth shall not exceed 2.0 percent when tested as specified in 4.4.3.

* 3.7.2 Water repellency (class 1A). The class 1 A cloth shall be given an approved Quarpel type (see 6.16) water repellent treatment and shall conform to the water repellency requirements of table III and 3.7.2.1 when tested as specified in 4.4.3. The use of materials other than approved water repellents are prohibited. The cured fabric shall be afterwashed to remove all unreacted reagents.

TABLE III. Water repellency requirements (class 1A)

Hydrostatic height (centimeters) minimum	Dynamic absorption (percent) maximum
18.0	20.0

* 3.7.2.1 Spray rating. The results of the three individual determinations on the sample unit for spray rating shall be equal to or better than ratings 100, 100, 90 when tested as specified in 4.4.3.

* 3.7.2.2 Liquid repellency. The treated finished class 1A cloth shall show no wetting by n-dodecane after 30 seconds and no wetting by tri-ethyl phosphate, di-methyl phosphonate and bis (2 ethyl hexyl) hydrogen phosphite after 8 hours when tested as specified in 4.4.3.

3.8 Dimensional stability. The shrinkage or elongation both in the warp and in the filling of the finished cloth shall not be greater than 3.5 percent for the individual sample unit and not greater than 3.0 percent for the lot average when tested as specified in 4.4.3. The preshrinkage process used shall not be identified by name or trademark either on the cloth, ticket or package.

3.9 pH. The pH value of the water extract of the finished cloth shall be no lower than 5.0 nor higher than 8.5 when tested as specified in 4.4.3.

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3.10 Seam efficiency. The finished cloth shall have a seam efficiency of no less than 80 percent when tested as specified in 4.4.3.

3.11 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 a roll as specified in 5.1.

3.12 Fiber identification. Each roll shall be labeled or ticketed for fiber content in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act.

3.13 Workmanship. The finished cloth shall conform to the quality established by this document. The demerit points per 100 square yards 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 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 the document 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 document shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements 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 indicted 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.

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

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4.3 First article inspection. When a first article is required (see 6.2), it shall be examined for appearance, color, and finish defects and shall be tested for the characteristics specified in table III. The presence of any defect or failure of any test shall be cause for rejection of the first article.

4.4 Quality conformance inspection.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this document or applicable purchase document.

* 4.4.2 End item examination. The maximum lot size shall be 150,000 linear yards.

4.4.2.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only (printed side). 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 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 4.4.2.1.1, except that only those slubs and knots which exceed the maximum limits shown on Sears Fabric Defect Scales (see 6.5), E or 3 as applicable 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 roll within the sample shall be penalized more than four 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 30 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 45 points. If one roll in the sample size of 20 exceeds 45 points per 100 square yards, a second sample of 20 rolls shall be examined for individual roll quality only. The lot shall be unacceptable if one or more rolls in the second sample exceeds 45.0 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

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

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

For defects up to and including 3 inches 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

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The following defects, when present, shall be scored four points for each yard in which they occur:

- * Objectionable odor
- Baggy, ridgy, or wavy cloth
- Width less than specified
- Edge ravel when pulled outward
- Slack or tight selvages 1/
- Overall uncleanness
- Pattern design not equal to standard sample
- Incorrect color in any part of the pattern
- Pattern repeat not equal to the standard sample
- Warpwise pattern repeat less than 15.0 inches or more than 18.0 inches (classes 1 and 1A)
- Skitteriness (mottled, uneven color) of pattern exceeds that shown by standard sample
- Excessive feathering or spew (fuzziness at color boundaries) of pattern as compared to the standard sample
- Excessive grinning (off register, gap where ground shade shows through) of pattern as compared to the standard sample
- Excessive haloing or trapping (overlapping of colors) of pattern as compared to the standard sample

1/ To determine the presence of unacceptable selvage conditions, the following procedure shall be observed: During the visual examination, the perch shall be stopped a minimum of three times for each roll in the sample, the tension removed and the finished cloth examined for the selvage conditions. Suspect rolls should be removed from the perch and unrolled on the floor or a table and further examined for the condition. A waviness in the selvage or significant ripples diagonally across the width of the fabric is an indication of slack or tight selvages.

4.4.2.2 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 ticket.

4.4.2.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade and appearance. If any one component color in any roll of the sample is off shade or does not have the same appearance as the standard sample it shall be cause for rejection of the entire lot represented by the sample.

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4.4.2.4 Roll identification examination. During the yard-by-yard examination, each roll in the sample shall be examined for proper identification. 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.

* 4.4.3 End item testing. The cloth shall be tested for the characteristics listed in table IV. The methods of testing specified in FED-STD-191 whenever applicable and as listed in table IV shall be followed. All test reports shall contain the individual values utilized in expressing the final results. The sample unit shall be 3 continuous yards full width of the finished cloth (for classes 1 and 2) or 4 continuous yards full width of the finished cloth (for class 1A), for all physical and chemical tests except dimensional stability (see 4.4.3.1). The lot shall be unacceptable if one or more sample units or the lot average for dimensional stability fail to meet any requirement specified. The maximum lot size shall be 150,000 linear yards. The sample size except for dimensional stability shall be in accordance with the following:

<u>Lot size (yards)</u>	<u>Sample size (sample units)</u>
800 or less	2
801 up to and including 22,000	3
22,001 up to and including 150,000	5

TABLE IV. End item tests

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>
Material		
Cotton fiber identification	3.3.1	1200 <u>1/</u>
Nylon:		
Identification	3.3.2	1530 <u>1/</u>
Luster	3.3.2	<u>1/</u>
Denier	3.3.2	<u>1/</u>
Absence of nylon waste	3.3.2	<u>1/</u>
Fiber content:		
Cotton content	3.3.3	2530 <u>1/ 2/</u>
Nylon content	3.3.3	2530 <u>1/</u>
Grid pattern bow (class 2)	3.4.2	5060
Presence of labile sulfur	3.4.3	2020 <u>1/</u>
Colorfastness to:		
Light	3.4.5	5660
Laundering (after 3 cycles)	3.4.5	5610
Perspiration	3.4.5	5680
Crocking	3.4.5	5651

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TABLE IV. End item tests (cont'd)

Characteristic	Requirement paragraph	Test method
Spectral reflectance:		
Classes 1 and 1A	3.5.1	4.5.1
Class 2	3.5.2	4.5.2
Weight	3.6	5041
Yarns per inch	3.6	5050
Breaking strength	3.6	5100
Tearing strength	3.6	ASTM D-1424
Air permeability	3.6	5450
Weave	3.6.1	Visual <u>1/</u>
Singed	3.7	<u>1/</u>
Desized	3.7	<u>1/</u>
Mercerized	3.7	<u>1/</u>
Non-fibrous material	3.7.1	2611
Water repellent (class 1A)	3.7.2	<u>3/</u>
Hydrostatic pressure (class 1A)	3.7.2	5514
Dynamic absorption (class 1A)	3.7.2	5500
Spray rating (class 1A)	3.7.2.1	5526
Liquid repellency (class 1A)	3.7.2.2	4.5.3
Dimensional stability	3.8	4.4.3.1
pH	3.9	2811
Seam efficiency	3.10	5110 <u>4/</u>

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

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2/ The cotton content shall be calculated as follows:

$$\text{Cotton content, percent} = \frac{R}{S} \times 100$$

R = Weight of residual fibers

S = Weight of dry desized specimen

3/ The contractor shall report the water repellents used and certify that no other material has been added.

4/ The needle shall measure 0.040 ± 0.001 inch across the blade at the eye. The thread shall be polyester/cotton-covered or rayon covered in accordance with MIL-T-43548, ticket no. 50, 2 or 3 ply for the needle and ticket no. 70 2 or 3 ply for the looper.

* 4.4.3.1 Dimensional stability testing. The cloth shall be tested for dimensional stability in accordance with 4.5.4 through 4.5.4.6.3. The sample unit shall be 2 continuous yards full width of the finished cloth. The lot size shall not exceed 150,000 yards. The sample size shall be in accordance with the following:

<u>Lot size (yards)</u>	<u>Sample size (number of sample units)</u>
10,000 or less	5
10,001 up to and including 35,000	8
35,001 up to and including 150,000	13

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

4.5 Methods of inspection.

* 4.5.1 Spectral reflectance test (classes 1 and 1A). Reflectance shall be obtained from 700 to 860 nm relative to barium sulfate, the preferred white reference standard. Other reference white materials may be used (Halon, magnesium oxide, or vitrolite tile), provided they are calibrated to absolute white (see 6.7). The spectral band width at 860 nm shall be less than 25 nm. Reflectance measurements may be made by either the monochromatic or polychromatic mode operation. When the polychromatic mode operation is used, the spectrophotometer (see 6.9) shall operate with the specimen diffusely illuminated with the full emission of a continuous source that simulates in the visible spectrum either CIE Source A or CIE Source D65. Specimens shall be measured as a single layer backed with two layers of the same shade cut from the standard. Readings shall be taken on a minimum of two different areas, and the data averaged. The specimen shall be viewed at any angle no greater than 10

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degrees from normal. Photometric accuracy of the spectro-photometer shall be within 1 percent and the wavelength accuracy shall be within 2 nm. When the measured reflectance values for any color at four or more of the listed wavelengths do not meet the limits specified in table I, it shall be considered a test failure.

* 4.5.2 Spectral reflectance test (class 2). The spectral reflectance shall be determined by recording the reflectance relative to barium sulfate at 1 micrometer using a spectrophotometer as described in 4.5.1 or using a photometer consisting of the following elements: a tungsten filament lamp, infrared filter having a low wave length cut off at 0.9 micrometer, a photodetector with an S-1 surface of appropriate sensitivity; a galvanometer of the spotlight type with a 0 to 100 scale on a microammeter of comparable sensitivity (see 6.8). The photometer shall be calibrated with vitreous enamel gray standards available from photometer manufacturers. Specimens shall be measured as a single layer backed with an additional two layers of the same fabric. The face sides of all three layers shall be toward the instrument port. The grid pattern of each layer shall be arranged so as to be superimposed on the pattern of the layer beneath. A minimum of five readings shall be made on each sample grid area only excluding rubble and the average of the readings shall be reported to the nearest unit. The standard aperture size used in the color measurement device shall be 1.0 to 1.25 inches in diameter.

* 4.5.3 Liquid repellency test. Place a small specimen of the treated finished camouflage cloth (comprised of all six colors in the pattern) on a smooth horizontal surface, face-up. Using a pipette or eye dropper, gently deposit a drop of each liquid specified in 3.7.2.2 on the surface of each shade of the camouflage pattern. After 30 seconds, examine each color of the specimen under light at an angle. Absence of light reflectance at the cloth-drop interface for the n-dodecane drop shall be taken as evidence of wetting. The test shall be continued for 8 hours for the drops of tri-ethyl phosphate, di-methyl phosphonate, and bis (2 ethyl hexyl) hydrogen phosphite. Absence of light reflectance at the cloth-drop interface for the three liquids after the 8-hour period shall be taken as evidence of wetting. Three specimens taken at various locations across the sample unit shall be tested. Evidence of wetting on any color of one or more specimens shall be considered a test failure.

* 4.5.4 Dimensional stability testing procedures.

4.5.4.1 Test specimen. The test specimen shall be a square of cloth 24 inches by 24 inches.

4.5.4.1.1 Number of determinations for dimensional stability. Three specimens from each sample unit shall be tested in each of the warp and filling directions.

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4.5.4.2 Apparatus.

4.5.4.2.1 Wash wheel (see 6.12). A cylindrical wash wheel of the reversing type shall be used. The wheel (cage) shall be 20 to 24-1/2 inches inside diameter and 20 to 24 inches inside length. There shall be three fins each approximately 3 inches wide extending the full length of the inside of the wheel. One fin shall be located every 120 degrees around the inside diameter of the wheel. The wash wheel shall rotate at a speed of 30 ± 4 revolutions per minute making 5 to 10 revolutions before reversing. The water inlets shall be large enough to permit filling the wheel to an 8 inch level in less than 2 minutes, and the outlet shall be large enough to permit discharge of this same amount of water in less than 2 minutes. The wash wheel shall be equipped with a pipe for injecting live steam that shall be capable of raising the temperature of water at an 8 inch level from 100° to 140°F in less than 2 minutes.

4.5.4.2.2 Wash wheel equipment. The wash wheel shall be equipped with a thermo-meter or other equivalent equipment for determining the temperature of the water during the washing and rinsing procedures, and with an outside water gage that will indicate the level of the water in the wheel.

4.5.4.2.3 Preheating tank or other device. A preheating device to supply water in quantity within $\pm 4^{\circ}\text{F}$.

4.5.4.2.4 Extractor (see 6.13). A centrifugal extractor of the laundry type with a perforated basket, approximately 11 inches deep by 17 to 20 inches in diameter with an operating speed of approximately 1500-1725 revolutions per minute.

4.5.4.2.5 Drier (see 6.12). A drier of the rotary, tumble type having a cylindrical basket approximately 36 inches in diameter and 24 inches in length and rotating at 35 ± 2 revolutions per minute. The drier shall be capable of maintaining a stack temperature within $\pm 5^{\circ}\text{F}$ of the specified test temperature. The stack temperature shall be measured 20 ± 2 inches from the exhaust opening of the drier.

4.5.4.2.6 Stamping device (see 6.15). A device capable of marking off an 18 inch distance with fine indelible ink lines.

4.5.4.2.7 Measuring ruler (see 6.15). Plastic type, graduated to give percent change directly in 0.2 percent increments and read to the nearest 0.1 percent. (Based on an original 18 inch marking.)

4.5.4.2.8 Balance. Balance or scale capable of weighing the specimen to an accuracy of ± 0.01 g.

4.5.4.3 Reagents.

4.5.4.3.1 Synthetic detergent (see 6.14). Synthetic detergent shall conform to MIL-D-43362.

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4.5.4.3.2 Sour. Sour shall conform to type I of P-S-683.

4.5.4.3.3 Water of not over 50 parts per million hardness.

4.5.4.4 Procedure.

4.5.4.4.1 Preparation of cloth. Prior to initial markings for determining dimensional stability and prior to determining the change after laundering, the cloth shall be brought to equilibrium under standard atmospheric conditions as defined in section 4 of FED-STD-191. (A minimum of 4 hours is required.) A flat, open mesh screen rack is recommended for this purpose.

4.5.4.4.2 Preparation of specimen for dimensional stability.

4.5.4.4.2.1 Selection of specimens. The three specimens shall be cut from the cloth (sample unit) as follows: One specimen from each side of the cloth to within 3 inches of the selvage and one specimen from the center of the cloth. No two specimens shall contain the same filling yarns. The cloth edges shall be slit by 1 inch diagonal cuts at intervals of about 6 inches on all four sides of the test specimen. The 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 18 inches apart shall be measured and marked off parallel to each of the warp and filling directions of the specimen. The distance shall be a minimum of 6 inches apart and 2 inches from any edge of the specimen. The distance should be marked with indelible ink by a stamping device. The measured distance shall be parallel to the respective yarns.

4.5.4.4.2.2 Standard load. A standard load comprising the specimens under test and clean ballast of comparable size, weight, and type of cloth shall be utilized. A total weight of 20 pounds consisting of specimens and ballast shall be used for the test.

4.5.4.4.2.3 Laundering procedure. Water of not over 50 parts per million hardness at the required temperature $\pm 4^{\circ}\text{F}$ shall be introduced into the wash wheel to the designated level. The schedule of table V shall be followed. At the end of each time interval, the machine shall be stopped, drained without removing the load, and refilled to the proper level before starting again. The wheel shall be in motion a total of 22 minutes during the period of testing.

TABLE V. Laundering schedule

Operation	Composition	Water volume gallons	Water level inches $\frac{1}{2}$	Temperature $^{\circ}\text{F}$	Time (minutes)
1. Suds	Synthetic detergent (13 g)	14.3	6	100	5

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TABLE V. Laundering schedule (cont'd)

Operation	Composition	Water volume gallons	Water level inches <u>1/</u>	Temperature °F	Time (minutes)
2. Suds	Synthetic detergent (7 g)	9.3	4	140	5
3. Rinse		20.5	8	140	3
4. Rinse		20.5	8	120	3
5. Rinse	Sour (24 g)	20.5	8	100	3
6. Rinse		20.5	8	100	<u>3</u> 22

1/ The water levels are based on a machine with an inside diameter of 28-1/2 inches and an inside length of 23-1/2 inches and may have to be adjusted to give the specific volumes.

4.5.4.4.2.4 Drying, procedure. After laundering, the standard load shall be extracted in two equivalent portions, a minimum of 3 minutes each. The specimens shall be separated, opened to full width and dried together with the ballast at $190^{\circ} \pm 5^{\circ}\text{F}$ for 60 minutes in a rotating tumble drier.

4.5.4.5 Evaluation.

4.5.4.5.1 Evaluation of cloth for dimensional stability. Immediately after tumble drying, each specimen shall be laid out, without tension or pressing, on a flat surface in the standard atmosphere until moisture equilibrium is reached. (A minimum of 4 hours is required.) Care shall be taken that the specimen is smooth and free from wrinkles or creases. The previously measured distance marked on the specimen shall again be measured in both the warp and filling direction using the measuring ruler specified in 4.5.4.2.7.

4.5.4.5.2 Calculation of results. The dimensional stability of the specimens shall be calculated as follows:

Shrinkage, percent =

Average of percent measurements after laundering (three specimens)

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4.5.4.6 Report of test results.4.5.4.6.1 Dimensional stability.

4.5.4.6.2 Shrinkage. The shrinkage of the sample unit in the warp direction and in the filling direction shall be the average of three specimens tested from each direction, respectively, and shall be reported separately to the nearest 0.1 percent.

4.5.4.6.3 Elongation. When a test result registers elongation rather than shrinkage, each elongation result shall be prefixed with a minus sign with both the minus sign and the value inclosed in parenthesis.

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.

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

6. NOTES

6.1 Intended use. The class 1 cloth is intended for use in the Daytime Desert Uniform. The class 1A cloth is intended for use in the Daytime Desert Camouflage Printed Uniform requiring Quarpel treatment. Class 2 cloth is intended for use in the Desert Night Parka and Trousers.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this document.
- b. Class of cloth required (see 1.2).
- c. When a first article is required (see 3.2, 4.3, and 6.4).
- d. Pattern drawing if required (see 3.4.2).
- e. Width of cloth required (see 3.6.2).
- f. Length required, if other than specified (see 3.11).
- g. Selection of applicable levels of preservation and packing (see 5.1 and 5.2).

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

6.4 First article. When a first article sample is required, it shall be inspected and approved under the appropriate provisions of FAR 52.209. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should include specific instructions in all acquisition instruments regarding arrangements for selection, inspection, and approval of the first article.

6.5 Fabric defect scales. Fabric Defect Replica Kits are available from Sears Roebuck and Company, Department 817, (ATTN: BSC 23-29), Sears Tower, Chicago, IL 60684.

6.6 Pattern areas.

6.6.1 Dye information, classes 1 and 1A. The areas of the pattern have been found to be satisfactory when dyed or printed with various combinations of the following dyes for 6 colored areas:

Light Tan 379 (Ground Shade)

Vat Yellow 33
Vat Brown 1
Vat Black 25
Vat Olive Green 2GI
Vat Gray 2 GR

Tan 380

Vat Brown 3
Vat Brown 33
Vat Brown 1
Vat Yellow 33
Vat Black 25

Light Brown 381

Vat Brown 3
Vat Brown 33
Vat Brown 57
Vat Brown 1
Vat Yellow 33

Dark Brown 382

Vat Brown 3
Vat Brown 33
Vat Brown 1
Vat Brown 57
Vat Yellow 33

Black 383

Sulfur Black 6
Vat Black 11

Khaki 384

Brown 1
Vat Brown 3
Vat Yellow 33
Vat Olive Green 2GI

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6.6.2 Dye formulation, class 2. Satisfactory colors with a resin bonded grid have been obtained with the following formulas:

Light Olive Green 426 (ground shade)

Acid Blue 258	Vat Orange 1
Acid Yellow 219	Vat Brown 57
Acid Red 266	Vat Green 3
Vat Blue 6	

Grid Overprint 425

Resin Bonded Pigments
 Chrome Oxide Green
 Carbon Black

* 6.7 Source of material. Barium sulfate and Halon of suitable quality for use as a white standard is available from Eastman Kodak Co. Suitable white tiles are available from the National Bureau of Standards or spectrophotometer manufacturers (see 4.5.1).

6.8 Photometers. Infrared photometers and appropriate calibration standard that meets the needs of 4.5.2 may be obtained from:

Hunter Labs
 11495 Sunset Hills Road
 Reston, Va 22090

6.9 Spectrophotometers. Suitable spectrophotometers that meet the requirements of 4.5.1 are the Diano Hardy, Diano Matchscan, and Hunter D54P-IR spectrophotometers.

6.10 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the document (see 3.3).

* 6.11 Heat setting. The contractors are cautioned to insure that the cloth prior to printing has been properly heat set in order that the final dimensions of the pattern will be within the limits set forth in 3.5.

* 6.12 Wash wheel and drier. The wash wheel and drier as described may be obtained from Ewing Division of Powercom, P. O. Box 454, Troy, NY 12181.

* 6.13 Extractor. The extractor may be obtained from Ewing Division of Powercom, P.O. Box 454, Troy, NY 12181, American Laundry Machinery Company, 5050 Section Avenue, Cincinnati, OH 45212, Bock Co., 3600 Summit Street, Toledo, OH 43611, Troy Machinery, East Moline, IL 61244, and Pellerin Milnor Corporation, Kenner, LA 70062.

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* 6.14 Detergent. Synthetic Laundering Detergent (under the name of Igepon T-77) may be obtained from GAF Corporation, Dyestuff and Chemical Division, 140 West 51st Street, New York, NY 10020.

6.15 Ruler, stamping device and ink. The measuring ruler, stamping device and indelible ink may be obtained from the Sanforized Co., 433 River Street, Troy, NY 12180.

* 6.16 Quarapel water repellent (class 1A). The "Quarapel type" water repellent treatment consists of the co-application of an emulsified fluorocarbon and a fluorocarbon extender. Approval of components and combinations is the responsibility of 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 chemical treatments already approved and so listed in the invitation for bids or request for proposal shall be considered acceptable for the related procurement.

* 6.17 Air permeability. Not all untreated cloth meeting the air permeability requirement for classes 1 and 2 will, after quarapel treatment, be capable of meeting class 1A air permeability requirements.

6.18 Changes from previous issue. The margins of this document 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 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:

Army - GL
Navy - NU
Air Force - 11

Preparing activity:

Army - GL
Project No. 8305-0052

Review activities:

Army - MD
Navy - MC
Air Force - 82, 99
DLA - CT

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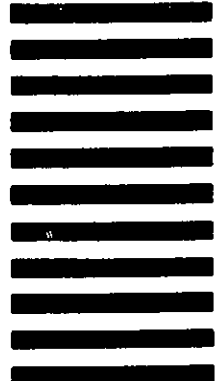
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-C-44034C		2. DOCUMENT TITLE Cloth, Twill, Camouflage Pattern, Cotton and Nylon For Desert Uniform	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
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)	