INCH-POUND

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SUPERSEDING
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DETAIL SPECIFICATION

CLOTH, DUCK, TEXTURED NYLON

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

1. SCOPE

1.1 Scope. This specification covers the requirements for textured nylon duck cloth, dyed or printed with a camouflage pattern.

1.2 Classification. The cloth includes the following types, classes and styles as specified (see 6.2).

1.2.1 Types.

Type I - 1000 denier

Class 1	- 9.5 oz/sq yd, Untreated
Class 2	- 9.5 oz/sq yd, Water repellent
Class 3	- 12.0 oz/sq yd, Water repellent/back coated
Class 4	- 12.0 oz/sq yd, Water repellent/flame retardant

Type II - 725 denier

Class 1	- 7.5 oz/sq yd. Untreated
Class 2	- 7.5 oz/sq yd, Water repellent
Class 3	- 10.0 oz/sq yd, Water repellent/back coated

Comments, suggestions, or questions on this document should be addressed to Attn: DLA Troop Support Standardization Team, 700 Robbins Avenue, Philadelphia, PA 19111-5096. Since contact information can change, you may want to verify the currency of the address information using Acquisition Streamlining and Standardization Information System (ASSIST) online database https://assist.dla.mil

AMSC NA FSC 8305

Type III - 500 denier

Class 1	- 7.0 oz/sq yd Untreated
Class 2	- 7.0 oz/sq yd, Water repellent
Class 3	- 8.0 oz/sq yd, Water repellent/back coated
Class 4	- 9.5 oz/sq yd, Water repellent/flame retardant

Type IV - 330 denier

Class 1	- 4.0 oz/sq yd Untreated
Class 2	- 4.0 oz/sq yd, Water repellent
Class 3	- 5.5 oz/sq yd, Water repellent/back coated
Class 4	- 7.5 oz/sq yd, Water repellent/flame retardant

1.2.2 Styles.

Style A - Solid shades
Style B - Woodland Camouflage Pattern
Style C - Desert Camouflage Pattern (3 Color)
Style D - DELETED
Style E - Woodland Camouflage Marine Pattern (MARPAT)
Style F - Desert Camouflage Marine Pattern (MARPAT)
Style G - DELETED
Style H - Operational Camouflage Pattern (OCP)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-3064 - Evaluation of Quality of Textile Materials

(Copies of this document are available online at https://quicksearch.dla.mil.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract.

DRAWINGS

U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND (CCDC) SOLDIER CENTER

2-1-1516	-	Woodland Camouflage Pattern
2-1-2240	-	Desert Camouflage Pattern (3 color)
2-1-2525	-	Woodland MARPAT Pattern 4 color (Coyote 476)
2-1-2526	-	Woodland MARPAT Pattern 4 color (Green 474 with EGA symbol)
2-1-2527	-	Woodland MARPAT Pattern 4 color (Black 477)
2-1-2528	-	Woodland MARPAT Pattern 4 color (Khaki 475)
2-1-2529	-	Desert MARPAT Pattern 4 color (Light Tan 479)
2-1-2530	-	Desert MARPAT Pattern 4 color (Urban Tan 478)
2-1-2531	-	Desert MARPAT Pattern 4 color (Light Coyote 481 with EGA symbol)
2-1-2532	-	Desert MARPAT Pattern 4 color (Highland 480)
2-1-2592	-	Operational Camouflage Pattern

(Copies of drawings are available from the U.S. Army Combat Capabilities Development Command (CCDC) Soldier Center, ATTN: FCDD-SCP-WC, 10 General Greene Avenue, Natick, MA 01760-5019.)

OTHER GOVERNMENT DOCUMENTS AND PUBLICATIONS

ENVIRONMENTAL PROTECTION AGENCY

EPA Product Performance Test Guidelines
OPPTS 810.370 Insect Repellents for Human Skin and Outdoor Premises

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
(40 CFR Part 162) State Registration of Pesticide Products

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
FIFRA as amended by the Food Quality Protection Act of 1996 and the Pesticide Registration Improvement Act of 2003

(Copies of these documents are available online at https://www.epa.gov/pesticides.)

FEDERAL TRADE COMMISSION

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies of this document are available online at https://www.ftc.gov.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC EP1	- Evaluation Procedure for Gray Scale for Color Change
AATCC EP2	- Evaluation Procedure for Gray Scale for Staining
AATCC EP8	- Evaluation Procedure for AATCC 9-Step Chromatic Transference Scale
AATCC EP9	- Evaluation Procedure for Visual Assessment of Color Difference of Textiles
AATCC TM8	- Test Method for Colorfastness to Crocking: Crockmeter
AATCC TM15	- Test Method for Colorfastness to Perspiration
AATCC TM16.3	- Test Method for Colorfastness to Light: Xenon Arc
AATCC TM20	- Test Method for Fiber Analysis: Qualitative
AATCC TM22	- Test Method for Water Repellency: Spray Test
AATCC TM61	- Test Method for Colorfastness to Laundering, Accelerated
AATCC TM70	- Test Method for Water Repellency: Tumble Jar Dynamic Absorption Test
AATCC TM81	- Test Method for pH of the Water-Extract from Wet Processed Textiles
AATCC TM118	- Test Method for Oil Repellency: Hydrocarbon Resistance
AATCC TM119	- Test Method for Color Change Due to Flat Abrasion (Frosting): Screen Wire Method
AATCC TM127	- Test Method for Water Resistance: Hydrostatic Pressure Test
AATCC TM135	- Test Method for Dimensional Changes of Fabrics after Home Laundering
AATCC TM169	- Test Method for Weather Resistance of Textiles Xenon Lamp Exposure

(Copies of these documents are available online at https://www.aatcc.org.)

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ/ANSI Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Copies of this document are available online at https://asq.org.)

ASTM INTERNATIONAL

ASTM D737	- Test Method for Air Permeability of Textile Fabrics
ASTM D747	- Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
ASTM D751	- Standard Test Method for Coated Fabrics

ASTM D1424	- Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
ASTM D1776/D1776M	- Standard Practice for Conditioning and Testing Textiles
ASTM D1907/D1907M	- Standard Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
ASTM D2261	- Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine)
ASTM D3775	- Standard Test Method for Warp (End) and Filling (Pick) Count of Woven Fabrics
ASTM D3776/D3776M	- Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D3884	- Standard Guide for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)
ASTM D5034	- Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM D6413/D6413M	- Standard Test Method for Flame Resistance of Textiles (Vertical Test)

(Copies of these documents are available online at https://www.astm.org.)

INFORMA HEALTHCARE

Repeat Insult Patch Test - Modified Draize Procedure –
Principles and Methods of Toxicology, A Wallace Hayes (editor).

(Copies of this document are available online at https://www.crcpress.com.)

SDL ATLAS

Part Number 402985 – Slub/Knot Replica Set

(Replica set is available for purchase from SDL Atlas Customer Service, 1-803-329-2110.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document supersedes applicable laws and regulations.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Standard sample. Unless otherwise indicated, the finished cloth shall match the standard sample for shade and appearance, 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).

3.3 Recycled, recovered, or environmentally preferable or biobased materials. Recycled, recovered, or environmentally preferable or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Material.

3.4.1 Yarn. The yarn shall be textured continuous filament nylon. Testing shall be as specified in 4.5.

3.4.1.1 Yarn denier. The yarn denier shall be 1000 for Type I, 725 for Type II, 500 for Type III and 330 for Type IV. Testing shall be as specified in 4.5.

3.5 Color.

3.5.1 Style A (solid shades). Unless otherwise specified in the contract or purchase order, the Style A finished cloth shall be dyed in one (1) of the following shades: Camouflage Green 483, Foliage Green 504, Urban Gray 505, Coyote 498, Coyote Brown 3758, Tan 380, Tan 499 and Arctic White (see 6.2). Resin bonded pigments shall not be used.

3.5.1 Style B, Woodland Camouflage Pattern. The Style B finished cloth shall be either dyed to a ground shade matching Light Green 354 and then overprinted with the remaining three (3) colors for the Dark Green 355, Brown 356, and Black 357 areas of the camouflage pattern or when the ground shade is not dyed to match Light Green 354, all four (4) colors of the camouflage pattern shall be printed to match all four (4) colors of the pattern. Resin bonded pigments shall not be used.

3.5.3 Style C, Desert Camouflage Pattern (3 color). The Style C finished cloth shall be either dyed to a ground shade matching Light Tan 492 and then overprinted with the remaining two (2) colors for the Light Brown 493 and Light Khaki 494 areas of the camouflage pattern or when the ground shade is not dyed to match Light Tan 492, then all three (3) colors of the camouflage pattern shall be printed to match all three (3) colors of the pattern. Resin bonded pigments shall not be used.

3.5.4 DELETED.

3.5.5 Style E, Woodland Camouflage Pattern (MARPAT). The Style E The finished cloth shall be either dyed to a ground shade matching Khaki 475 and then overprinted with the remaining three (3) colors for the Green 474, Coyote 476 and Black 477 areas of the camouflage pattern or when the ground shade is not dyed to Khaki 475, all four (4) colors of the camouflage pattern shall be printed to match all four (4) colors of the pattern. Resin bonded pigments shall not be used.

3.5.6 Style F, Desert Camouflage Pattern (MARPAT). The Style F finished cloth shall be either dyed to a ground shade matching Light Tan 479 and then overprinted with the remaining three (3) colors the Urban Tan 478, Highland 480 and Light Coyote 481 areas of the camouflage pattern or when the ground shade is not dyed to Light Tan 479, all four (4) colors of the camouflage pattern shall be printed to match all four (4) colors of the pattern. Resin bonded pigments shall not be used.

3.5.7 DELETED.

3.5.8 Style H, Operational Camouflage Pattern (OCP). The Style H finished cloth shall be either dyed to a ground shade matching Dark Cream 559 and then overprinted with the remaining six (6) colors Tan 525, Light Sage 560, Olive 527, Dark Green 528, Brown 529, and Bark Brown 561 areas of the camouflage pattern or when the ground shade is not dyed to Dark Cream 559 all seven (7) colors of the camouflage pattern shall be printed to match all seven (7) colors of the pattern. Resin bonded pigments shall not be used.

3.5.9 Visual shade matching. The color and appearance of the dyed or camouflage printed finished cloth shall match the standard sample when tested as specified in 4.5 (see 6.6).

3.5.10 Colorfastness. Unless otherwise, specified in the contract or purchase order documents, the finished cloth shall conform to the colorfastness requirements specified in Table I when tested as specified in 4.5.

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TABLE I. Colorfastness requirements (all styles).

Style	Color Evaluation	Laundering (Color Change & Staining) (3 cycles) (min.)	Light (after 40 AFU or 170 kJ/(m²nm) @ 420 nm) (min.) 1/	Perspiration (acid & alkaline) (Color Change and Staining) (min.)	Crocking Dry/Wet (min.)	Accelerated weathering (80 AFU or 340 kJ/(m²nm) @ 420 nm) (min.) 1/, 2/	Frosting (Carbon Black) (min.)
A - Solid Shades	All colors	3-4	3-4	3-4	3.5	3-4	N/A
B - Woodland Camouflage	All colors except Black 357	3-4	3-4	3-4	3.5	N/A	N/A
	Black 357 3/	3	3	3-4	2.0	N/A	3-4
C- Desert Camouflage 3-Color	All colors	3-4	3-4	3-4	3.5	N/A	N/A
E - Woodland MARPAT	All colors except Black 477	3-4	3-4	3-4	3.5	N/A	N/A
	Black 477 3/	3-4	3-4	3-4	3.0	N/A	3-4
F - Desert MARPAT	All colors	3-4	3-4	3-4	3.5	N/A	N/A
H - Operational Camouflage Pattern	Dk. Green 528, Brown 529, Bark Brown 561	3-4	3-4	3-4	3.5	N/A	N/A
	Dark Cream 599, Tan 525, Light Sage 560, Olive 527 2/	3-4	3	3-4	3.5	N/A	N/A

1/ AFU: AATCC Fading Units
2/ Style A only
3/ When using Carbon Black dyes

3.6 Pattern execution. The pattern on the printed finished cloth(s) shall match the standard sample with respect to design, colors, and registration of the respective areas. The various areas of the pattern shall be properly registered in relation to each other and shall present definite sharp demarcations and/or feathering as required for each color. Each pattern area shall show full coverage; skitteriness, feathering, haloing or trapping and off register exceeding that shown by the standard sample will not be acceptable. When a standard sample is not available for pattern execution, a pattern drawing will be provided (see 6.3), and the pattern on the finished cloth shall match that of the drawing (see 2.2.2. and 6.2). The pattern repeat for each style shall be as follows:

Woodland Camouflage - 27.25 (+1.25, -2.50) inches in the warp direction.
Desert Camouflage (3 color) - 16.75 (+1.25, -2.25) inches in the warp direction.
Woodland MARPAT - 35.00 (+1.50, -1.50) inches in the warp direction.
Desert MARPAT - 35.00 (+1.50, -1.50) inches in the warp direction.
Operational Camouflage Pattern (OCP) - 25.255 (+1.25, -2.50) inches in the warp direction and 68-inches maximum camouflage printed area in the filling direction.

3.7 Spectral reflectance. The spectral reflectance values for each style shall conform to the requirements specified in their respective applicable Tables II through IX when tested as specified in 4.5.

TABLE II. Spectral reflectance (percent), Style A.

Solid Shades														
Wavelength nanometers (nm)	Camouflage Green 483		Foliage Green 504		Urban Gray 505		Coyote 498		Coyote Brown 3758		Tan 380		Tan 499	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
600	3	10	8	26	12	26	8	20	8	20	N/A	N/A	8	26
620	3	10	8	26	14	26	8	20	8	20	N/A	N/A	8	26
640	3	10	8	28	14	28	8	22	8	22	N/A	N/A	8	30
660	3	11	10	30	14	30	8	24	8	26	N/A	N/A	8	34
680	3	13	10	34	18	34	12	24	10	27	N/A	N/A	12	38
700	4	28	12	38	24	38	12	34	12	53	25	53	12	40
720	5	40	16	42	26	42	16	42	16	54	25	54	16	46
740	7	52	16	46	30	46	22	46	20	55	25	55	22	50
760	11	60	18	48	32	48	30	50	21	56	26	56	30	50
780	17	64	18	48	34	48	34	54	21	57	27	57	34	54
800	24	67	20	50	34	50	36	56	22	58	28	58	36	56
820	32	70	22	54	36	54	38	58	23	59	30	59	38	58
840	37	71	24	54	38	54	38	58	24	62	33	62	38	58
860	40	73	26	56	40	56	40	60	25	65	36	65	40	60

TABLE III. Spectral reflectance (percent), Style B.

Woodland Camouflage Pattern						
Wavelengths (nanometers)	Light Green 354		Dark Green 355 & Brown 356		Black 357	
	Min	Max	Min	Max	Min	Max
600	8	20	3	9	N/A	N/A
620	8	20	3	9	N/A	N/A
640	8	20	3	9	N/A	N/A
660	8	20	3	12	N/A	N/A
680	10	30	3	16	N/A	N/A
700	18	50	5	32	N/A	20
720	22	54	7	44	N/A	30
740	30	56	12	52	N/A	33
760	35	58	18	56	N/A	33
780	40	62	26	56	N/A	34
800	55	80	34	56	N/A	34
820	55	80	42	60	N/A	35
840	55	84	44	60	N/A	35
860	60	84	44	60	N/A	35

TABLE IV. Spectral reflectance (percent), Style C.

Desert Camouflage Pattern (3-color)						
Wavelength, (nanometers)	Light Tan 492		Light Brown 493		Light Khaki 494	
	Min	Max	Min	Max	Min	Max
700	38	53	19	36	25	48
720	38	58	20	36	25	52
740	39	62	20	36	25	54
760	40	66	21	36	26	56
780	41	72	21	38	27	57
800	43	76	22	43	28	58
820	45	76	23	45	30	58
840	48	78	24	46	33	58
860	50	78	25	46	36	59

TABLE V. DELETED.

TABLE VI. Spectral reflectance (percent), Style E.

Marine Pattern (MARPAT) Woodland Camouflage Pattern						
Wavelengths (nanometers)	Khaki 475 & Coyote 476		Green 474		Black 477	
	Min	Max	Min	Max	Min	Max
600	8	20	3	9	N/A	N/A
620	8	20	3	9	N/A	N/A
640	8	20	3	9	N/A	N/A
660	8	20	3	12	N/A	N/A
680	10	30	3	16	N/A	N/A
700	18	50	5	32	N/A	20
720	22	54	7	44	N/A	30
740	30	56	12	52	N/A	33
760	35	58	18	56	N/A	33
780	40	62	26	56	N/A	34
800	55	80	34	56	N/A	34
820	55	80	42	60	N/A	35
840	55	84	44	60	N/A	35
860	60	84	44	60	N/A	35

TABLE VII. Spectral reflectance (percent), Style F.

Marine Pattern (MARPAT) Desert Camouflage Pattern						
Wavelength, (nanometers)	Light Tan 479		Highland 480 & Light Coyote 481		Urban Tan 478	
	Min	Max	Min	Max	Min	Max
700	38	53	19	36	25	48
720	38	58	20	36	25	52
740	39	62	20	36	25	54
760	40	66	21	36	26	56
780	41	72	21	38	27	57
800	43	76	22	43	28	58
820	45	76	23	45	30	58
840	48	78	24	46	33	58
860	50	78	25	46	36	59

TABLE VIII. - DELETED.

TABLE IX. Spectral reflectance (percent), Style H.

Operational Camouflage Pattern (OCP)						
Wavelength, (nanometers) (nm)	Tan 525 & Dark Cream 559		Olive 527, Light Sage 560 & Brown 529		Dark Green 528 & Bark Brown 561	
	Min	Max	Min	Max	Min	Max
600	22	44	12	30	3	12
620	24	45	12	30	3	12
640	24	45	12	32	4	12
660	25	45	12	32	4	13
680	28	45	14	34	4	18
700	28	48	14	36	6	25
720	30	52	16	39	6	27
740	32	55	18	41	10	29
760	36	56	20	43	14	33
780	38	57	22	45	18	36
800	40	57	22	45	20	37
820	44	58	24	46	20	38
840	46	59	26	47	21	39
860	48	60	28	48	21	40

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

TABLE X. Physical requirements.

Characteristic	Weight (oz./sq.yd.)		Yarns per inch (min.)		Breaking strength lbs. (min.)		Air permeability (cu.ft./min./sq.ft.)
	Min.	Max.	Warp	Filling	Warp	Filling	Max.
Type I Classes 1 and 2	8.5	9.5	35	28	500	300	10 1/
Type I Class 3	11.0	12.0	35	28	500	300	N/A
Type I Class 4	11.0	12.0	35	28	500	300	N/A
Type II Classes 1 and 2	6.5	7.5	41	36	450	280	N/A
Type II Class 3	9.0	10	41	36	450	280	N/A
Type III Classes 1 and 2	6.0	7.0	48	35	275	200	N/A

TABLE X. Physical requirements. - Continued

Characteristic	Weight (oz./sq. yd.)		Yarns per inch (min.)		Breaking strength lbs. (min.)		Air permeability (cu.ft./min./sq.ft.)
	Min.	Max.	Warp	Filling	Warp	Filling	Max.
Type III Class 3	7.0	8.0	48	35	300	225	N/A
Type III Class 4	8.0	9.5	48	35	360	270	N/A
Type IV Classes 1 and 2	N/A	5.5	58	38	200	155	N/A
Type IV Class 3	N/A	6.0	58	38	200	155	N/A
Type IV Class 4	N/A	7.5	58	38	200	155	N/A

1/ Requirement applicable to Type I, Class 1 (solid shades) only.

3.8.1 Tear strength. The Type IV, Class 2 cloth shall have a tear strength of 8.0 pounds minimum in both the warp and fill. Testing shall be as specified in 4.5.

3.8.1.1 Tongue tear strength. Type IV Class 3 cloth shall have a tongue tear strength of 16.0 pounds minimum in the warp direction and 14.0 pounds minimum in the filling direction. The Type IV, Class 4 shall have a tongue tear strength of 9.0 pounds minimum in the warp direction and 6.0 pounds minimum in the filling direction. Testing shall be as specified in 4.5.

3.8.2 Abrasion resistance. Unless otherwise specified in the end item use, contract or purchase order (see 6.2), the Type III, Class 4 cloth shall show abrasion resistance to 800 cycles minimum and Type IV, Class 3 shall show abrasion resistance to 700 cycles minimum and Type III, Class 3 and Type IV, Class 4 shall show abrasion resistance to 500 cycles minimum. Testing shall be as specified in 4.5.

3.8.3 Weave. The weave for all types and classes shall be plain with one (1) up and one (1) down. Testing shall be as specified in 4.5.

3.9 Finish. Classes 2, 3 and 4 cloths (all types) shall be given a water repellent treatment (see 3.9.1); Class 3 cloths (all types) shall be back coated (see 3.9.2) and the Class 4 cloths (Types I, III and IV) shall be coated/treated with a flame retardant and water repellent treatment (see 3.9.9).

3.9.1 Water repellency. The Class 2, 3, and 4 cloths (all types) shall be given a water repellent treatment and shall meet all water repellency characteristics referenced in this specification.

3.9.1.1 Spray rating. Three (3) individual determinations for Class 2 cloth (all types), shall be equal to or better than 90, 90, 80 initially. Three (3) individual determinations for the Class 3 (all types) and Class 4 (Type I, III and IV) cloth shall be equal to or better than 100, 100, 90 initially and 90, 90, 80 after one (1) laundering. Testing shall be as specified in 4.5.

3.9.1.2 Hydrostatic resistance. The Class 3 (Types I, II and III), back coated cloths and the Class 4 flame retardant treated/coated cloth (Types I, and III) shall show no leakage below a hydrostatic height of 35 centimeters. Testing shall be as specified in 4.5.

3.9.1.3 Dynamic water absorption (Class 2, 3 and 4). The Class 2 cloth (all types) shall not have dynamic water absorption greater than 25 percent initially. The cloths for Class 3 (all types), and Class 4 (Types I, and III) shall not show more than 20 percent dynamic water absorption initially and after one (1) laundering. Testing shall be as specified in 4.5.

3.9.2 Back coating. The Class 3 cloths (all types) shall be treated on the back side only with a suitable clear polyurethane coating compound and shall show water repellency characteristics on the face side. If plasticizers are used in the coating, they shall be limited to those compatible with polyurethane and not promoting of mildew and/or mold growth with a preference given to phthalate-free plasticizers.

3.9.3 Blocking. The blocking properties at 180°F of the finished back treated side of the Class 3 cloths (all types) and Class 4 cloths (Types I, III and IV), shall not be greater than a No. 3 rating. When Class 3 cloth is procured for Airdrop contracts, the blocking properties shall not be greater than a No. 2 rating. Testing shall be as specified in 4.5.

3.9.4 Resistance to organic liquid. The finished Classes 2, 3 and 4 cloths (all types) shall show no wetting by N-Tetradecane minimum initially and after one (1) laundering. Testing shall be as specified in 4.5.

3.9.5 Resistance to Diethyltoluamide (DEET). The finished Class 3 cloths (all types) (and Class 4 cloths (Types I, III and IV) shall show no lifting, tackiness, solution, pickoff or adherence to itself greater than a scale rating of "2" (trace blocking). Testing shall be as specified in 4.5.

3.9.6 Resistance to low temperature. The finished Class 3 cloths (all types), and Class 4 cloths (Types I and III), shall not show any cracking, flaking or separation of the coating from the base cloth. Testing shall be as specified in 4.5.

3.9.7 Resistance to high humidity. For the finished Class 3 cloths (all types), and Class 4 cloths (Types I and III), the coating shall not show stiffness, brittleness, softness or tackiness, and shall show no evidence of cracking or crazing. Testing shall be as specified in 4.5.

3.9.8 Stiffness. The stiffness of the Types I, II and III Class 3 finished back coated cloths and Types I, III, and IV, Class 4 back coated cloths shall not be more than 0.034 pounds per square inch (psi) in the warp or filling directions. The Type IV Class 3 cloth when used for Army uniform components shall show a maximum stiffness of 0.002 psi at 32°F and 70°F when tested

as specified in 4.5. The Type IV Class 3 cloth when used for Marine Corps uniform components, shall show a maximum stiffness of 11 centimeters in both the warp and filling when tested as specified in 4.5.

3.9.9 Flame resistance. The Class 4 flame retardant cloths (Types I, III and IV) shall be flame retardant treated and shall have an average after-flame time of not more than 3.0 seconds in both the warp and fill directions; an average after-glow time of not more than 2.0 seconds in both the warp and fill directions and an average char length of not more than 4-1/2-inches initially and after five (5) launderings in both the warp and fill directions. The average melt/drip after removal of source flame shall be less than one (1) droplet in both the warp and fill directions. Testing shall be as specified in 4.5.

3.10 pH. The pH value of the water extract of the finished cloths (all types and classes) shall be not less than 5.0 or more than 8.5 when tested as specified in 4.5.

3.11 Dimensional stability. The finished cloth shall have an average dimensional change of no more than 3.0 percent in the warp and no more than 2.0 percent in the filling directions, with no single value over 3.5 and 2.5 percent, respectively after one (1) laundering cycle. Testing shall be as specified in 4.5.

3.12 Width. For Government procurements only, unless otherwise specified, the width of the finished cloth shall be as specified in the contract or purchase order (see 6.2) and shall be the minimum acceptable width inclusive of selvages.

3.13 Length and put-up. For Government procurements only, unless otherwise specified (see 6.2), the cloth shall be furnished full width in continuous lengths, each not less than 40-yards. Each length shall be put-up full width on a roll as specified in 5.1.

3.14 Face or back identification. The face or back side of Style A, solid shade dyed cloth shall be identified by stamping that side with the word “FACE” or “BACK” at each end of the roll.

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

3.16 Toxicity The finished cloth shall not present a health hazard and shall show compatibility with prolonged, direct skin contact when tested as specified in 4.5. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.17 Workmanship. The finished cloths shall be uniform in quality and shall conform to the quality of product established by this specification. The occurrence of defects or demerit points, as specified in 4.4, shall not exceed the criteria specified in the contract or purchase order.

4. VERIFICATION

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

a. First article inspection (see 4.2).
b. Conformance inspection (see 4.3).

4.2 First article inspection. A first article, submitted in accordance with 3.1, shall be inspected, examined for appearance, color and visual defects in 4.4 and tested for the characteristics specified in 4.5 through 4.6.7 as applicable.

4.2.1 First article samples. Unless otherwise specified in the contract or purchase order, the sample unit shall be one (1) continuous 5 yard length of full width, finished cloth.

4.3 Conformance inspection. Conformance inspection shall include the visual examination of 4.4 and the tests of 4.5 through 4.6.7 as applicable. Sampling for inspection shall be performed in accordance with ASQ/ANSI Z1.4 and with quality acceptance levels (AQL) as specified in the contract and/or order, except where otherwise indicated.

4.3.1 Inspection conditions. Unless otherwise specified, excluded, amended, modified or qualified in this specification or applicable procurement documents (see 6.2), all inspections shall be performed in accordance with all the requirements of referenced documents.

4.4 Visual examination. Each roll in the sample shall be examined yard-by-yard on the face side for defects in accordance with Type I of MIL-STD-3064 for all Types and Classes, except Class 3 and Class 4 which shall be examined in accordance with Type II of MIL-STD-3064. Additionally, to determine the presence of unacceptable selvage conditions, the following procedure shall be followed: During the visual examination, the perch shall be stopped a minimum of three (3) times for each roll in the sample, tension removed and the finished cloth examined for selvage conditions. A waviness in the selvage or significant ripples diagonally across the width of the fabric is an indication of slack or tight selvage.

4.4.1 Roll identification and marking (face or back) examination. During the yard-by-yard examination, each roll in the sample shall be examined for defects as specified in MIL-STD-3064.

4.4.2 Shade variation examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade variation as specified in MIL-STD-3064.

4.4.3 Length examination. For Government procurements only, during the yard-by-yard examination, each roll in the sample shall be examined for length as specified in MIL-STD-3064.

4.5 Material testing. The cloth shall be tested for the characteristics listed in Table XI. The methods of testing as specified wherever applicable and as listed in Table XI shall be followed.

All test reports shall contain the individual values utilized in expressing the final results. The sample unit shall be five (5) continuous yards full width of the finished cloth for all physical and chemical tests. The lot shall be unacceptable if one (1) or more tests fail to meet the requirement specified. The sample size shall be in accordance with the following:

Lot size (yards)	Sample size (sample units)
800 or less	2
801 up to and including 22,000	3
22,001 and over	5

TABLE XI. Material tests.

Characteristic	Requirement Paragraph	Test Method
Yarn:		
Fiber identification	3.4.1	AATCC TM20 (see 6.7)
Yarn denier	3.4.1.1	ASTM D1907/D1907M
Visual shade matching	3.5.9	4.6.1
Colorfastness to:		
Laundering	Table I	AATCC TM61, Test 1A 1/
Light	Table I	AATCC TM16.3 Option 3 2/
Perspiration (acid & alkaline)	Table I	AATCC TM15 1/
Crocking (wet and dry)	Table I	AATCC TM8 3/
Accelerated Weathering (Style A only)	Table I	AATCC TM169 Option 3 2/
Frosting (carbon black only) (300 cycles)	Table I	AATCC TM119 2/
Pattern execution	3.6	Visual
Spectral reflectance	Tables II-IX	4.6.2
Weight	Table X	ASTM D3776/D3776M, Option C
Yarns per inch	Table X	ASTM D3775
Breaking strength	Table X	ASTM D5034
Air permeability (Type I Class 1 and 2)	Table X	ASTM D737
Tear strength (Type IV Class 2)	3.8.1	ASTM D1424
Tongue tear strength (Type IV, Class 3 & 4)	3.8.1.1	ASTM D 2261
Abrasion resistance	3.8.2	ASTM D3884 4/

TABLE XI. End item tests. - Continued

Characteristic	Requirement Paragraph	Test Method
Weave	3.8.3	Visual
Spray rating Initial: All Types (Classes 2 & 3) and Types I, III and IV (Class 4) After one (1) laundering All Types (Class 3) and Types I, III and IV (Class 4)	3.9.1.1 3.9.1.1	AATCC TM22 AATCC TM135, (3)(V)Aiii and AATCC TM22
Hydrostatic resistance Types I, II & III (Class 3) Types I and III (Class 4)	3.9.1.2	AATCC TM127 or ASTM D751, 5/, 6/
Dynamic absorption: Initial: All Types (Classes 2 & 3) and Types I and III (Class 4) After one (1) laundering All Types (Classes 3) and Types I & III (Class 4)	3.9.1.3 3.9.1.3	AATCC TM70 AATCC TM135, (3)(V)Aiii and AATCC TM70
Blocking: All Types, (Classes 3) & Type I, III and IV (Class 4)	3.9.3	ASTM D751, and 4.6.3
Resistance to organic liquid: Initial: All Types (Classes 2, 3 & 4) After one (1) laundering: All Types (Classes 2, 3 & 4)	3.9.4 3.9.4	AATCC TM118 7/ AATCC TM135, (3)(V)Aiii and AATCC TM118
Resistance to Diethyltoluamide (DEET): All Types (Class 3) and Type I, III & IV (Class 4)	3.9.5	4.6.4
Resistance to low temperature: All Types (Class 3) and Types I & III (Class 4)	3.9.6	4.6.5
Resistance to high humidity: All Types (Class 3) and Types I & III (Class 4)	3.9.7	4.6.6
Stiffness: Types I, II & III (Class 3) and Types I, III & IV (Class 4) Type IV (Class 3) Army @ 32 °F& 70°F Type IV (Class 3) (Marine Corps only)	3.9.8 3.9.8 3.9.8	ASTM D747 ASTM D747 4.6.7

TABLE XI. Material tests. - Continued

Characteristic	Requirement Paragraph	Test Method
Flame retardant: Type I, III and IV (Class 4) Initial After five (5) launderings	 3.9.9 3.9.9	 ASTM D6413/D6413M 8/ AATCC TM135, (3)(V)Aiii & ASTM D6413/D6413M 8/
pH	3.10	AATCC TM81
Dimensional stability(after 1 cycle)	3.11	AATCC TM135, (3)(V)Aiii
Toxicity	3.16	4.7

1/ Rated using the AATCC EP1, Evaluation Procedure for Gray Scale for Color Change and AATCC EP2, Evaluation Procedure for Gray Scale for Staining.
2/ Rated using the AATCC EP1, Evaluation Procedure for Gray Scale for Color Change
3/ Rated using the AATCC EP8, Evaluation Procedure for AATCC 9-Step Chromatic Transference Scale
4/ H-18 abrasive wheel with 1000 gram load shall be used. A hole shall be defined as the wear through of one (1) warp end and one (1) filling yarn at the same location.
5/ Leakage is defined as the appearance of water at three or more different places within the 4-1/2-inch diameter test area at a hydrostatic height of 35.0 centimeters. The uncoated side of the coated cloth shall contact the water.
6/ In cases of dispute, the ASTM method prevails
7/ Test for N-tetradecane minimum only.
8/ Specimen which burn along the edge of the specimen holder shall be considered invalid and retested.

4.6 Methods of testing and inspection.

4.6.1 Visual shade matching. The color and appearance of the cloth shall match the standard sample when viewed using the AATCC EP9, Option C (see 6.6), with sources simulating artificial daylight D75 illuminant with a color temperature of 7500K (± 200) illumination of 100 (± 20) foot candles, and shall be a good match to the standard sample under incandescent A illuminant with a color temperature of 2856K.

4.6.2 Spectral reflectance test. Spectral reflectance data shall be obtained from 600 to 860 nanometers (nm) for Woodland Camouflage (Styles B and E), and Operational Camouflage (OCP – Style H) and most solids, 700 to 860 nanometers (nm) for Desert Camouflage (Styles C and at 20 nm intervals on a spectrophotometer relative to the polytetrafluoroethylene (PTFE) family of compounds, the preferred white standard. Other white reference materials may be used provided they are calibrated to absolute white or vitrolite tiles. The spectral band width shall be less than 20 nm at 860 nm. Reflectance measurements shall be made by either the mono-chromatic or polychromatic mode of operation. When the poly-chromatic mode of operation is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a continuous source that simulates either CIE Source A or CIE Source D65.

Measurements shall be taken on a minimum of two (2) different areas and the data averaged. The measured areas should be at least 6-inches away from the selvage. The specimen shall be measured as a single layer backed with layers of the same fabric and shade as follows: Styles B and E (Woodland print cloths) three (3) backing layers of the same shade for Light Green 354, Dark Green 355 and Brown 356 colors and two (2) backing layers of the same shade for Black 357. Styles C and F (Desert print cloths) and Style H (OCP) with four (4) layers of the same shade. The specimen shall be viewed at an angle no greater than 10° from normal, with the specular component included. Measurements shall be taken on a minimum of two (2) different areas. Specimens shall be oriented in different directions during testing. When possible, the specimens tested shall not contain the same yarns when presented to the sample port. Camouflage materials should be measured with the appropriate aperture size to ensure that only one (1) color is measured at a time. (NOTE: Always use the largest aperture possible). The diameter for standard aperture size used in the color measurement device shall be 1.0 to 1.25-inches for most solid colors (Style A), Woodland (Style B) and Desert Camouflage (Style C) and 0.3725-inches or larger for the Woodland MARPAT (Style E), Desert Camouflage MARPAT (Style F), and OCP (Style H). Photometric accuracy of the spectrophotometer shall be within one (1) percent and wavelength accuracy within two (2) nm. Any color having spectral reflectance values falling outside the limits at four (4) or more of the wavelengths specified shall be considered a test failure.

4.6.3 Blocking. The test shall be performed in accordance with ASTM D751, Blocking Resistance at Elevated Temperatures, except that the test shall be performed at a temperature of 180 (± 2) ºF for 30 minutes. Evaluate the resistance of the specimen to blocking by the scale given below:

1 – No Blocking. - Cloth surfaces are free and separate without any evidence of cohesion or adhesion.
2 – Trace blocking. - Cloth surfaces show slight cohesion or adhesion.
3 – Slight blocking. - Cloth surfaces must be lightly peeled to separate.
4 – Blocking. - Cloth surfaces separate with difficulty or coating is removed during separation.

4.6.4 Resistance to Diethyltoluamide (DEET). The DEET solution contains 75 percent diethyltoluamide and 25 percent ethanol (see 4.6.4.1). Three (3) drops of the DEET solution shall be placed in the center of a 4 by 8-inch specimen of the finished cloth with the coated side up. The specimen shall be folded to form a 4 by 4-inch square with the coated side folded onto itself. The folded specimen shall then be placed between two (2) 6 by 6-inch glass plates and a 4-pound weight placed on the assembly and left at standard conditions for 16 hours. The specimen shall then be removed from between the glass plates, and immediately rated using the blocking scale ratings as shown in 4.6.3.

4.6.4.1 DEET reagent. The DEET reagent is an insect repellent reagent solution of 75 percent by weight (min) of diethyltoluamide and the remainder denatured alcohol. The diethyltoluamide component of the solution shall be a technical grade and containing N, N-diethylmetatoluamide of not less than 95 percent purity and the remainder shall consist of entirely or mixture of ortho or para isomers of N, N- diethyltoluamide. The denatured alcohol

component of the solution shall be ethanol, U.S.P. 94.9 percent by volume and denatured in accordance with, The Code of Federal Regulations 27 CFR 21, Formula 40 (see 2.2.2). The diethyltoluamide shall be registered with the U. S. Environmental Protection Agency in accordance with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) (see 2.2.2).

4.6.5 Resistance to low temperature. The test shall be performed in accordance with ASTM D751, Low Temperature Crack Test, with the exposure time 4-hours (min.) at a test temperature of -40°F (± 5)°F; the test for hydrostatic resistance shall not be performed. The specimen shall be removed from the chamber, allowed to come to room temperature and visually examined for any signs of cracking, flaking or separation of the coating from the base cloth. Unless otherwise specified, at least three (3) specimens from the sample shall be tested. Results of tests shall be expressed as "pass" or "fail" as exhibiting visible coating nonconformities.

4.6.6 Resistance to high humidity. Three 4 by 4-inch specimens shall be laid flat, coated side up, on a supporting plate and the assembly placed in a desiccator containing water in the lower portion. The water level shall be approximately 1-inch below the specimens. The lid of the desiccator shall be put in place and the desiccator placed in a circulating air oven having a temperature of 125°F (± 2)°F for a period of seven (7) days. At the end of the aging period, each specimen shall be removed from the desiccator, visually examined for colorfastness and then visually examined for any evidence of stiffness, brittleness, softness, tackiness, cracking or crazing.

4.6.7 Stiffness test (Marine Corps only).

Apparatus. The test apparatus shall consist of a framework with a rotating, two (2) roller spindle assembly and a calibrated linear measuring tool. Of the assembly, the two (2) rolls, each 1-inch in diameter and approximately 4.25-inches in length, are positioned parallel to one another and held in contact by spring tension. The line of contact of the two (2) rolls shall coincide with the axis of rotation of the spindle assembly attached to the fixed framework. A pointer shall be attached to the spindle assembly to indicate the relative angular position of the assembly to a moveable circular scale calibrated in degrees. The rolls of the spindle assembly shall be capable of being rotated on their axis using a slow gear adjustment to adjust the length of the test specimen. The assembly shall rotate, in both clockwise and counterclockwise directions, at a uniform rate of one (1) revolution per 60 (± 5) seconds. The linear measuring tool, graduated to 0.1 mm, shall be used to measure the length of a test specimen extending perpendicular from the line of contact or nip of the two (2) rolls.

Test specimens. The specimen shall be a rectangle of cloth 1-1/4-inches wide by 6- to 12-inches long with the longer dimension parallel to the direction being tested; unless otherwise specified, the warp or machine direction of the sample shall be tested. The specimens shall be cut with clean, straight and parallel edges from locations diagonally across the width of the sample and they shall not contain any evidence of creasing or folding.

Number of determinations. Unless otherwise specified, five (5) specimens from each of the designated directions shall be tested from each sample unit.

Procedure. Conditioned test specimens in accordance with ASTM D1776/D1776M and test with specimens and apparatus in that environment, unless otherwise specified. Level the apparatus, before use, so that the spindle assembly is horizontal. Secure an end of the test specimen in and perpendicular to the nip of the rolls with enough length projecting on the left so that on rotating the spindle assembly clockwise, the projecting end of the test specimen falls through the vertical to the right. On rotating the spindle assembly counterclockwise from the stop or end point, the test specimen should not fall back to the left until it is turned through an angle of 90 degrees. Shorten the projecting length until a rotation of 90 (± 2) degrees causes the end of the test specimen to fall from one side to the other. This defines the critical length which is measured from the line gripping the specimen (or nip of the rollers) to its free end. Measure the critical length of the test specimen in millimeters and to the nearest millimeter using the linear measuring tool. Report all individual readings of critical length and the average of results for the specified direction of test of each sample unit.

4.7 Toxicity test. Unless otherwise specified (see 6.2), an acute dermal irritation study and a skin sensitization study shall be conducted. When the results of the studies indicate the finished cloth is not a sensitizer or irritant, a Repeat Insult Patch Test shall be performed in accordance with the Modified Draize Procedure (see 2.3). If the toxicity requirement (see 3.16) can be demonstrated with historical use data on the finishing treatments used, toxicity testing may not be required (see 6.2).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD or in- house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Department or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The cloth is intended for use in the manufacture of load bearing vests, field packs, body armor protective vests, duffel bags, reinforcement elbow and knee patches and other field items.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this Specification.
b. Type, class and style of cloth required (see 1.2).
c. The specific issue of individual documents referenced (see 2.2 and 2.3).
d. When first article is required (see 3.1, 4.2 and 6.3).
e. Color required if Style A is specified (see 3.5.1).
f. Pattern drawing and/or standard sample, if printed camouflage required (see 3.6).
g. When abrasion requirement is not applicable (see 3.8.2)
h. Width of cloth required, (see 3.12).
i. Length required if other than specified (see 3.13).
j. When toxicity testing is required (see 3.16 and 4.7).
k. Conformance inspection conditions (see 4.3)
l. Inspection conditions (see 4.3.1).
m. Packaging requirements (see 5.1).

6.3 Standard sample. For access to samples and pattern drawings, address the contracting activity issuing the invitation for bids or request for proposal.

6.4 Supersession data. This document supersedes MIL-C-43734D. The supersession data is as follows:

MIL-C-43734D	MIL-DTL-32439
Class 1	Type I, Class 1, Style A
Class 2	Type I, Class 2, Style B
Class 3	Type I, Class 3, Style A
Class 4	Type III, Class 3, Style B
Class 5	Type III, Class 2, Style B

6.5 Replica set. The SDL Atlas Slub/Knot Replica Set is not available from their website at this time. Recommend calling customer service, 1-803-329-2110.

6.6 Visual shade matching. In 2019, Option A of AATCC Evaluation Procedure 9, Visual Assessment of Color Difference of Textiles was changed to Option C. NOTE: In case of confusion, the viewing geometry should be such that the specimen plane and illumination source are parallel to each other and aligned so that the light flux is incident at the center of the specimen plane, which is set at a 35 (± 5°) angle relative to the horizontal. The observer will view the specimens at a 90° angle, relative to the plane of the specimens.

6.7 Certificate of compliance. The contracting activity may select to accept a certificate of compliance for stated requirement.

6.8 Subject term (key word) listing).

Vest, Survival,
AIRSAVE Bag,
Camouflage, Desert,
Camouflage, MARPAT
Camouflage, Woodland
Camouflage, OCP
Duffel
Equipage item
Flame retardant
Water repellency

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of changes.

Custodians:
Army - GL
Navy - NU
Air Force - 11

Preparing Activity:
DLA-CT

Review Activities:
Army – AV, MD
Navy – AS, MC

(Project: 8305-2020-017)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using ASSIST Online database at https://assist.dla.mil/.