

INCH-POUND

MIL-C-43906C  
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SUPERSEDING  
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## MILITARY SPECIFICATION

## CLOTH, COATED, NYLON, POLYURETHANE DOUBLE COATED

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

## 1. SCOPE

1.1 Scope. This specification covers two types of nylon cloth coated on both sides with polyurethane.

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

- Type I - Camouflage Green 483
- Type II - Woodland Camouflage Printed

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be used in improving this document should be addressed to: U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5019 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 8305

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SPECIFICATIONS

FEDERAL

- O-I-503 - Insect Repellent, Clothing and Personal Application
- PPP-P-1136 - Packaging of Coated (Plastic; Rubber) and Laminated Fabrics

STANDARDS

FEDERAL

- FED-STD-191 - Textile Test Methods

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-1487 - Glossary of Cloth Coating Imperfections

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

DRAWINGS

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

- 2-1-1516 - Woodland Pattern - 48 inches
- 2-1-1516B - Woodland Pattern - 60 inches

(Copies of drawings are available from the U.S. Army Natick Research, Development, and Engineering Center, ATTN: SIRNC-UX, Natick MA 01760-5017.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issue of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 1424 - Tear Resistance of Woven Fabrics by Falling-Pendulum (Elmendorf) Apparatus
- D 5035 - Breaking Force and Elongation of Textiles

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

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

Technical Manual of the American Association of Textile Chemists  
and Colorists

## AATCC Method-169 - Weather Resistance of Textiles: Xenon Lamp Exposure

(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.)

(Non-Government standards and other publications are normally available from organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 Standard sample. The coated 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 6.4).

3.3 Materials. It is encouraged that recycled material be used when practical as long as it meets the requirements of this specification.

3.3.1 Base cloth. The base cloth shall be cloth, nylon, oxford weave, semi-dull or bright filament nylon, 200 to 210 denier, 60 by 50 yarns per inch (minimum), 3.0 to 3.5 ounces per square yard. As an alternative for the type I coated cloth only, the base cloth shall be cloth, nylon, plain weave, semi-dull or bright filament nylon, 200 to 210 denier, 40 by 40 yarns per inch (minimum), 2.0 to 2.4 ounces per square yard. The base cloth shall be scoured and heat set prior to coating. After heat set testing as specified in 4.4.1, the cloth shall show no appreciable distortion or puckering, and no more than 2.0 percent dimensional change in either the warp or filling direction.

3.3.1.1 Base cloth color for type I. The cloth shall be natural color, undyed (see 3.3.2).

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3.3.1.2 Base cloth color for type II, printed. The base cloth shall be dyed and printed to the Woodland camouflage pattern. The base cloth shall be dyed approximating Light Green 354 shade and overprinted by using an acid dyestuff combination (see 6.8). The cloth shall be overprinted using the Woodland camouflage pattern obtained by roller or screen printing using four rollers or screens as appropriate for the Light Green 354, Dark Green 355, Dark Brown 356 and Black 357 (see 6.8) areas of the pattern.

3.3.1.2.1 Pattern execution, type II. The pattern shall reproduce the standard sample in respect to design, colors, and registration of the respective areas. The pattern repeat of the dyed, printed, and finished cloth shall be 27.25 +1.25 -2.50 inches in the warp direction. The various areas of the pattern shall be properly registered in relation to each other and present definite sharp demarcations with a minimum of feathering or spew. 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. When the standard sample is not referenced for pattern execution or design, a pattern drawing shall be provided, and the pattern on the finished cloth shall match that of the drawing (see 6.2 and 6.3).

3.3.2 Coating compound, type I. The coating compound shall be a composition of polyurethane suitably compounded and pigmented to a dull Camouflage Green 483 color. The pigment system shall be selected to produce a coated fabric with the spectral reflectance value specified in 3.5.4.1. The use of an acrylic anchor coat only is permissible. No plasticizer shall be used in the coating compound. The major portion of vehicle solids in the coating compound shall be polyurethane. If necessary, a thermoplastic polyurethane top coating may be used on the back side only of the coated cloth in order to meet the requirement for seam tape adhesion.

3.3.3 Coating compound, type II. The coating compound shall be a composition of unpigmented polyurethane suitably compounded with a dulling agent to produce a clear, dull coating. The use of an acrylic anchor coat only is permissible. No plasticizer shall be used in the coating compound. The major portion of vehicle solids in the coating compound shall be polyurethane. If necessary, a thermoplastic polyurethane top coating may be used on the back side only of the coated cloth in order to meet the requirement for seam tape adhesion.

3.3.4 Dusting powder. If dusting powder is used for application to the coated cloth, it shall be whiting, talc, or finely divided mineral material which does not support mildew growth.

3.4 Coated cloth. The base cloth specified in 3.3.1 shall be coated on the face side with 2.0 to 2.5 ounces per square yard and on the back side with 1.0 to 1.25 ounces per square yard of the coating compound specified in 3.3.2 for type I coated cloth or 3.3.3 for type II coated cloth. At the option of the contractor, the coated cloth may be dusted with the dusting

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powder specified in 3.3.4. The dusting powder shall not be applied prior to final curing of the coated fabric and shall be easily removed with a damp cloth. The coated cloth shall meet the requirements specified in table I when tested as specified in 4.4.3.

TABLE I. Physical requirements of coated cloth

Characteristic	Requirement	
	Minimum	Maximum
Weight, oz./sq. yd.	5.5	7.2
Breaking strength, pounds/inch width:		
Warp	120	-
Filling	85	-
Tearing strength, grams:		
Warp	1850	-
Filling	1650	-
Hydrostatic resistance, psi:		
Initial	200	-
After accelerated weathering	150 <u>1/</u>	-
After abrasion	150	-
After strength of coating	150	-
After high humidity	150 <u>1/</u>	-
Colorfastness after accelerated weathering	No appreciable change <u>2/</u>	-
Colorfastness after high humidity	No appreciable change <u>2/</u>	-
Stiffness, warp only cm:		
At 70°F	-	10
At 0°F	-	13
Adhesion of coating, lbs./2-inch width		
Face side	12.0	
Back side	6.0	
Blocking, scale rating	-	(2)
Resistance to leakage	No leakage <u>3/</u>	-
Resistance to diethyltoluamide	<u>4/</u>	-
Adhesion of seam tape, lbs.	3.0	

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- 1/ The coating shall not become stiff and brittle nor soft and tacky and there shall be no evidence of cracking or crazing under visual examination.
- 2/ "Appreciable change in color" means a change that is immediately noticeable on comparison of the test specimen with the original, unexposed sample. If closer inspection or a change of angle of light is required to make apparent a slight change of color, the change is not considered appreciable.
- 3/ Leakage is defined as the appearance of water at three or more different places within the 4-1/2 inch diameter test area.
- 4/ The coated cloth shall show no lifting of the coating, no tackiness, no solution, no pickoff of the coating, no adherence of the coating to itself greater than scale rating (3) (slight blocking).

3.5 Color of coated cloth.

3.5.1 Type I. The color of the finished type I coated cloth shall be dull Camouflage Green 483.

3.5.2 Type II. The color of the finished type II coated cloth shall be Light Green 354, Dark Green 355, Dark Brown 356, and Black 357 with each area matching the specific colors of the Woodland camouflage pattern on the standard sample (see 6.3).

3.5.3 Matching. The color of the finished cloth shall match the standard sample when viewed under filtered tungsten lamps that approximate artificial daylight and that have a correlated color temperature of  $7500 \pm 200$  K with illumination of  $100 \pm 20$  foot candles and shall be a good match to the standard sample under incandescent lamplight at  $2300 \pm 200$  K.

3.5.4 Spectral reflectance.

3.5.4.1 Type I. The spectral reflectance values of the Camouflage Green 483 finished cloth shall conform to the requirements specified in table II when tested as specified in 4.4.3.

TABLE II. Spectral reflectance requirements, type I  
Camouflage Green 483

Wavelength nanometers	Reflectance (%)		Wavelength nanometers	Reflectance (%)	
	Min.	Max.		Min.	Max.
600	5	12	740	24	42
620	5	12	760	32	50
640	5	12	780	38	56
660	5	13	800	41	60

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TABLE II. Spectral reflectance requirements, type I  
Camouflage Green 483 (cont'd)

Wavelength nanometers	Reflectance (%)		Wavelength nanometers	Reflectance (%)	
	Min.	Max.		Min.	Max.
680	6	15	820	43	63
700	9	21	840	45	65
720	15	30	860	46	66

3.5.4.2 Type II. The spectral reflectance of the colors in the 4-color camouflage printed finished cloth shall conform to the requirements specified in table III when tested as specified in 4.4.3 (see 6.8).

TABLE III. Spectral reflectance requirements, type II

Wavelength nanometers	Reflectance values %				
	Light Green 354		Dark Green 355 and Brown 356		Black 357
	min.	max.	min.	max.	max.
600	8	20	3	13	10
620	8	20	3	13	10
640	8	20	3	13	10
660	8	22	3	13	10
680	8	36	3	22	10
700	14	60	8	46	10
720	26	78	20	66	10
740	40	90	30	80	10
760	50	92	32	88	10
780	55	92	32	90	10
800	55	92	32	90	10
820	55	92	32	90	10
840	55	92	32	90	10
860	55	92	32	90	10

3.6 Width. The minimum overall width, after selvage trimming, shall be as specified (see 6.2). Selvages shall be trimmed to give a straight, uniform edge.

3.7 Length and put-up. The coated cloth shall be put-up in rolls as specified in 5.1. The minimum length of any one roll shall be 50 yards. The maximum number of pieces per roll shall be three and no single piece shall be less than 25 yards in length. The ends of the pieces shall be overlapped, not joined by a seam.

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3.7.1 Face side identification. The face side of the cloth shall be identified by applying a stamping on that side of the cloth with the word "Face" on each end of each individual piece.

3.8 Odor. The coated cloth shall be free from any objectionable odor. Characteristic odor of coating is not considered objectionable.

3.9 Workmanship. The finished coated cloth shall conform to the quality of product established by this specification. The occurrence of defects shall not exceed the applicable acceptable quality levels.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Responsibility for dimensional requirements. Unless otherwise specified in the contract or purchase order, the contractor is responsible for ensuring that all specified dimensions have been met. When dimensions cannot be examined on the end item, inspection shall be made at any point, or at all points in the manufacturing process necessary to assure compliance with all dimensional requirements.

4.1.3 Certificate of compliance. Where certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

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

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

4.3 First article inspection. When a first article is required (see 6.2), it shall be examined for the defects listed in 4.4.2 and shall be tested for the characteristics specified in table VI. The presence of any defect or failure of any test shall be cause for rejection of the first article.

4.4 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

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 specification or applicable purchase document.

4.4.1.1 Component and material certification. A certificate of compliance may be acceptable as evidence that the characteristics listed in table IV conform to the specified requirements.

TABLE IV. Component tests

Characteristic	Requirement paragraph	Test method
Base Cloth:		
Material identification	3.3.1	1530 of FED-STD-191
Weave	3.3.1	Visual
Yarns per inch	3.3.1	5050 of FED-STD-191
Weight	3.3.1	5041 of FED-STD-191
Denier	3.3.1	-
Luster and type	3.3.1	-
Scouring	3.3.1	-
Heat set	3.3.1	<u>1</u> /
Color	3.3.1.1 and 3.3.1.2	Visual
Coating Compound:		
Composition	3.3.2 and 3.3.3	-
Plasticizer prohibition	3.3.2 and 3.3.3	-
Dusting powder (when used)	3.3.4	-

1/ Cut a minimum 12- by 12-inch square specimen from the base cloth with the length and width parallel to the warp and filling. Measure and record the length and width of the specimen. Place the specimen flat without tension in an oven and expose to a temperature of  $280^{\circ} \pm 2^{\circ}\text{F}$  for 2 hours. Remove specimen from oven and condition under standard conditions

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as defined in section 4 of FED-STD-191 for a minimum of 4 hours. Then visually compare the conditioned specimen with the original unheated cloth for distortion or puckering. Remeasure the conditioned specimen and calculate the dimensional change as follows:

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

Where: A = Initial measurement

B = Measurement after heating and conditioning

#### 4.4.2 End item examination.

4.4.2.1 Yard-by-yard examination. During the yard-by-yard examination, each roll in the sample shall be examined for the defects listed below. The required yardage of each roll in the sample shall be examined on both sides. The same yardage shall be given a throughlight inspection for pinholes and thinly coated areas. The through-light inspection shall be performed in accordance with MIL-STD-1487. The defects found shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition of the cloth, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each warpwise yard or fraction thereof in which it occurs. The sample unit shall be 1 linear yard. The inspection level shall be II and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 4.0. The number of rolls from which the sample yardage is to be selected shall be in accordance with table V. The sample yardage shall be apportioned equally among the selected rolls.

Examine	Defect
Coating	Any cut, hole, tear, scratch, or abrasion mark Any pinhole Any uncoated area Any thinly coated area (applies to face side only) Any pit, blister, tunnel, or delamination of coating Any lump or heavily coated area Any crease or wrinkle resulting in doubling or adhesion of surfaces that cannot be corrected by manual pressure Any spot, stain, or streak more than 1 inch in combined directions <u>1/</u> Any embedded foreign matter Any scorch or burn Any piece not coated on both sides Any objectionable odor <u>2/</u> Not clean Curled, folded, scalloped or rolled edges

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Examine	Defect
Width	Trimmed width less than minimum specified Selvages not trimmed Edges not straight and uniform
Type II (applies to face side only)	Any skitteriness of pattern exceeding that shown by standard sample Pattern design not equal to standard sample Excessive feathering or spew of pattern Pattern repeat not equal to the standard pattern Warpwise pattern repeat less than 24.75 inches or more than 28.50 inches

- 1/ Clearly visible at normal inspection distance (approximately 3 feet).
- 2/ Odors of chemicals commonly used in coating compounds shall not be regarded as objectionable.

TABLE V. Sample size and acceptance criteria

Lot size (yards)	Sample size (rolls)	Acceptance number <u>2/</u>
Up to 1200 inclusive <u>1/</u>	3	0
1201 up to and including 3200	5	0
3201 up to and including 10,000	8	0
10,001 up to and including 35,000	13	0
35,001 up to and including 150,000	20	1
150,001 and over	32	2

- 1/ If lot contains fewer than three rolls, each roll in the lot shall be examined.
- 2/ Applicable to length examination defects only (see 4.4.2.2).

4.4.2.2 Length examination. Each roll of cloth used in the yard by yard examination shall be examined for the defects listed below. If the total number of defects in the sample rolls exceeds the applicable acceptance number specified in table V or if the total of the actual lengths of the sample rolls is less than the total of the lengths marked on the roll tickets, the lot shall be rejected.

- Any roll containing more than three pieces.
- Any piece in roll less than 25 yards in length.
- Any roll with a total length of less than 50 yards.

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Any roll with a total length more than 2 yards less than that marked on ticket.

Any piece joined by a seam.

Any piece not marked with the word "Face" on both ends of the piece.

4.4.2.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined on the face side for shade and appearance. If any roll in the sample is off shade or shaded side to side, side to center, or end to end, or if any roll does not have the same appearance as the standard sample, the lot represented by the sample shall be rejected.

4.4.3 End item testing. The coated cloth shall be tested for the characteristics listed in table VI. The methods of testing specified in FED-STD-191 wherever applicable and as listed in table VI shall be followed. The sample unit for testing shall be 3 continuous yards, full width, of the coated cloth. The lot shall be unacceptable if any sample unit fails to meet any requirement specified. All test reports shall contain the individual values used in expressing the final results. The sample size shall be in accordance with the following:

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

TABLE VI. End item tests

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>
Distribution of coating	3.4	<u>1/</u>
Weight	3.4	5041
Breaking strength	3.4	ASTM D 5035
Tearing strength	3.4	ASTM D 1424
Hydrostatic resistance:		
Initial	3.4	5512 <u>2/</u>
After accelerated weathering	3.4	5804 <u>3/</u> or 4.5.5 and 5512 <u>2/</u>
After abrasion	3.4	5302 <u>4/</u> and 5512 <u>2/</u>
After strength of coating	3.4	5972 <u>5/</u> and 5512 <u>2/</u>
After high humidity	3.4	4.5.1 and 5512 <u>2/</u>

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TABLE VI. End item tests (cont'd)

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>
Colorfastness after accelerated weathering	3.4	5804 <u>3/</u> or 4.5.5
Colorfastness after high humidity	3.4	4.5.1
Stiffness, warp only:		
At 70° $\pm$ 2°F	3.4	5204
At 0° $\pm$ 2°F	3.4	5204 <u>6/</u>
Adhesion of coating	3.4	5970
Blocking	3.4	5872 <u>7/</u>
Resistance to leakage	3.4	4.5.2
Resistance to diethyltoluamide	3.4	4.5.3
Adhesion of seam tape	3.4	<u>8/</u>
Spectral reflectance:		
Type I	3.5.4.1	4.5.4
Type II	3.5.4.2	4.5.4

- 1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement.
- 2/ The water pressure shall be applied only to the heavier coated side (face) of the coated cloth.
- 3/ The heavier coated side of the coated cloth shall be exposed to the light source. The exposure period in the weatherometer shall be 100 hours. At the end of the exposure period, the specimens shall be visually examined to determine if the coating has become stiff and brittle or soft and tacky, or if there is evidence of cracking or crazing.
- 4/ A solid rubber diaphragm 0.030  $\pm$  0.010 inch thick with a nonmetallic contact shall be used. The abradant shall be the heavily coated side of the coated cloth. The heavier coated side of the specimen shall be abraded 1000 double strokes and then tested for hydrostatic resistance with the abraded portion of the test specimen centered in the hydrostatic test area.

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- 5/ Except that the specimens shall be stretched at 20 pounds.
- 6/ The test specimens shall be subjected to a temperature of  $0^{\circ} \pm 2^{\circ}\text{F}$  for a minimum of 4 hours and the test shall be performed in a still atmosphere at that temperature.
- 7/ Except that only one specimen shall be tested.

- 8/ The test shall be conducted as follows:

Specimen preparation — A two-layer, semi-clear, heat seal tape (consisting of a 0.004 inch thick, high temperature resistant polyurethane carrier membrane and a 0.002 inch thick, thermoplastic polyurethane adhesive layer; see 6.9), 1 inch ( $\pm 1/16$  inch) wide shall be heat sealed to the lightly coated back side of the coated cloth by activating the thermoplastic adhesive layer of the heat seal tape using high temperature air and then immediately plying the tape with the coated cloth (parallel to the warp direction of the coated cloth) obtaining intimate contact between the tape and coated cloth by passing through pressurized rollers. The use of a flat-faced heated platen-type seam sealing machine is prohibited. Five specimens shall be prepared; no two specimens shall contain the same warp yarns. Test specimens shall be cooled and conditioned prior to testing for adhesion.

Test procedure — The test shall be conducted in accordance with Method 5962 of FED-STD-191 except that the maximum load of resistance occurring in the 3-inch separation shall be recorded.

4.4.4 Packaging inspection. The inspection shall be in accordance with the quality assurance provisions of PPP-P-1136.

#### 4.5 Methods of inspection.

4.5.1 Resistance to high humidity. Three 4 by 4-inch specimens shall be laid flat, heavier 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  $125^{\circ} \pm 2^{\circ}\text{F}$  for a period of 7 days. At the end of the aging period, each specimen shall be removed from the desiccator, visually examined for colorfastness and then tested immediately in accordance with Method 5512 of FED-STD-191 with the water pressure being applied to the heavily coated side.

4.5.2 Resistance to leakage test. The test for resistance to leakage shall be conducted as specified in Method 5516 of FED-STD-191 except that the lightly coated side of the cloth shall contact the water. The hydrostatic head shall be 50 centimeters, and shall be held for 10 minutes. The report shall only include "measurement of the appearance of water drops". Leakage of any specimen shall be considered a test failure.

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4.5.3 Resistance to diethyltoluamide test. The diethyltoluamide for use in this test shall conform to type II concentration A of O-I-503. Three drops of the diethyltoluamide solution shall be placed in the center of a 4 by 8-inch sample of coated cloth with the diethyltoluamide solution contacting the heavily coated side. The sample shall be folded to form a 4 by 4-inch square with the heavily coated sides contacting each other. The folded sample shall then be placed between two 6 by 6-inch glass plates and a 4-pound weight placed on the assembly and left at standard conditions for 16 hours. The sample shall then be removed from between the glass plates, rated for blocking as required in Method 5872 of FED-STD-191 and immediately examined for conformance to the requirements in table I.

4.5.4 Spectral reflectance tests. Spectral reflectance data shall be determined on the heavier coated side and shall be obtained from 600 to 800 nanometers (nm), at a 20 nm intervals on a spectrophotometer (see 6.6) relative to a barium sulfate standard, the preferred white standard. Other white reference materials may be used, provided they are calibrated to absolute white, e.g. Halon, magnesium oxide, or vitrolite tiles (see 6.7). The spectral band width shall be less than 26 nm at 860 nm. Reflectance measurements may be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a source that simulates either CIE Source A or CIE Source D65. The specimen shall be measured as a single layer, backed with two layers of the same fabric and shade. Measurements shall be taken on a minimum of two different areas and the data averaged. The measurement areas should be at least 6 inches away from the selvage. The specimen shall be viewed at an angle no greater than 10 degrees from normal, with the specular component included. Photometric accuracy of the spectrophotometer shall be within 1 percent and wavelength accuracy within 2 nm. The standard aperture size used in the color measurement device shall be 1.0 to 1.25 inches in diameter. Any color having spectral reflectance values falling outside the limits at four or more of the wavelength specified in 3.5.4.1 for type I or in 3.5.4.2 for type II shall be considered a test failure.

4.5.5 Alternate accelerated weathering procedure. The test procedure shall be in accordance with AATOC Method 169 except that the following deviations shall apply:

a. The test apparatus shall be either test chamber type 1A or 1B. Type 1B shall be equipped with a three-tiered inclined specimen rack. The apparatus shall be equipped with an automatic light monitor and shall be capable of automatically controlling irradiance, temperature, and humidity. The apparatus shall be maintained in accordance with the manufacturer's recommendations.

b. The weathering test cycle shall be 40 minutes of light, 20 minutes of light with water spray on the fabric face, 60 minutes of light, 60 minutes of darkness. The test cycle shall be repeated until the total energy exposure is equal to 40 kilojoules per square meter.

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c. The irradiance level shall be  $0.55 \pm 0.01$  watt/square meter/nanometer (W/sq/m/nm) bandpass at 340 nanometers.

d. The glass filter combination shall be a quartz inner filter and a borosilicate type "S" outer filter:

e. The relative humidity shall be  $50 \pm 5$  percent during the light cycle and not lower than 95 percent during the dark cycle.

f. The control set points shall be as follows:

	<u>Dark cycle</u>	<u>Light cycle</u>
Black panel	38°C	77°C
Conditioning water	40°C	53°C
Wet bulb depression <u>1/</u>	0°C	

1/ As a guide only; adjust to achieve required relative humidity (see e. above).

g. The test specimens shall fit smoothly on the specimen rack of the apparatus with no wrinkles or gaps. The test specimen shall be mounted to the outside of the rack with the use of appropriate stainless steel spring clips. After the required exposure period, the specimens shall be removed from the apparatus and allowed to dry and condition at Standard Conditions. Then test specimens for each required test shall be cut and tested appropriately.

NOTE: Monitoring of dry bulb temperature, wet bulb depression, irradiance, and black panel temperature is recommended through the use of chart recorders.

## 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 coated cloth shall be put-up and preserved in accordance with the applicable requirements of PPP-P-1136.

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 coated cloth shall be packed in accordance with the applicable requirements of PPP-P-1136.

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-1136.

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## 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 coated cloth is intended for use in the fabrication of wet weather parkas and trousers.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Type required (see 1.2).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- d. When a first article is required (see 3.1, 4.3, and 6.3).
- e. Woodland camouflage pattern drawing if required (see 3.3.1.2.1).
- f. Width required (see 3.6).
- g. Selection of applicable levels of put-up, preservation and packing (see 5.1 and 5.2).

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of Federal Acquisition Regulation (FAR) 52.209-4. The first article should be a pre-production sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

6.4 Standard sample and pattern drawing. For access to the standard shade sample (see 3.1) and the Woodland camouflage pattern drawing, if applicable (see 3.3.1.2.1) address the contracting activity issuing the invitation for bids or request for proposal.

6.5 Coating compound suggestion. The incorporation of an isocyanate (PAPI or MDI) in the top coating using a thermo-plastic polyurethane, or the use of a thermo-setting or cross linked polyurethane has been found necessary to meet the requirements of this specification. The coating limitations are intended to guarantee a waterproof cloth with adequate resistance to mildew and bacterial degradation (see 3.3.2 or 3.3.3). The top coating applied to the lightly coated side of the coated cloth shall be compatible with thermo-plastic polyurethane seam sealing tapes used in the fabrication of the finished wet weather parkas and trousers.

6.6 Spectrophotometer. Suitable spectrophotometers for measuring spectral reflectance in the visible/near infrared include the Diano Hardy, Diano Match Scan, Milton Roy Match Scan 2, Hunter D54P-IR, Applied Color Systems Spectro

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Sensor I&II, ACS CS-5, Hunter VIS/NIR Spectrocolorimeter and the MacBeth 1500 with IR options.

6.7 White standard. Barium sulfate of suitable quality for use as a white reference standard is available from the Eastman Kodak Company. The same source has available magnesium reagent (ribbon) and Halon. Suitable tiles can be obtained from the National Institute of Standards and Technology or the instrument manufacturers (see 4.5.4).

6.8 Suggested dyestuff formulation for type II coated cloth. The dyed ground shade Light Green 354, and the printing of Dark Green 355, Dark Brown 356 and Black 357 may be accomplished by varying the amounts of the following dyestuffs:

Acid Blue 258	Acid Orange 156
Acid Orange 4R	Acid Red 266
Acid Yellow 219	Acid Blue 258

Shade Black 357 may also be satisfactorily printed with the use of carbon black alone or in combination with the above dyes.

6.9 Tape. Tape conforming to Style ST52 produced by Bemis Corporation (Shirley, MA) has been found satisfactory for the Adhesion of Seam Tape test.

6.10 Subject term (keyword) listing.

Camouflage  
Parka  
Trousers  
Wet weather clothing system  
Woodland

6.11 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 the changes.

Custodians:

Army - GL  
Navy - NU  
Air Force - 99

Preparing activity:

Army - GL  
(Project 8305-0449)

Review activities:

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

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

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

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>RECOMMEND A CHANGE</b>	1. DOCUMENT NUMBER MIL-C-43906C	2. DOCUMENT DATE (YYMMDD) 1992 March 31
3. DOCUMENT TITLE CLOTH, COATED, NYLON, POLYURETHANE DOUBLE COATED		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME (Include First, Middle, Initial)		ORGANIZATION
b. ADDRESS (Include Zip Code)		DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME U.S. Army Natick RD&E Center		b. TELEPHONE (Include Area Code) (1) Commercial 508-651-4532 (2) AUTOVON/DSN 256-4532
c. ADDRESS (Include Zip Code) Commander, U.S. Army Natick RD&E Center ATTN: STRNC-IRT Natick, MA 01760-5019		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340