

INCH POUND

MIL-DTL-44431B

November 7, 2003

Supercedes

MIL-DTL-4431A

9 October 2003

## DETAIL SPECIFICATION

### CLOTH, PLAIN WEAVE, NYLON FILAMENT, LIGHTWEIGHT

This specification is approved for use by the Natick Research, Development and Engineering Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers one type of lightweight, nylon filament, and water repellent treated cloth.

#### 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 Acquisition Streamlining and Standardization Information System (ASSIST) database and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Philadelphia, Clothing and Textiles Directorate, Attn: DSCP-COCT, 700 Robins Ave Philadelphia, PA 19111-5096

AMSC N/A

FSC 8305

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## SPECIFICATIONS

### FEDERAL

A-A-50199 - Thread, Polyester Core, Cotton-or Polyester-Covered

## STANDARDS

### FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections

2.1.2 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.

## FEDERAL TRADE COMMISSION

### RULES AND REGULATIONS UNDER THE TEXTILE FIBER PRODUCTS IDENTIFICATION ACT

(Copies may be obtained without charge from the Federal Trade Commission, Pennsylvania Avenue at Sixth Street, N.W., Washington, DC 20580-0001. Website address <http://www.ftc.gov>)

## CODE OF FEDERAL REGULATIONS

16 CFR Part 1500- Federal Hazardous Substances Act Regulations  
29 CFR Part 1910- Occupational Safety and Health Standards

(Applications for copies of referenced documents should be addressed to U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.)

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 737	- Air Permeability of Textile Fabrics
ASTM D 1424	- Tear Strength of Woven Fabrics by Falling-Pendulum (Elmendorf)
ASTM D 1683	- Failure in Sewn Seams of Woven Fabrics
ASTM D 2165	- pH of Aqueous Extracts of Wool and Similar Animal Fibers
ASTM D 3775	- Fabric Count of Woven Fabric
ASTM D 3776	- Mass Per Unit Area (Weight) of Fabric Option C
ASTM D 5034	- Breaking Strength and Elongation of Textile Fabrics (Grab)

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(Applications for copies should be addressed to American Society For Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.) Website address: <http://www.astm.org>

ANSI/ASQC Z1.4 1993- Sampling Procedures and Tables for Inspection of Attributes  
(For all inquires please contact the American National Standards Institute, 25 West 43<sup>rd</sup> Street, 4<sup>th</sup> Floor, New York, NY 10036). Website address: <http://www.ansi.org>

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

#### AMERICAN ASSOCIATION OF TEXTILE CHEMIST AND COLORIST (AATCC)

AATCC-16	Colorfastness to Light
AATCC-22	Water Repellency: Spray Test
AATCC-61	Colorfastness to Laundering, Home and Commercial: Accelerated
AATCC-70	Water Repellency: Tumble Jar Dynamic Absorption Test
AATCC-81	pH of the Water-Extract from Wet Processed Textiles
AATCC-96	Dimensional Changes in Commercial Laundering of Woven and Knitted Fabrics Except Wool.
AATCC-118	Oil Repellency: Hydrocarbon Resistance Test
AATCC-127	Water Resistance: Hydrostatic Pressure Test

(For all inquires please contact the American Association of Textile Chemist and Colorist (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-2215.) Website address <http://www.aatcc.org>

#### MISCELLANEOUS

Principles and Methods of Toxicology, A. Wallace Hayes (editor), 1989, pp 394-396.

(Applications for copies of referenced documents should be addressed to Raven Press, 1185 Avenue of the Americas, New York, NY 10036)

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 6.3, in accordance with 4.3.

3.2 Standard sample. 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 6.4).

3.3 Material. (see 6.5)

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3.3.1 Yarn. The yarn for the warp and filling shall be semi-dull, continuous multifilament nylon. The warp yarn shall be singles and the filling yarn shall be 3-ply, air texturized.

3.4 Color. The cloth shall be scoured white to match the standard sample (see 6.4). A fluorescent optical brightener with a resulting peak emission in the blue violet shall be used. The hue of fluorescence shall be the same as that of the standard sample when tested as specified in 4.4.3.

3.4.1 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  $7500 \pm 200\text{K}$ , with illumination of  $100 \pm 20$  foot candles and shall be a good match to the standard sample under incandescent lamplight at  $2300 \pm 200\text{ K}$ .

3.4.2 Colorfastness. The finished cloth shall show fastness to laundering (after 3 cycles) and light (after 20 standard fading hours) equal to or better than the standard sample or equal to or better than a rating of 3-4 on the AATCC gray scale for color change for laundering and a rating of 2-3 on the AATCC gray scale for color change for light. Testing shall be specified in 4.4.3.

3.5 Physical requirements. The physical requirements for the finished cloth shall be as specified in table I when tested as specified in 4.4.3.

Table I. Physical requirements

Characteristic	Requirement
Weight, oz./sq.yd.	3.4(min)-3.9(max)
Breaking strength (pounds) min.	
Warp	200
Filling	150
Tearing strength (pounds) min.	
Warp	5
Filling	4
Yarn per inch, (min.)	
Warp	148
Filling	57
Air permeability, (ft. <sup>3</sup> /max/ft. <sup>2</sup> )	16

3.5.1 Weave. The weave shall be plain.

3.5.2 Width. The width of the finished cloth shall be as specified (see 6.2) and shall be the minimum acceptable width inclusive of the 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 yarns on each side excluding the protruding fringe(s).

3.6 Cloth preparation. The cloth shall be scoured.

3.7 Finish. The cloth shall be given a fluorocarbon type water repellent treatment. The finished cloth shall meet the requirements specified in table II when tested as specified in 4.4.3.

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Table II. Water repellent requirements

Spray rating <u>1/</u>		Hydrostatic height (centimeter) (min lot avg) min <u>2/</u>		Dynamic absorption (percent) (max lot avg) max <u>3/</u>	
Initial	90, 90, 90	25	20	20	30
After 3 laundryings	80, 80, 80	20	20	-	-
After 15 laundryings	- - -	-	-	-	-

1/ Three individual determinations shall be equal to or better than the rating specified.

2/ No individual specimen shall fall below the specified minimum.

3/ No individual specimen shall exceed the specified maximum.

3.7.1 Resistance to organic liquid. The finished cloth shall show no wetting by n-tetradecane either initially or after 15 laundryings when tested as specified in 4.4.3.

3.8 pH. The pH of the water extract of the finished cloth shall be not less than 5.0 and not greater than 8.5 when tested as specified in 4.4.3.

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

3.10 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 60 percent minimum when tested as specified in 4.4.3.

3.11 Length and put-up. For Government procurements only, 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 Face identification. The face side of the cloth shall be identified by stamping the word "FACE" on that side at each end of the roll.

3.13 Fiber identification. Each roll of the cloth shall be labeled or ticketed for fiber content in accordance with the rules and regulations under the Textile Fiber Products Identification Act.

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

3.15 Toxicity. The finished cloth shall not present a health hazard when used as intended. (see 4.4.3.1).

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#### 4. VERIFICATION

4.1 Verification 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.

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

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 3.1 and 6.2), it shall be examined for appearance, color, and finish defects and tested for the characteristics specified in table III.

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 specification or applicable purchase document.

4.4.2 End item examination.

4.4.2.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only. When the total yardage in the roll does not exceed 100 yards, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects, as defined in section III of FED-STD-4, that are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.4.2.1.1. No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll 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 30.0 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 45.0 points per 100 square yard, a second sample of 20 rolls shall be examined for roll quality only. The lot shall be unacceptable if one or more rolls in the second sample exceed 45.0 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

Total points scored in sample x 3600 = Points per 100



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unacceptable if one or more sample units fail to meet any requirements specified. The sample size 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 and over	5

TABLE III. End item tests

Characteristics	Requirement paragraph	Test method
Yarn identification, warp and filling	3.3.1	<u>1</u> /
Fluorescence	3.4	4.5.1
Colorfastness to: Laundering (after 3 cycles)	3.4.2	AATCC-61 Test 3A <u>2</u> /
Light	3.4.2	AATCC-16 Opt A
Weight	3.5	ASTM D 3776
Breaking Strength	3.5	ASTM D 5034
Tearing Strength	3.5	ASTM D 1424
Yarns per inch	3.5	ASTM D 3775
Air permeability	3.5	ASTM D 737
Weave	3.5.1	Visual <u>3</u> /
Water repellency Spray rating: Initial	3.7	AATCC-22
After 3 launderings	3.7	AATCC-96 Test VI, A and AATCC-22
Hydrostatic height: Initial	3.7	AATCC 127
After 3 launderings	3.7	AATCC 96, Test VI, A
Dynamic absorption: Initial	3.7	AATCC-70
After 15 launderings	3.7	AATCC-96 Test VI, A and AATCC-70



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Resistance to organic liquid:		
Initial	3.7.1	4.5.2
After 15 launderings	3.7.1	AATCC-96 Test VI, A and AATCC 118 6/ AATCC-81
pH	3.8	
Dimensional stability	3.9	AATCC-96 Test VI, A 4/
Seam efficiency	3.10	ASTM D 1683 5/

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

2/ The specimens shall be dried after each of the 3 launderings.

3/ One determination shall be made on each sample unit and the result reported as “pass” or “fail”.

4/ Dimensional stability shall be measured after one laundering.

5/ The needle shall measure  $0.040 \pm 0.001$  inch across the blade at the eye. The thread shall be polyester core, cotton- or polyester-covered in accordance with A-A-50199, ticket no. 50, 2 or 3 ply for the needle and ticket no. 70, 2 or 3 ply for the looper. Construct ASTM D-6193, “Stitches and Seams” Seam Type LSc-2 with 2 needle 401 machine set at 10 stitches per inch.

6/ Three specimens (or areas) taken at various locations across the sample unit will be tested. Evidence of wetting on one or more specimens shall be considered a test failure.

4.4.3.1 Toxicity Assessment. The contractor must furnish information, which certifies that the finished product is composed of materials, which have been safely used commercially or provide sufficient toxicity data to show compatibility with prolonged, direct skin contact. At a minimum, toxicity data should include results from a primary dermal irritation study in laboratory animals (see 2.1.2) and a repeated insult human patch test (Modified Draize Procedure) (see 2.2). The latter must be conducted under the supervision of a qualified dermatologist using at least 100 free-living individuals.

4.4.3.1 Toxicity documents. All finishes/chemicals used to process the cloth shall be identified and accompanied by the appropriate Material Safety Data Sheet (MSDS) information. The use of chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens is prohibited.

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4.4.4 Packaging inspection. The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the quality assurance provisions of FED-STD-802.

#### 4.5 Methods of inspection

4.5.1 Determination of fluorescence. One specimen from the sample unit and one specimen from the standard sample shall be compared under ultra-violet light in an otherwise completely dark room. The specimen shall be considered satisfactory if its hue of fluorescence is the same as the standard sample. The result shall be reported as “pass” or “fail”.

### 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2) When packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contract the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military services systems commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contracting 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 the arctic parka and trouser, mitten shell, field pack cover, and helmet cover.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2.1 and 2.2).
- c. When first article inspection is required, (see 3.1, 4.3, and 6.3) the item will be tested and should be a first article sample.
- d. Width of cloth required (see 3.5.2)
- e. Length required if other than specified (see 3.11)
- f. Selection of applicable levels of preservation and packing (see 5.1 and 5.2)

6.3 First article. When a first article is required, it will be inspected and approved under the appropriate provisions of 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 furnish. The contracting officer should also include specific instructions in all acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

6.4 Sample. For access to samples, address the contracting activity issuing the invitation for bids or request for proposal.

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6.5 Material. The cloth has been found to be successfully manufactured with the use of nylon Supplex\* filling yarn, 3-ply/70 denier/66 filaments and nylon warp yarn, 1-ply/70 denier/34 filaments. This yarn is available from Dupont, Wilmington, DE.

6.7 Subject term (key word) listing.

Arctic clothing  
Textured nylon  
Snow camouflage  
Water repellent

MILITARY INTERESTS:

Custodians

Army – GL

CIVIL AGENCY COORDINATING ACTIVITY:

GSA - FSS

PREPARING ACTIVITY:

DLA - CT

Project

(project number 8305-0838 )