

INCH-POUND

MIL-C-44431 (GL)  
30 September 1991

## MILITARY 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, 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 Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

## SPECIFICATIONS

## FEDERAL

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

## STANDARDS

## FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections  
FED-STD-191 - Textile Test Methods  
FED-STD-802 - Packaging of Synthetic Fiber Fabrics

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

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-C-44431(GL)

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

(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.)

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 are available from the Federal Trade Commission, Pennsylvania Avenue at Sixth Street, N.W., Washington, DC 20508-0001.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted 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 5034 - Breaking Force and Elongation of Textile Fabrics (Grab)

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

(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.)

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.

## MIL-C-44431(GL)

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)

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  $7500 \pm 200$  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.

3.4.2 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 "good". Testing shall be as 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 - 3.8
Breaking strength (pounds) min.	
Warp	240
Filling	180
Tearing strength, (pounds) min.	
Warp	6
Filling	5
Yarn per inch, (min.)	
Warp	150
Filling	60
Air permeability, (ft. <sup>3</sup> /min./ft. <sup>2</sup> )	16

## MIL-C-44431(GL)

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 yarn 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 an approved fluorocarbon type water repellent treatment (see 6.6). The use of finishing materials other than the approved water repellents is prohibited. The finished cloth shall meet the requirements specified in table II when tested as specified in 4.4.3.

TABLE II. Water repellency requirements

	Spray rating <u>1/</u>	Hydrostatic height (centimeter)		Dynamic absorption (percent)	
		(min lot avg)	min <u>2/</u>	(max lot avg)	max <u>3/</u>
Initial	100, 100, 90	30	25	15	20
After 3 laundryings	90, 90, 80	30	25	-	-
After 15 laundryings	- - -	-	-	15	20

1/ Three individual determinations shall be equal to or better than the ratings 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 2.5 percent for the individual sample unit and not greater than 2.0 percent for the lot 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.

## MIL-C-44431(GL)

3.10 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 75 percent 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 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.

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 Certificates 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:

## MIL-C-44431 (GL)

- 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. If one roll in the sample exceeds 45.0 points per 100 square yards, 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 exceeds 45.0 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

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

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

- |   |                |
|---|----------------|
| For defects up to 3 inches in any dimension                                 | - one point    |
| For defects exceeding 3 inches, but not exceeding 6 inches in any dimension | - two points   |
| For defects exceeding 6 inches, but not exceeding 9 inches in any dimension | - three points |
| For defects exceeding 9 inches in any dimension                             | - four points  |

## MIL-C-44431(GL)

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

Width less than specified  
 Objectionable odor  
 Overall uncleaness  
 Uneven weaving throughout

4.4.2.2 Length examination. During the yard-by-yard examination, each roll in the sample shall be examined for length. Any length found to be less than the minimum specified or more than 2 yards less than the length marked on the ticket shall be considered a defect with respect to length. The lot shall be unacceptable if two or more rolls in the sample are defective with respect to length or if the total of the actual lengths of the rolls in the sample is less than the total of lengths marked on the tickets.

4.4.2.3 Roll identification examination. During the yard-by-yard examination, each roll shall be examined for the defects listed below. The lot shall be unacceptable if two or more rolls in the sample contain one or more of the following defects:

Face identification missing from either or both ends  
 Preshrinking process identified by name or trademark on cloth or ticket  
 Not labeled in accordance with the rules and regulations under the  
 Textile Fiber Products Identification Act

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

4.4.3 End item testing. The cloth shall be tested for the characteristics listed in table III. The methods of testing as specified in FED-STD-191 wherever applicable and as listed in table III shall be followed. The sample unit shall be 3 continuous yards full width of the finished cloth. The lot shall be unacceptable if one or more sample units fail to meet any requirement 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

## MIL-C-44431(GL)

TABLE III. End item tests

Characteristics	Requirement paragraph	Test method
Yard 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	5610 <u>2/</u>
Light	3.4.2	5660
Weight	3.5	5041
Breaking strength	3.5	ASTM D 5034
Tearing strength	3.5	ASTM D 1424
Yarns per inch	3.5	5050
Air permeability	3.5	5450
Weave	3.5.1	Visual <u>3/</u>
Water repellency:		
Spray rating:		
Initial	3.7	5526
After 3 launderings	3.7	5556 and 5526
Hydrostatic height:		
Initial	3.7	5514
After 3 launderings	3.7	5556 and 5514
Dynamic absorption:		
Initial	3.7	5500
After 15 launderings	3.7	5556 and 5500
Resistance to organic liquid:		
Initial	3.7.1	4.5.2
After 15 launderings	3.7.1	5556 and 4.5.2
pH	3.8	2811
Dimensional stability	3.9	5556 <u>4/</u>
Seam efficiency	3.10	5110 <u>5/</u>

- 1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement.
- 2/ The specimens shall be dried after each of the 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.



MIL-C-44431 (GL)

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".

4.5.2 Resistance to organic liquid test. Place a specimen of the cloth, face up, on a smooth horizontal surface. Using a pipette or eye dropper, gently deposit one drop of n-tetradecane on the surface of the specimen. After one minute, examine the specimen under light at an angle. Absence of light reflectance at the cloth-drop interface shall be taken as evidence of wetting. Three specimens (or areas) taken at various locations across the sample unit shall be tested. Evidence of wetting on one or more specimens shall be considered a test failure.

5. PACKAGING

5.1 Put up and preservation. Put up and preservation shall be level A or Commercial as specified (see 6.2).

5.1.1 Levels A and Commercial. The cloth shall be put up and preserved in accordance with the applicable requirements of FED-STD-802.

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

5.2.1 Levels A, B, and Commercial. The cloth shall be packed in accordance with the applicable requirements of FED-STD-802.

5.3 Marking. In addition to any special marking required in the contract or purchase order, shipments shall be marked in accordance with the requirements of FED-STD-802.

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.

## MIL-C-44431(GL)

6.2 Acquisition requirements. Acquisition documents must 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 2.1.1 and 2.2).
- c. When first article is required (see 3.1, 4.3, and 6.3).
- 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 shall be inspected and approved under the appropriate provisions of FAR 52.209-4. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to furnished. 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.

6.5 Material. The cloth has been found to be successfully manufactured with the use of nylon Supplex<sup>+</sup> filling yarn, 3-ply/70 denier/66 filaments and nylon warp yarn, 1-ply/70 denier/34 filaments. The yarn is available from E. I. DuPont de Nemours Co., Wilmington, DE 19880.

6.6 Fluorocarbon water repellent. Approval of the fluorocarbon water repellent treatment is the responsibility of the U.S. Army Natick Research, Development and Engineering Center, Natick, MA 01760-5019, and is based on more extensive tests including those for toxicity, which are not set forth in this specification. Because of the time necessary to conduct full evaluation (approximately six months), only those chemical treatments already approved and so listed in the invitation for bids or request for proposal shall be considered acceptable for the related procurement.

6.7 Subject term (key word) listing.

Arctic clothing  
Textured nylon  
Snow camouflage  
Water repellent

Custodian:

Army - GL

Preparing activity:

Army - GL

(Project 8305-A454)

## 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-44431(GL)	2. DOCUMENT DATE (YYMMDD) :991 September 30
3. DOCUMENT TITLE CLOTH, PLAIN WEAVE, NYLON FILAMENT, LIGHTWEIGHT			
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 (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	e. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME 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	