

INCH-POUND
MIL-DTL-44431C
14 September 2020
SUPERSEDING
MIL-DTL-44431B
7 November 2003

DETAIL SPECIFICATION
CLOTH, PLAIN WEAVE, NYLON FILAMENT, LIGHTWEIGHT

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 one (1) type of plain weave, lightweight, nylon filament, water repellent treated cloth as specified.

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 document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

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, verify the currency of the address information using Acquisition Streamlining and Standardization Information System (ASSIST) online database <https://assist.dla.mil/>.

AMSC N/A

FSC 8305

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

MIL-DTL-44431C

COMMERCIAL ITEM DESCRIPTIONS

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

DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents 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.

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.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

- AATCC EP1 - Evaluation Procedure for Gray Scale for Color Change
- AATCC EP9 - Evaluation Procedure for Visual Assessment of Color Difference of Textiles
- 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
- AATCC TM61 - Test Method for Colorfastness to Laundering: Accelerated
- AATCC TM70 - Test Method for Water Repellency: Tumble Jar Dynamic Absorption
- AATCC TM81 - Test Method for pH of the Water-Extract from Wet Processed Textiles
- AATCC TM118 - Test Method for Oil Repellency: Hydrocarbon Resistance
- AATCC TM127 - Test Method for Water Resistance: Hydrostatic Pressure
- AATCC TM135 - Test Method for Dimensional Changes of Fabrics after Home Laundering

(Copies of these documents are available on line at <https://www.aatcc.org.>)

AMERICAN SOCIETY FOR QUALITY (ASQ)

MIL-DTL-44431C

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

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

ASTM INTERNATIONAL

- ASTM D737 - Standard Test Method for Air Permeability of Textile Fabrics
- ASTM D1424 - Standard Test Method for Tearing Strength of Woven Fabrics by Falling-Pendulum (Elmendorf-Type) Apparatus
- ASTM D1683 - Standard Test Method for Failure in Sewn Seams of Woven
- ASTM D3775 - Standard Test Method for End (Warp) and Pick (Filling) Count of Woven Fabrics
- ASTM D3776/D3776M - Standard Test Method for Mass per Unit Area (Weight) of Fabric
- ASTM D5034 - Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
- ASTM D6193 - Standard Practice for Seams and Stitches

(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>.)

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, 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 in accordance with 4.3.

3.2 Standard sample. Unless otherwise specified, 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

MIL-DTL-44431C

requirements, and promotes economically advantageous life cycle costs.

3.4 Material.

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

3.4.2 Weave. The weave shall be plain.

3.5 Color.

3.5.1 Color. The cloth shall be scoured white to match the standard sample (see 6.3). 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 of the standard sample when tested as specified in 4.6.1.

3.5.2 Visual shade matching. The appearance of the white cloth shall match the standard sample (see 6.3) when tested as specified in 4.5.

3.6 Physical requirements. The finished cloth shall conform to the colorfastness and physical requirements listed below in Table I, when tested in accordance with the test methods specified in 4.5.

THIS SPACE LEFT INTENTIONALLY BLANK

MIL-DTL-44431C

TABLE I. Colorfastness and physical requirements.

Characteristic	Requirement
Weight, oz./yd ² , (range)	3.4-3.9
Breaking strength, pounds, (min.)	
Warp direction	200
Filling direction	150
Tearing strength, pounds, (min.)	
Warp direction	5
Filling direction	4
Colorfastness: (min.)	
Laundering (3 cycles) (color change only)	3-4
Light (20 AFU or 85 kJ/(m ² nm) @ 420 nm) <u>1/</u>	2-3
Air permeability (ft ³ /min/ft ²) (max.)	16
Dimensional change, percent (max.) (growth and elongation)	
Warp	3.0
Filling	3.0
Seam efficiency, percent (min.)	60

1/ AFU - AATCC Fading Units

3.7 Finish. The cloth shall be given a durable water repellent treatment. The water repellent treated cloth shall meet the requirements specified in Table II when tested as specified in 4.5.

TABLE II. Water repellent requirements.

	Spray rating <u>1/</u>	Hydrostatic height, (cm)		Dynamic absorption (percent)		Resistance to organic liquid (min.)
		Min. lot average	Min. <u>2/</u>	Max. lot average	Max. <u>3/</u>	
Initial	90, 90, 90	25	20	20	30	No wetting by n-tetradecane
After 3 laundering cycles	80, 80, 80	20	20	-	-	-
After 15 laundering cycles	-	-	-	20	30	No wetting by n-tetradecane

1/ Three (3) 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 fall above the specified maximum.

MIL-DTL-44431C

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 4.5.

3.9 Toxicity. The finished cloth shall not present a health hazard and shall show compatibility with prolonged, direct skin contact when tested as specified in 4.7. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.10 Marking. The face side shall be identified by applying a stamping on the face side of the cloth with the word "FACE" at each end of the roll.

3.11 Width. For Government procurements only, the width of the finished cloths shall be as specified (see 6.2) and shall be the minimum acceptable width inclusive of the selvage.

3.12 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 50 yards. Each length shall be put-up full width on a roll as specified in 5.1.

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

3.14 Workmanship. The finished cloths shall conform to the quality of product established on this specification. The occurrence of defects shall not exceed the quality acceptance levels as 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, fluorescent optical brightness (white) and finished defects listed in 4.4 and tested for the characteristics as specified in 4.5.

4.3 Conformance inspection. Conformance inspection shall include the visual examination of 4.4 and the tests of 4.5 through 4.7 as applicable. Sampling for inspection shall be performed in accordance with ASQ/ANSI Z1.4 and with acceptance quality limits (AQLs) as specified in the contract and/or order, except where otherwise indicated (see 6.2).

MIL-DTL-44431C

4.3.1 Inspection conditions. Unless otherwise specified in this specification or applicable procurement documents (see 6.2), all inspections shall be performed in accordance with this specification and 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 MIL-STD-3064, Type I.

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

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

4.4.3 Length examination (individual and total yardage). 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 III. The methods of testing as specified wherever applicable and as listed in Table III 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:

<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. Material tests.

Characteristic	Requirement Reference	Test Method
Fiber identification	See 3.4	AATCC TM20 (see 6.4)
Weave	See 3.4.2	Visual <u>1</u> /
Fluorescence	See 3.5.1	See 4.6.1
Yarns per inch	Table I	ASTM D3775

MIL-DTL-44431C

TABLE III. Material tests. - Continued

Characteristic	Requirement Reference	Test Method
Colorfastness: Laundering (after three (3) cycles) Light (20 AFU or 85 kJ/(m ² nm) @ 420 nm) (min.)	Table I	AATCC TM61 Test 3A <u>2/</u> , <u>3/</u> AATCC TM16.3, Opt. 3
Weight	Table I	ASTM D3776/D3776M (Opt. C)
Breaking strength	Table I	ASTM D5034
Tearing strength	Table I	ASTM D1424
Air permeability	Table I	ASTM D737
Dimensional change (after one (1) cycle)	Table I	AATCC TM135, (3)(III)(Aiii)
Seam efficiency	Table I	ASTM D1683 <u>4/</u>
Spray rating Initial After three (3) launderings	Table II	AATCC TM22 AATCC TM135 (3)(III)(Aiii) & AATCC TM22
Hydrostatic height Initial After three (3) launderings	Table II	AATCC TM127 AATCC TM135 (3)(III)(Aiii) & AATCC TM127
Dynamic absorption Initial After 15 launderings	Table II	AATCC TM70 AATCC TM135 (3)(III)(Aiii) & AATCC TM70
Resistance to organic liquid Initial After 15 launderings	Table II	AATCC TM118 <u>5/</u> AATCC TM135 (3)(III)(Aiii) & AATCC TM118
pH	See 3.8	AATCC TM81
Toxicity	See 3.9	See 4.7

1/ One determination shall be made from each sample and results reported as “pass” or “fail”.

2/ Rated using the AATCC EP1, Evaluation Procedure for Gray Scale for Color Change.

3/ The specimens shall be dried after each of the three (3) launderings.

4/ The needle shall measure 0.040 (±) 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, Tex 36-45, 2 or 3 ply for the needle and Tex 31-35, 2 or 3 ply for the looper. Construct in accordance with ASTM D6193, Seam Type LSc-2 with 2 needle 401 machine set at 10 stitches per inch.

5/ Three (3) specimen areas taken at various locations of the sample unit shall be tested. Evidence of wetting on one (1) or more specimens shall be considered a failure.

MIL-DTL-44431C

4.6 Methods of testing and inspection.

4.6.1 Determination of fluorescence. One (1) specimen from the sample unit and one (1) 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”.

4.6.2 Visual shade matching. The white appearance of the cloths shall match the standard sample when viewed using the AATCC EP9, Option C (see 6.5), with sources simulating artificial daylight D₇₅ illuminant with a color temperature of 7500 (± 200) K 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 2856 (± 200) K. The fluorescence level shall be evaluated in accordance with 4.6.1.

4.7 Toxicity test. When required, (see 6.2), an acute dermal irritation study and a skin sensitization study shall be conducted. When the results of these studies indicate the finish 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 3.9) 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 materiel 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 manufacture of helmet covers.

MIL-DTL-44431C

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification
- b. The specific issue of individual documents referenced (see 2.2)
- c. When first article is required (see 3.1, 4.2)
- d. When toxicity is required (see 3.9, 4.7)
- e. Width of cloth required (see 3.11)
- f. Length required if other than specified (see 3.12)
- g. Conformance inspection (see 4.3)
- h. Inspection conditions (see 4.3.1)
- i. Packaging (see 5.1)

6.3 Standard sample. For access to standard samples address the contracting activity issuing the invitation for bids or request for proposal.

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

6.5 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 $35 (\pm 5^\circ)$ angle relative to the horizontal. The observer will view the specimens at a 90° angle, relative to the plane of the specimens.

6.6 Changes from previous issue. Marginal notations are not used on this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.7 Subject term (key word) listing.

Artic Clothing
Fluorescence
Helmet
Optical brightener
Snow Camouflage
Textured
Water repellent

MIL-DTL-44431C

Custodians:

Army - GL

Navy – NU

Air Force - 11

Preparing Activity:

DLA-CT

Review activities:

Navy - AS, MC

(Project: 8305-2020-027)

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/>.