

INCH-POUND
MIL-DTL-8061A
02 June 2020
SUPERSEDING
MIL-C-8061
13 February 1953

## DETAIL SPECIFICATION

### CLOTH, NYLON, RASCHEL KNIT

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 three (3) types of raschel knit nylon cloth as specified.

1.2 Classification. The raschel knit cloths will be of the following types and classes as specified.

##### 1.2.1 Types.

Type I - Non flame resistant  
Type II - Non-flame resistant, high tenacity  
Type III - Flame resistant

##### 1.2.2 Classes.

Class 1 - Coyote 498  
Class 2 - Tan 499  
Class 3 - Coyote Brown 3758  
Class 4 - Coyote 476  
Class 5 - Black 357  
Class 6 - Camouflage Green 483  
Class 7 - White

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

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## 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.

## DEPARTMENT OF DEFENSE STANDARDS

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

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

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

## 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 EP2, Evaluation Procedure for Gray Scale for Staining  
 AATCC EP8, Evaluation Procedure for AATCC 9-Step Chromatic Transference Scale  
 AATCC EP9, Evaluation Procedure for Visual Assessment of Color Difference of Textiles  
 AATCC TM8 - Test Method for Colorfastness to Crocking: Crockmeter Method  
 AATCC TM16.3 - Test Method for Colorfastness to Light: Xenon Arc  
 AATCC TM20 - Test Method for Fiber Analysis: Qualitative  
 AATCC TM61 - Test Method for Colorfastness to Laundering: Accelerated

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- AATCC TM81 - Test Method for pH of the Water-Extract from Wet Processed Textiles  
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)

- 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 D747 - Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam  
ASTM D1424 - Standard Test Method for Tearing Strength of Woven Fabrics by Falling-Pendulum (Elmendorf-Type) Apparatus  
ASTM D1777 - Standard Test Method for Thickness of Textile Materials  
ASTM D3776/D3776M - Standard Test Method for Mass per Unit Area (Weight) of Fabric  
ASTM D3787 - Standard Test Method for Bursting Strength of Textile – Constant- Rate-of-Traverse (CRT) Ball Burst Test  
ASTM D5034 - Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Grab Test)  
ASTM D6413/D6413M - Standard Test Method for Flame Resistance of Textiles (Vertical Test)

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

## INFORMA HEALTHCARE

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

(Copies of these documents 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. Unless a specific exemption has been obtained, nothing in this document supersedes applicable laws and regulations.

## 3. REQUIREMENTS

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

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3.2 Standard sample. Unless otherwise specified, the finished knit 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 Recycled, recovered, or environmentally preferable or biobased materials. Recycled, recovered, or environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Material. The raschel knit material shall be made of a high tenacity nylon of suitable grade quality and denier to meet the stated requirements in Table II.

3.4.1 Construction, Type I and Type II. The Type I and Type III cloth shall be a raschel knit with 36-42 meshes per square inch.

3.4.2 Construction, Type II. The Type II cloth shall be a raschel knit fabric on a 12 needle per inch machine, using 840 denier, threaded every other guide and 200 denier threaded every guide. A minimum 6 mesh per inch in each direction or 36 meshes per square inch.

### 3.5 Color.

3.5.1 Color. The color of the finished knit cloth shall be as stated in 1.2.2 or as specified in the contract or purchase order (see 6.2).

3.5.2 Visual shade matching (all classes). The color and appearance of the white and dyed raschel knit cloth shall match the standard sample (see 6.4) when tested as specified in 4.5.

3.5.3 Colorfastness (all classes except Class 7). Unless otherwise specified in the contract or purchase order, the finished knit cloth shall conform to the colorfastness requirements listed below in Table I, when tested in accordance with the test methods specified in 4.5.

TABLE I. Colorfastness requirements.

Colors Evaluation	Laundrying (Color Change and Staining) one (1) cycle (min.)	Light (20 AFU or 85 kJ / (m <sup>2</sup> nm) @ 420 nm) (min.) <u>1/</u>	Crocking (Wet and Dry) (min.)
All colors	4	4	4

1/ AFU - AATCC Fading Units

3.6 Physical requirements. The finished knit cloth(s) shall conform to the physical requirements, listed below in Table II, when tested in accordance with the test methods specified in 4.5.

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TABLE II. Physical requirements.

Characteristic	Requirements		
	Type I	Type II	Type III
Thickness, inches, (maximum)	0.04	0.05	-
Thickness, inches, (range)	-	-	0.04-0.65
Weight, oz./sq. yd., (maximum)	10.5	11.5	-
Weight, oz./sq. yd., (range))	-	-	10.5-13
Breaking strength, pounds, (minimum)			
Wale direction	200	350	200
Course direction	200	200	200
Bursting strength, pounds, (minimum)	250	325	250
Tearing strength, pounds, (minimum)			
Wale direction	23	25	25
Course direction	23	25	25
Ultimate elongation, percent, (maximum)			
Wale direction	95	95	125
Course direction	125	140	125
Elongation at 2/3 breaking load, percent, (maximum)			
Wale direction	75	-	100
Course direction	100	-	100
Stiffness, load-pounds, (minimum)			
Wale direction	0.010	0.010	0.010
Course direction	0.010	0.010	0.010
Dimensional stability, percent, (maximum)			
Wale direction	3	5.0	5.0
Course direction	3	5.0	5.0
Flame resistance (initial), (courses and wales)			
Char length, inches, (maximum)	-	-	4
After flame, seconds, (maximum)	-	-	2
After glow, seconds (maximum)	-	-	12
No melt, No drip	-	-	<u>1/</u>
Tear length (inches)	-	-	<3 <u>2/</u>

1/ Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling

2/ When the cloth is used for NAVAIR items it shall be tested for tear length after burning. The length of the tear after burning shall be measured by subtracting the total char length from the charred length only (before applying the weight).

3.7 Spectral reflectance.

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3.7.1 Spectral reflectance, Class 1, Coyote 498, Class 2, Tan 499 and Class 3, Coyote Brown 3758. The spectral reflectance values shall conform to the requirements specified in Table III when tested as specified in 4.5.

TABLE III. Spectral reflectance (Classes 1, 2 and 3).

Wavelength, Nanometers (nm)	Class 1, Coyote 498		Class 2, Tan 499		Class 3, Coyote Brown 3758	
	Min.	Max.	Min.	Max.	Min.	Max.
600	8	20	8	26	8	20
620	8	20	8	26	8	20
640	8	22	8	30	8	22
660	8	24	8	34	8	26
680	12	24	12	38	10	27
700	12	34	12	40	12	53
720	16	42	16	46	16	54
740	22	46	22	50	20	55
760	30	50	30	50	21	56
780	34	54	34	54	21	57
800	36	56	36	56	22	58
820	38	58	38	58	23	59
840	38	58	38	58	24	62
860	40	60	40	60	25	65

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3.7.2 Spectral reflectance, Class 4, Coyote 476, Class 5, Black 357 and Class 6, Camouflage Green 483. The spectral reflectance values shall conform to the requirements specified in Table IIIa when tested as specified in 4.5.

TABLE IIIa. Spectral reflectance (Classes 4, 5 and 6).

Wavelength, Nanometers (nm)	Class 4, Coyote 476		Class 5, Black 357		Class 6, Camouflage green 483	
	Min.	Max.	Min.	Min.	Max.	Max.
600	8	20	N/A	N/A	3	10
620	8	20	N/A	N/A	3	10
640	8	20	N/A	N/A	3	10
660	8	20	N/A	N/A	3	11
680	10	30	N/A	N/A	3	13
700	18	50	N/A	20	4	28
720	22	54	N/A	30	5	40
740	30	56	N/A	33	7	52
760	35	58	N/A	33	11	60
780	40	62	N/A	34	17	64
800	55	80	N/A	34	24	67
820	55	80	N/A	35	32	70
840	55	84	N/A	35	37	71
860	60	84	N/A	35	40	73

3.8 pH. The pH of the water extract of the finished knit cloths shall be not less than 5.0 and not greater than 8.5 when tested as specified in 4.5.

3.9 Flame resistance. The Type III knit cloth shall be flame resistant to meet the requirements of Table II when tested as specified in 4.5.

3.10 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.

3.11 Marking. The face or back side shall be identified by applying a stamping on that side of the cloth with either the word "FACE" or "BACK" at each end of the roll.

3.12 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.

3.13 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.

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3.14 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.

3.15 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, color 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).

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

4.4 Visual examination. Each roll in the sample shall be examined yard by yard on the face side for defects in accordance with MIL-STD-3064, Type V.

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

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

4.4.3 Length examination (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 knit cloth shall be tested for the characteristics listed in Table IV. The methods of testing as specified wherever applicable and as listed in Table IV 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



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knit 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 IV. Material tests.

Characteristic	Requirement Reference	Test
Fiber identification	3.4	AATCC TM20 (see 6.5)
Raschel knit construction	3.4.1 & 3.4.2	Visual
Visual shade matching	3.5.2	4.6.1
Colorfastness to: Laundering after three (3) cycles Light (20 AFU or 85 kJ/(m <sup>2</sup> nm) @ 420 nm) (min.) Crocking (wet and dry)	3.5.3	AATCC TM61 3A <u>1</u> /  AATCC TM16.3, Opt 3 <u>2</u> / AATCC TM8 <u>3</u> /
Thickness	Table II	ASTM D1777
Weight	Table II	ASTM D3776/D3776M (Method C)
Bursting strength	Table II	ASTM D3787
Breaking strength	Table II	ASTM D5034
Ultimate Elongation	Table II	ASTM D5034
Elongation at 2/3 breaking strength	Table II	ASTM D5034
Tearing strength	Table II	ASTM D1424
Stiffness	Table II	ASTM D747
Dimensional stability after three (3) cycles	Table II	AATCC TM135, (3)(V)Aiii
Flame resistance	Table II & 3.9	ASTM D6413/D6413M
Spectral reflectance	3.7	4.6.2
pH	3.8	AATCC TM81
Toxicity	3.10	4.7

1/ Rated using the AATCC EP1, Evaluation Procedure for Gray Scale for Color Change and AATCC EP2, Evaluation Procedure for Gray Scale for Staining.

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

3/ Rated using the AATCC EP8, Evaluation Procedure for AATCC 9-Step Chromatic Transference Scale.

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4.6 Methods of testing and inspection.

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

4.6.2 Spectral reflectance test. Spectral reflectance data shall be obtained from 600 to 860 nanometer (nm) at 20nm intervals on a spectrophotometer relative to the polytetrafluoroethylene (PTFE) family of compounds, the preferred white standard. Other white reference materials may be used provided they are calibrated to absolute white or vitrolite tiles. The spectral band width shall be less than 20 nm at 860 nm. Reflectance measurements shall be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode of operation is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a continuous source that simulates in the visible spectrum either CIE Source A or CIE Source D65. Measurements shall be taken on a minimum of two (2) different areas and the data averaged. Specimens shall be oriented in different directions during testing. The measured areas should be at least 6 inches away from the selvage. The spectral reflectance shall be measured as a single layer backed with four (4) layers of the same fabric and shade. The specimen shall be viewed at an angle no greater than 10° from normal, the specular component included. When possible, the specimens tested shall not contain the same warp and filling yarns. Photometric accuracy of the spectrophotometer shall be within one (1) percent and wavelength accuracy within two (2) nm. Any color having spectral reflectance values falling outside the limits at four (4) or more of the wavelengths specified shall be considered a test failure.

4.7 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 3.10) can be demonstrated with historical use data on the finishing treatments used, toxicity testing may not be required (see 6.2).

## 5. PACKAGING

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

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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 knit cloth is intended for individual equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification
- b. Type and class required (see 1.2)
- c. The specific issue of individual documents referenced (see 2.2)
- d. When first article is required (see 3.1, 4.2, 6.3)
- e. Color required (see 3.5)
- f. When toxicity is required (see 3.10, 4.7)
- g. Width of cloth required (see 3.12)
- h. Length required if other than specified (see 3.13)
- i. Conformance inspection (see 4.3)
- j. Inspection conditions (see 4.3.1)
- k. Packaging (see 5.1)

6.3 First article. When a first article inspection is required (see 3.1), it will 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 be furnished. The contracting officer should include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

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

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

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

6.7 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.

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6.8 Subject term ( key word) listing.

Load bearing vest  
Mesh  
Tactical vest

Custodians:

Army - GL

Navy-NU

Air Force-11

Preparing Activity:

DLA-CT

Review activities:

Navy -AS, MC

(Project: 8305-2020-019)

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>.