INCH-POUND
MIL-DTL-MC034
DRAFT

DETAIL SPECIFICATION

CLOTH, MESH KNIT

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

1. SCOPE

1.1 Scope. This document covers the requirements for a no melt/no drip mesh knit cloth (see 6.1).

1.2 Classification. The cloth is available in one type and one class.

1.2.1 Type.

Type 1 - Modacrylic/rayon

1.2.2 Class.

Class 1 - Coyote 498

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 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.

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 303 - Rules and Regulations Under the Textile Fiber Products Identification Act

40 CFR - Protection of Environment

(Copies of these documents are available online at www.ecfr.gov.)

Comments, suggestions, or questions on this document should be addressed to Marine Corps Systems Command, 2200 Lester Street, Quantico, VA 22134 ATTN: SEAL-SE-STDS or emailed to USMC_STDZ@usmc.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

AMSC N/A FSC 8305

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 EP9	-	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 TM20A	-	Test Method for Fiber Analysis: Quantitative
AATCC TM61	-	Test Method for Colorfastness to Laundering: Accelerated
AATCC TM70	-	Water Repellency: Tumble Jar Dynamic Absorption
AATCC TM81	-	Test Method for pH of the Water-Extract from Wet Processed Textiles
AATCC TM135	-	Dimensional Changes of Fabrics after Home Laundering

(Copies of these documents are available online at www.aatcc.org.)

ASTM INTERNATIONAL

ASTM D1777	-	Standard Test Method for Thickness of Textile Materials
ASTM D1909	-	Standard Tables of Commercial Moisture Regains and Commercial Allowances for Textile Fibers
ASTM D2594/D2594M	-	Standard Test Method for Stretch Properties of Knitted Fabrics Having Low Power
ASTM D3512/D3512M	-	Standard Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Random Tumble Pilling Tester
ASTM D3776/D3776M	-	Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D3787	-	Standard Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test
ASTM D3939/D3939M	-	Standard Test Method for Snagging Resistance of Fabrics (Mace)
ASTM D6413/D6413M	-	Standard Test Method for Flame Resistance of Textiles (Vertical Test)

(Copies of these documents are available online at www.astm.org.)

ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD)

OECD Guidelines for the Testing of Chemicals, Section 4, Test No. 404	-	Acute Dermal Irritation/Corrosion
OECD Guidelines for the Testing of Chemicals, Section 4, Test No. 406	-	Skin Sensitisation

(Copies of these documents are available online at https://www.oecd-ilibrary.org/.)

SAE INTERNATIONAL

AMS-STD-595 - Colors Used in Government Procurement

AMS-STD-595/20150 - Coyote 498

(Copies of this document are available online at www.sae.org.)

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, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Inspections.

3.1.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.1.2 Conformance inspection. When specified (see 6.2), a sample shall be subjected to conformance inspection in accordance with 4.3.

3.2 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, 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.

3.3 Physical requirements. The cloth shall be an open-hole, net-like mesh warp knit conforming to the requirements specified in table I when tested as specified in 4.5.1.

TABLE I. Physical requirements.

Characteristic	Requirement
Construction	Open-hole, net-like warp knit mesh construction
Holes (voids) per square inch (relaxed)	30 – 55
Hole (void) size (relaxed), millimeters (mm) (minimum)	1.6
Fiber content	Modacrylic/rayon
Weight, ounces per square yard	3.0 – 4.0
Thickness (inches) (minimum)	0.02
Snag test (courses and wales) (minimum)	4
Pilling, rating (minimum)	4
Moisture regain, commercial, percent (maximum)	5
Drying time at 95 percent, minutes (maximum)	90
Dimensional stability (3 cycles), percent (maximum)	
Wales	5
Courses	12
Bursting strength, pounds (minimum)	40
Fabric stretch, percent (minimum)	
Wales	20
Courses	25

TABLE I. Physical requirements – Continued.

Characteristic	Requirement
Fabric growth, percent (maximum)	
Wales	5
Courses	10
Vertical flame (initial and after 5 launderings)	
Wales	No melt/no drip
Courses	No melt/no drip
pH (water extract)	5.0 – 8.5
Labile sulfur	See 3.4
Colorfastness, rating (minimum)	
Laundering (3 cycles)	4.0
Crocking	
Wet	4.0
Dry	4.0
Light (After 40 AFU [1/] or 170 kJ/(m^2nm) [2/] at 420 nm)	4.0
Visual shade matching	
Daylight D65	AMS-STD-595/20150 [3/]
Incandescent A	AMS-STD-595/20150 [3/]

FOOTNOTES:

[1/] AATCC fading units.

[2/] Kilojoules (kJ) per square meter per nanometer (m^2nm).

[3/] See 6.3.2.

3.4 Labile sulfur. The use of dyes and compounds containing sulfur capable of oxidation to sulfuric acid shall be chosen and applied such that the dyed and finished cloth shall show a rating of "slight" or "free" labile sulfur when tested as specified in 4.5.1.

3.5 Toxicity. When tested as specified in 4.5.3, the finished cloth shall not present a health hazard and shall show compatibility with prolonged, direct skin contact, as specified in 40 CFR §798.2250, Dermal Toxicity, and 40 CFR §798.4100, Dermal Sensitization. Chemicals recognized by the Environmental Protection Agency as human carcinogens shall not be used.

3.6 Length, width, and put-up.

3.6.1 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, and each length shall be put-up on a roll when examined in accordance with 4.5.2.

3.6.2 Width. For Government procurements only, the width of the finished cloth shall be as specified in the procurement document (see 6.2) and shall be the minimum acceptable width, inclusive of the selvage, when examined in accordance with 4.5.2.

3.7 Roll identification.

3.7.1 Fiber identification. Each roll shall be labeled or ticketed for fiber content in accordance with 16 CFR 303 when examined in accordance with 4.5.2.

3.7.2 Face identification. The face side of the cloth shall be identified by stamping the face side with the word "FACE" at each end of the roll when examined in accordance with 4.5.2.

3.8 Workmanship. The cloth shall conform to the quality of product established by this document. The cloth shall be uniform, and the occurrence of defects, when examined in accordance with 4.5.2, shall not exceed the established Acceptance Quality Limits (AQL) (see 6.2) and shall not adversely affect the serviceability, appearance, and uniformity of the product.

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. The first article, in accordance with 3.1.1, shall be examined in accordance with 4.5.1 through 4.5.3 for compliance with construction, appearance, color, finish, testing, configuration, and workmanship requirements as specified in this document.

4.2.1 First article samples and acceptance criteria. Unless otherwise specified in the contract (see 6.2), first article samples shall be provided. The sample unit shall be one continuous 5-yard length of full-width cloth. The presence of defects exceeding the established AQLs specified in the procurement document (see 6.2) or failure of any testing specified in in 4.5.1 through 4.5.3 shall be cause for rejection of the first article.

4.3 Conformance inspection. Unless otherwise specified in the contract (see 6.2), conformance inspection, in accordance with 3.1.2, shall consist of the examinations and tests as specified in 4.5.1 through 4.5.3.

4.3.1 Conformance sampling and acceptance criteria. Unless otherwise specified in referenced documents or procurement documents (see 6.2), material sampling shall be in accordance with table II. For material testing, the sample unit shall be 5 continuous yards full-width of the finished cloth for all physical and chemical tests. For visual inspection, the sample unit shall be a roll of fabric. The lot shall be unacceptable if one or more sample units fail to meet any test requirements specified in this document or fail to meet the AQLs (see 3.8) as defined by the contract (see 6.2).

TABLE II. Material sampling.

Lot size (yards)	Sample size (sample units)
800 or less	2
801 through 22,000	3
22,001 and over	4

4.4 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be performed in accordance with the test conditions specified in applicable test method documents for material testing and as specified in MIL-STD-3064 for visual inspection.

4.5 Inspection methods.

4.5.1 Material examinations and tests. In accordance with 3.3, the cloth shall be tested in accordance with the specified examinations and tests referenced in table III unless otherwise excluded, amended, or modified in applicable procurement documents (see 6.2).

TABLE III. Basic material verification.

Characteristic	Requirement	Verification method
Construction	3.3	Visual
Holes (voids) per square inch (in^2) (relaxed)	3.3	Visual
Hole (void) size (relaxed), millimeters (mm) (minimum)	3.3	4.5.1.1
Fiber content	3.3	AATCC TM20
Weight, ounces per square yard (oz/yd^2)	3.3	ASTM D3776/D3776M (method C)
Thickness (inches) (minimum)	3.3	ASTM D1777
Snag test (courses and wales) (minimum)	3.3	ASTM D3939/D3939M
Pilling, rating (minimum)	3.3	ASTM D3512/D3512M
Moisture regain, commercial percent (maximum)	3.3	ASTM D1909 and 4.5.1.2
Drying time at 95 percent, minutes (maximum)	3.3	4.5.1.3
Dimensional stability (3 cycles), percent (maximum)		
Wales	3.3	AATCC TM135, (1), III, (A), i
Courses	3.3	AATCC TM135, (1), III, (A), i
Fabric stretch, percent (minimum)		
Wales	3.3	ASTM D2594/D2594M 1/
Courses	3.3	ASTM D2594/D2594M 1/
Fabric growth, percent (maximum)		
Wales	3.3	ASTM D2594/D2594M 1/
Courses	3.3	ASTM D2594/D2594M 1/
Bursting strength, pounds (lbs.) (minimum)	3.3	ASTM D3787 2/ or ASTM D6797 2/
Vertical flame (initial and after 5 launderings)		
Wales	3.3	ASTM D6413/D6413M
Courses	3.3	ASTM D6413/D6413M
pH	3.3	AATCC TM81
Labile sulfur	3.3	4.5.1.4
Colorfastness, rating (minimum)		
Laundering (3 cycles)	3.3	AATCC TM61, Test 2A
Crocking		
Wet	3.3	AATCC TM8
Dry	3.3	AATCC TM8
Light (after 40 AFU or 170 $kJ/(m^2nm)$ at 420 nm)	3.3	AATCC TM16.3, option 3
Visual shade matching		
Daylight D65 (6500±200K)	3.3	AATCC EP 9, option A (see 4.5.4 and 6.3)
Incandescent A (2856±200K)	3.3	AATCC EP 9, option A (see 4.5.4 and 6.3)

FOOTNOTE:

1/ Use conditioning and procedures specified in ASTM D2594/D2594M for loose fitting items.

2/ The test method used is at the discretion of the vendor and should be specified in all reporting of the results.

4.5.1.1 Hole size determination. The hole size is determined by measuring the hole void in both the course and wale directions and taking the average of the course and wale void dimensions. A minimum of ten voids shall be measured in each direction. The cloth should be laid flat and be under no tension when measuring hole void.

4.5.1.2 Moisture regain. The commercial moisture regain (CMR) values from ASTM D1909 shall be used for the fibers used in the yarn blend to calculate the moisture regain with the following formula:

$$\begin{aligned} &CMR\ of\ Fiber\ \#1 \times Fiber\ \#1\ blend\ percentage \\ &CMR\ of\ Fiber\ \#2 \times Fiber\ \#2\ blend\ percentage \\ &\underline{+\ CMR\ of\ Fiber\ \#3 \times Fiber\ \#3\ blend\ percentage} \\ &Total\ commercial\ moisture\ regain\ (CMR) \end{aligned}$$

Example: 78/22 modacrylic/rayon fabric

$$0.4\% \times 78\%\ modacrylic + 11\% \times 22\%\ rayon = 2.7\%\ commercial\ moisture\ regain$$

Where 0.4% is the CMR value for modacrylic fiber and 11% is the CMR value for rayon fiber.

4.5.1.3 Drying time.

4.5.1.3.1 Apparatus and materials. The following apparatus and materials shall be used:

a. Wringer (motor driven) (see AATCC TM70 and 6.5).

b. Laboratory balance, accurate to 0.01 gram.

c. White AATCC textile blotting paper, 25 x 25 centimeters (see AATCC TM70 and 6.5).

d. Water, distilled.

e. 250-milliliter glass beaker.

4.5.1.3.2 Test specimens. The fabric samples and blotting paper shall be conditioned at 65±2 percent relative humidity (RH) and 70±2 °F for a minimum of 4 hours. Three 2- by 2-inch test specimens shall be tested per sample.

4.5.1.3.3 Drying time test procedure. The following drying time test procedure shall be followed:

a. Run test in standard conditions: 65±2 percent RH and 70±2 °F.

b. Weigh the conditioned specimen using a laboratory balance accurate to 0.01 gram.

c. Place 100 milliliters of distilled water into a 250-milliliter glass beaker.

d. Submerge the specimen in the beaker of water for 30 minutes. Make certain that the specimen is completely submerged to insure complete wetting.

e. Remove the specimen and sandwich it between two pieces of unused blotting paper. Pass the sandwich through the wringer with a dead weight load of 27.7±0.5 kilograms.

f. Immediately place specimen on the balance with top door of the balance open, side doors closed and record wet weight either to the nearest 0.01 or 0.10 gram. (The degree of dryness shall be determined by the user.) Manually monitor weight at set intervals until dry or use an automated balance with capability to weigh specimen until dry (see 4.5.1.3.4.c). Record time to dry.

g. Repeat for remaining specimens. Average the 3 specimens.

4.5.1.3.4 Drying time test notes.

a. Wringer (motor driven): See AATCC TM70.

b. Blotting paper: See AATCC TM70.

c. Balance: If software is used for the balance, it shall be validated prior to use.

4.5.1.4 Presence of labile sulfur test. The cloth shall meet the requirements specified in 3.4. In the determination of the presence of labile sulfur in textile materials with lead acetate, two 1.50±0.01-gram samples from each material submitted for evaluation shall be tested. Each of the two samples shall be cut into very small pieces and placed into separate test tubes. The samples shall be submersed into a stannous chloride solution that contains 100 grams of American Chemical Society (ACS) grade stannous chloride crystals in 100 milliliters of ACS grade hydrochloric acid (35 percent concentration) and 50 milliliters of distilled water. A filter paper wet out with a 5.0 percent lead acetate solution shall be placed over the top of the test tube. The lead acetate solution contains 5.0 grams of chemically pure (CP) reagent grade lead acetate and enough distilled water to make up a 100-milliliter solution; if the solution is not clear, a few drops (one at a time) of glacial acetic acid shall be added until the solution is clear. The test tube containing the textile sample, stannous chloride, and wet filter paper shall be heated over a low flame until the solution is boiling. The solution should not be heated for more than 15 seconds. A brown or black stain on the filter paper shall be evaluated as follows:

a. Free – The filter paper shows no discoloration or staining of any kind.

b. Slight – The filter paper shows a light tan to light brown discoloration stain.

c. Moderate – The filter paper shows a dark brown discoloration stain.

d. Severe – The filter paper shows a black color stain.

Results of the testing should be reported as “pass” or “fail”.

4.5.2 Visual examination. Each roll in the sample shall be examined on the face side in accordance with MIL-STD-3064, type V yard-by-yard examination; roll examination, and shade examination for defects.

4.5.3 Toxicity test. When the toxicity requirement (see 3.5) can be demonstrated with historical use data, toxicity testing may not be required on the finishing treatments used. If dermal toxicity testing is required (see 6.2), it shall be conducted in accordance with 40 CFR § 798.2250 and 40 CFR § 798.4100, which are consistent with OECD Guidelines for the Testing of Chemicals, Section 4, Test Nos. 404 and 406 (see 6.6).

4.5.4 Visual shade matching. The color and appearance of the fabric shall match the standard sample when viewed using the AATCC EP 9, Option C, (see 6.5) with a primary light source simulating the spectral quality of average daylight, CIE Illuminant D65, with a color temperature of 6500 (± 200) Kelvin (K) illumination of 100 (± 20) foot candles. Alternatively, the color and appearance of the (item) shall match the standard sample with a primary light source simulating artificial daylight, CIE Illuminant D75, with a color temperature of 7500K (± 200) illumination of 100 (± 20) foot candles in lieu of D65. (See 6.5.1). The (item) shall also be a good match to the standard sample with a secondary source simulating the spectral quality of incandescent lamplight, CIE Illuminant A, with a color temperature of 2856K (± 200).

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 materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact 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 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 used in the mesh cold weather base layer (MCWBL) undershirt and drawers, part of the cold weather clothing layering system worn by personnel of the United States Marine Corps in extreme cold weather environments.

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 and 2.3).
c. When first article is required (see 3.1.1).
d. When conformance inspection is required (see 3.1.2).
e. Length and put-up required (see 3.6.1)
f. Width required (see 3.6.2).
g. AQLs (see 3.8 and 4.3.1).
h. First article sampling and acceptance criteria (see 4.2.1).
i. Conformance inspection (see 4.3).
j. Material sampling and acceptance criteria (see 4.3.1).
k. Inspection conditions (see 4.4).
l. Material examinations and test exclusions (see 4.5.1).
m. Toxicity testing requirements (see 4.5.3).
n. Packaging requirements (see 5.1).
o. Shade standard information (see 6.3.2).

6.3 Visual shade matching. In 2017, option A of AATCC EP9 was changed to option C. NOTE: In case of confusion, the viewing geometry should be "The specimen plane and illumination source will be 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 (± 5°) angle relative to the horizontal. The observer will view the specimens at a 90° angle, relative to the plane of the specimens".

6.3.1 Use of D75 illuminant. The use of D75 illuminant with a color temperature of 7500±200 Kelvin and illumination of 100±20 foot candles in lieu of the specified D65 illuminant is permitted.

6.3.2 Shade criticality. Some items may be deemed "non-shade-critical" by the contracting agency and alternative shade standards or information regarding shade may be specified in the contract or order (see 6.2). It is recommended that manufacturers refer to the contract or order to determine the criticality of the shade matching or alternate shade standards that are acceptable.

6.4 Sources of supply. A known source of fabric meeting the requirements of this specification is Hornwood (www.hornwoodinc.com or 766 Haileys Ferry Road, Lilesville, NC 28091).

6.5 Wringer. AATCC TM70 cites criteria for the wringer and the blotting paper (see 4.5.1.3.1 and 4.5.1.3.4).

6.6 Toxicity testing. OECD Guidelines for the Testing of Chemicals, Section 4, Test Nos. 404 and 406 are recommended by the Office of the Surgeon General to assess the requirement of 3.5, but other test methods may be used. It is recommended that alternative test methods are assessed by the contracting agency prior to being used to address the toxicity requirements.

6.7 Subject term (key word) listing.

Baselayer

Drawers

Extreme cold weather

ECW

Marine Corps
MCWBL
No drip
No melt
Thermal
Underlayer
Undershirt

CONCLUDING MATERIAL

Custodians:
Army – GL
Navy – MC
Air Force – 11

Review activities:
Army – AV, CR, IH, MI
Navy – AS, CG1, NU
Air Force – 03
DLA – CT

Civilian review activity:
GSA – FAS

Preparing activity:
Navy − MC
(Project 8305-2022-035)

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 the ASSIST Online database at https://assist.dla.mil.