

INCH-POUND
GL-PD-15-04E
1 August 2019
SUPERSEDING
GL-PD-15-04D
6 February 2019

PURCHASE DESCRIPTION

COAT, IMPROVED HOT WEATHER COMBAT UNIFORM

This Purchase Description is approved for use by DLA Troop Support and is available for use by all Departments and Agencies of the Department of Defense (DoD).

1. SCOPE

1.1 Scope. This Purchase Description covers the requirements for an improved hot weather combat uniform coat to be worn by Army personnel in hot weather environments.

1.2 Classification. The coat for the Improved Hot Weather Combat Uniform (IHWCU) is treated for insect repellency and will be available in the following types, class and sizes.

1.2.1 Types.

Type I. Unisex
Type II. Female

1.2.2 Classes.

Class 1 Deleted
Class 2 Operational Camouflage Pattern (OCP)

Comments, suggestions, or questions on this document should be addressed to: Department of the Army, Combat Capabilities Development Command Soldier Center, 10 General Greene Avenue, Natick, MA 01760-5019. ATTN: FCDD-SCP-WC.

AMSC N/A

FSC 8415

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

1.2.3 Sizes. The coat unisex and female sizes will be as follows:

SCHEDULE OF SIZES - TYPE I UNISEX					
X-Small (XS)	Small (S)	Medium (M)	Large (L)	X-Large (XL)	XX-Large (2XL)
XX-Short (XX-S)	XX-Short	XX-Short	XX-Short	XX-Short	----
X-Short (X-S)	X-Short	X-Short	X-Short	X-Short	----
Short (S)	Short	Short	Short	Short	----
Regular (R)	Regular	Regular	Regular	Regular	Regular
Long (L)	Long	Long	Long	Long	Long
X-Long (X-L)	X-Long	X-Long	X-Long	X-Long	X-Long
----	----	XX-Long (XX-L)	XX-Long	XX-Long	XX-Long

SCHEDULE OF SIZES - TYPE II FEMALE			
30	33	36	39
X-Short	X-Short	X-Short	----
Short	Short	Short	Short
Regular	Regular	Regular	Regular
----	Long	Long	Long
----	----	X-Long	X-Long

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.

COMMERCIAL ITEM DESCRIPTIONS

- A-A-50199 - Thread, Polyester Core, Cotton or Polyester-Covered
- A-A-55126 - Fastener Tape, Hook and Loop, Synthetic
- A-A-59994 - Button, Sewing, Hole and Button Staple (plastic)

DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-DTL-5038 - Tape, Textile and Webbing, Textile, Reinforcing Nylon

MIL-DTL-32075 - Label: For Clothing, Equipage, and Tentage (General Use)
MIL-DTL-32439 - Cloth, Duck, Textured Nylon
MIL-C-44296 - Cloth, Fusible
MIL-DTL-44411 - Insect Repellent, Permethrin

(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 specified in the solicitation or contract.

DRAWINGS

U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND SOLDIER CENTER

2-1-2592 Operational Camouflage Pattern (OCP)

(Copies of drawings are available from the U.S. Army Combat Capabilities Development Command Soldier Center, ATTN: FCDD-SCP-WC, 10 General Greene Avenue, Natick, MA 01760-5019.)

OTHER GOVERNMENT DOCUMENTS AND PUBLICATIONS

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA Product Performance Test Guidelines
OPPTS 810.370 Insect Repellents For Human Skin and Outdoor Premises

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
(40 CFR Part 162) State Registration of Pesticide Products

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
FIFRA as amended by the Food Quality Protection Act of 1996 and the Pesticide Registration Improvement Act of 2003

(Copies are available online at <https://www.epa.gov/pesticides>.)

PURCHASE DESCRIPTIONS

CO-PD 06-05 Patch and Brassard, Identification, Infrared Retroflective

(Copies of documents are available through the contracting activity.)

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 specified in the solicitation or contract.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC Evaluation Procedure 1	- Gray Scale for Color Change
AATCC Evaluation Procedure 2	- Gray Scale for Staining
AATCC Evaluation Procedure 8	- Chromatic Transference Scale, 9-Step
AATCC Evaluation Procedure 9	- Visual Assessment of Color Difference in Textiles
AATCC Test Method 8	- Colorfastness to Crocking: AATCC Crockmeter Method
AATCC Test Method 15	- Colorfastness to Perspiration
AATCC Test Method 16.3	- Colorfastness to Light: Xenon
AATCC Test Method 20A	- Fiber Analysis: Quantitative
AATCC Test Method 61	- Colorfastness to Laundering: Accelerated
AATCC Test Method 81	- pH of the Water-Extract from Wet Processed Textiles
AATCC Test Method 135	- Dimensional Changes of Fabrics After Home Laundering

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

AMERICAN SOCIETY FOR QUALITY (ASQ)

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

(Copies are available on line at <https://asq.org>.)

ASTM INTERNATIONAL

ASTM D737	- Standard Test Method for Air Permeability of Textile Fabrics
ASTM D1424	- Standard Test Method for Tearing Strength of Fabrics by Falling - Pendulum (Elmendorf Type) Apparatus
ASTM D3775	- Standard Test Method for Warp (End) and Filling (Pick) Fabric Count of Woven Fabric
ASTM D3776/D3776M	- Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D3990	- Standard Terminology Relating to Fabric Defects
ASTM D5034	- Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM D6193	- Standard Practice for Stitches and Seams

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

OTHER PUBLICATIONS

SDL ATLAS

Part Number 402985 – Slub/Knot Replica Set

(Replica set is available for purchase from SDL Atlas Customer Service, 1-803-329-2110.)

INFORMA HEALTHCARE

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

(Copies 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 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 Design. The coat design for all types has a single-breasted front with a six (6) button closure, see patterns; a fold down collar with a fusible interlining, long sleeves with cuffs and one (1) button, three (3) buttonholes adjustable cuff tab. The top of the button down closure is open to accommodate a pen. The front has loop tape to accommodate the Name and US Army Tapes. The front placket has a loop tape for the Rank Patch. The coat has two (2) bellow style top opening upper sleeve pockets including an eyelet drainhole and loop tape on both the pocket and the flap. The coat sleeves have an elbow reinforcement patch. Both sleeves have an Identification Friend or Foe tab cover that can be opened and closed using hook and loop fastener. The IFF tab cover is centered and sewn on the IFF loop tape and the IFF loop is sewn and placed per the patterns. The left sleeve has a two (2) channel pencil pocket. The coat has a double turned and cleaned finished hem.

3.4 Materials.

3.4.1 Basic material. The basic material for the coat shall meet the requirements of Table I when tested as specified in 4.5. The color of the cloth shall be OCP for Class 2.

TABLE I. Physical requirements, basic material.

Characteristic	Requirements
Fiber identification quantitative, percent	57% T420 High Tenacity Nylon 43% Cotton
Weave	Ripstop
Weight, oz./square yard	5.0 - 6.0
Construction,(yarns per inch), (min.)	
Warp	75
Filling	45
Breaking strength, lbs. (min.)	
Warp	175
Filling	100
Tearing strength, (pounds) (min.)	
Warp	18
Filling	14
Dimensional stability, percent (max):	
Warp direction	3
Filling direction	3
Air Permeability (min.)	60 CFM
Toxicity	See 3.14

3.4.1.1 Operational Camouflage Pattern (OCP), Class 2. The cloth(s) shall be dyed to a ground shade matching Dark Cream 559 and then shall be overprinted with the camouflage pattern matching Drawing 2-1-2592. When the ground shade is dyed to match Dark Cream 559, the remaining six (6) colors shall be printed as appropriate, for the Tan 525, Light Sage 560, Olive 527, Dark Green 528, Brown 529 and Bark Brown 561 areas of the pattern. When the ground shade is not dyed Dark Cream 559 all seven (7) colors of the camouflage pattern shall be printed to match all seven (7) colors of the pattern.

3.4.1.2 Pattern execution. The pattern on the printed finished cloth(s) shall reproduce the standard sample in respect to design, colors and registration of the respective areas. The pattern repeat of shall be 25.255 (+1.25, -2.50) inches in the warp direction. The various areas of the pattern shall be properly registered in relation to each other and shall present definite sharp demarcations with a minimum of feathering or spew. Each pattern area shall show solid coverage; skitteriness exceeding that shown on the standard sample in any of the printed areas will not be acceptable. When the standard sample is not referenced for pattern execution, a pattern drawing shall be provided.

3.4.1.2.1 Pattern width (filling direction). The maximum camouflage printed area for the cloth shall be 68-inches in the filling direction.

3.4.1.3 Labile sulfur. Dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid shall not be used.

3.4.1.4 Visual shade matching (all Classes). The color and appearance of the cloth(s) shall match the standard sample (see 6.4) when tested as specified in 4.5.

3.4.1.5 Color. The cloth for the coat shall meet the colorfastness requirements of Table II when tested as specified in 4.5.

TABLE II. Colorfastness requirements.

Colors Evaluation	Laundering (3 cycles) Color Change and Staining (min.)	Light (40 AFU or 170kJ/ (m ² nm) @ 420 nm) (min.) <u>1/</u>	Perspiration (acid & alkaline) Color Change and Staining (min.)	Crocking (Dry and Wet) (min.)
Dk. Green 528, Brown 529, Bark Brown 561	3-4	3-4	3-4	3.5
Tan 525, Olive 527, Dark Cream 559, Light Sage 560	3-4	3	3-4	3.5

1/ AATCC Fading Units (AFU)

3.4.1.6 Spectral reflectance.

3.4.1.6.1 Operational Camouflage Pattern (OCP), Class 2. The reflectance values for the Class 2 cloth shall conform to the requirements listed in Table III, when tested as specified in 4.5.

TABLE III. Spectral reflectance requirements, Class 2.

Reflectance values (percent): Operational Camouflage Pattern (OCP)						
Wavelength, Nanometers (nm)	Dark Cream 559 & Tan 525		Light Sage 560, Olive 527 & Brown 529		Dark Green 528 & Bark Brown 561	
	Min.	Max.	Min.	Max.	Min.	Max.
600	22	44	12	30	3	11
620	24	45	12	30	3	12
640	24	45	12	32	4	13
660	25	45	12	32	4	14

TABLE III. Spectral reflectance requirements, Class 2.

Reflectance values (percent): Operational Camouflage Pattern (OCP)						
Wavelength, Nanometers (nm)	Dark Cream 559 & Tan 525		Light Sage 560, Olive 527 & Brown 529		Dark Green 528 & Bark Brown 561	
	Min.	Max.	Min.	Max.	Min.	Max.
680	28	45	14	34	4	17
700	28	48	14	36	6	23
720	30	52	16	39	6	23
740	32	55	18	41	10	25
760	36	56	20	43	14	30
780	38	57	22	45	18	35
800	40	57	22	45	21	40
820	44	58	24	46	24	42
840	46	59	26	47	26	43
860	48	60	28	48	28	45

3.4.2 Fusible interfacing (all types and classes). The fusible interfacing shall conform to MIL-C-44296, Type V, VI or VII, Style B or C substrate with Class 1 (polyamide) or Class 3 (Polyethylene, high density) adhesive. The fusible shall meet the bonding strength and shrinkage requirements, initial and after three (3) launderings as specified in MIL-C-44296.

3.4.3 Reinforcement patch cloth. The reinforcement patch cloth shall be in accordance with MIL-DTL-32439 Type IV, Class 1, Style H (OCP).

3.5 Insect bite protection (all types and classes). The finished garments with insect repellent treatment shall provide the minimum mosquito bite protection specified in 3.5.1 and the treatment shall be strictly limited to the levels specified in 3.5.2

3.5.1 Percent (%) bite protection. Finished insect repellent treated garments shall provide the minimum bite protection specified below when assessed by the biting protection testing specified in 4.6.2. Government approval shall be required initially, and any time there is a change in the insect repellent treatment formulation or processing conditions.

<u>Condition</u>	<u>% Mosquito Bite Protection</u>
Initial	≥ 85%
After 20 launderings	≥ 80%
After 50 launderings	≥ 70%

3.5.1.1 Insect repellent garment treatment of camouflage patterns. The mixing of camouflage patterns in the same insect repellent treatment garment application is not allowed. Patterns shall be treated separately.

3.5.1.2 Insect repellent garment application, finished measurements. Manufacturers shall comply with the finished measurement requirements in 3.13.1 and compensate for actual fabric shrinkage or growth after the application of garment treatment.

3.5.2 Insect repellent treatment. Insect repellent treatment process and garments will comply with Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) as amended (see 2.2.2). Insect repellent concentration in the coats shall comply with EPA Toxicological Category IV. The coats shall have an EPA registered (See 6.5) insect protection treatment. The garments shall be labeled in accordance with 3.9.3 and 3.9.4. The insect repellent finish shall be uniformly applied across the fabric or garments at an initial target level as specified in the EPA registered label and **strictly** controlled to fall within the minimum and maximum levels specified in Table IV. The treatment level shall provide the percent (%) bite protection specified in 3.5.1. The insect repellent treatment shall be durable to repeated laundering to provide the minimum insect repellent level after 20 laundings specified in Table IV. The insect repellent level will be measured as specified in paragraph 4.6.1. The finished insect repellent treatment shall not degrade any performance characteristics or present any latent defects to the cloth or garment.

TABLE IV. Insect repellent treatment level requirements.

Repellent active ingredient (AI)	Condition	AI target level (w/w%)	AI concentration (mg/cm ²)	
			Minimum	Maximum
Permethrin	Initial	0.52%	0.079	0.116
	After 20 x	--	0.025	0.116
Other AI	Initial	See 6.2	See 6.2	See 6.2
	After 20 x	--	See 6.2	--

3.6 pH (Class 2). The pH value of the water extract of all the finished cloth and garments shall be no lower than 5.0 or higher than 8.5 when tested as specified in 4.5 and 4.6.

3.7 Components materials and shade (All Classes). The component materials for the coat shall be made in accordance to paragraphs 3.3 and 3.7 - 3.7.5. Component materials for the coat are for all classes unless otherwise noted. All component shade shall match Tan 499 for OCP uniforms unless otherwise noted.

3.7.1 Tape. The nylon tape to cover the identification friend or foe (IFF) material shall be 1-inch wide conforming to Type III of MIL-DTL-5038. The ends of the tape shall be heat cut to prevent raveling.

3.7.2 Fastener tape, hook and loop. The hook fastener tape shall conform to Type II, Class 1 or Class 4 of A-A-55126. The loop fastener tape shall conform to Class 1 or Class 4 of A-A-55126. The widths shall be as specified for each application throughout this purchase description. The fastener tape, hook and loop, shall be consistent in manufacturer within a garment.

3.7.2.1 Fastener tape, hook and loop use. The use of hook and loop with and without selvage within a garment is allowed (does not need to be consistent within the garment). Hook and loop without selvage shall be heat slit along edges by hook and loop manufacturer only and shall not fray and shall meet the requirements of A-A-55126.

3.7.3 Identification friend or foe (IFF) material. The IFF material shall conform to Type I of CO-PD-06-05.

3.7.4 Thread (All Classes). The thread for seaming and stitching the coat shall conform to Table V. All thread shall be non-staining and the requirements in each Commercial Item Description (CID) shall apply.

TABLE V. Thread requirements.

Component area	Thread specification	Needle thread 1/ (Tex size)	Bobbin/Looper thread 1/ (Tex size)
All seaming, stitching and bar-tacking	A-A-50199, Type II	36-45 or 46-60	36-45 or 46-60
Button attachment	A-A-50199, Type II	71-105	71-105
Overedge stitching (raw edges)	A-A-50199, Type II	31-35	31-35

1/ Needle & Bobbin/Looper shall use same Tex size thread

3.7.5 Buttons. Buttons shall be dull finish, four (4) holes, 30 ligne conforming to A-A-59994, Type I, Class 1, Style 26. When attached to the coat, the button and thread shall withstand a pull/break of 40 pounds (minimum) when tested as specified in 4.6.

3.8 Construction. The construction for the coat shall be made in accordance to paragraphs 3.8 - 3.8.10. Construction is for all classes unless otherwise noted. All garment material edges shall be clean finished, either, turned-in, turned-under or serged unless otherwise indicated. All components with a grain line shall follow the grain line of the basic garment material or as indicated on pattern.

3.8.1 Fastener tape (hook and loop). All widths of hook and loop tape shall be sewn 1/8-inch to 3/16-inch from bound selvage (for fastener tape with selvage) or from tape edge (for fastener tape without selvage) to prevent needle cutting along edges, stitching runoffs or improper fit into automatic sewing equipment. To prevent raveling on fastener tape with selvage, do not sew directly on the selvage. The use of fastener tape that is slit, has split edges, or any splicing of fastener tape is not permitted. Under no circumstances shall any fastener tape be re-stitched for repair purposes. New tape shall be used for repairs to prevent needle cutting, thus offering maximum field life. Tolerance for all lengths and width shall be ($\pm 1/8$) inch (see Table VIII). See patterns for placement of fastener tape.

3.8.2 Collar. The coat collar shall be a fold down style. The inside ply of the collar, when in standing position, shall be interlined.

3.8.3 Coat front. The coat shall have a left front facing that conceals a five (5) buttonhole placket. The coat shall have six (6) buttons attached to the right front, one (1) shall be positioned at top of the front opening in accordance with buttonhole mark on the pattern and five (5) shall align with the buttonholes on the left placket. Front left placket will be aligned with corresponding markings. Coat fronts shall be equal in length to each other. The front facings and placket shall not be exposed.

3.8.4 Sleeve pockets.

3.8.4.1 Upper sleeve pockets. Each sleeve shall have an upper pocket.

3.8.4.2 Upper sleeve pocket flaps. Each upper sleeve pocket shall have a pocket flap.

3.8.4.3 Upper sleeve pocket bellows. The sleeve pocket shall have bellows at the back and bottom. The pocket shall finish 5-1/4 ($\pm 3/16$) inches in width and 6-1/2 ($\pm 3/16$) inches in length.

3.8.4.4 Upper sleeve pocket eyelets. The sleeve pockets shall have an eyelet at the bottom bellow. The sewn-in eyelets for the sleeve pocket bellows shall have a 1/4-inch ($\pm 1/16$) diameter finished opening. See pattern for eyelet placement.

3.8.4.5 Upper sleeve pocket loop tape. The sleeve pocket shall have loop tape (3.8.1), 4-inches in width and 4-1/2 inches in length. The pocket flap shall have loop tape that is 2-inches wide and 3-1/2 inches long. The sleeve pocket loop tape shall be "X" stitched from corner to corner.

3.8.4.6 Pencil pocket. The left sleeve shall have a 2-channel pencil pocket above the sleeve cuff. The pocket shall be 2-3/8 ($\pm 1/8$) inches wide and have a 3/4-inch double turned cleaned finished hem (see figure 1). The pocket shall have two (2) evenly spaced channels (permitted variation within 1/8-inch). See pattern for placement.

3.8.5 Sleeve cuff. The sleeve cuff shall be as specified in the pattern. The main body of the sleeve cuff shall have three (3) buttonholes spaced as per pattern. The sleeve cuff shall have a pointed adjustable tab with one (1) button sewn to the underside for closure adjustment (see Figures 4, 5 and 6). The sleeve tabs shall be 2-1/8 ($\pm 1/8$) inches wide by 3-1/8 ($\pm 1/8$) in length for all sizes.

3.8.5.1 Buttonholes. The buttonholes shall be bar type (see Figures 4, 5 and 6) for the cuff with not less than four (4) tacking stitches at bar end (not counting the crossover stitch). The purling shall not be visible on the exterior of the coat. The cut lengths shall be 3/4 to 7/8-inch. The buttonholes shall be clean cut with the stitching securely caught in fabric. The replacement button shall be positioned on the inside of the right front facing, 2 ($\pm 1/2$) inches up from the finished bottom. All buttonholes shall be reinforced with sewn, fused or self-fabric interfacing to stabilize the buttonholes.

3.8.6 Elbow reinforcement. The coat shall have an elbow reinforcement patch on each sleeve, stitched down on all four (4) sides. See pattern for placement.

3.8.7 Coat hem. The coat hem shall finish $5/8$ ($\pm 1/8$) inch wide, double turned and clean finished.

3.8.8 Name tape and U.S. Army tape. There shall be a piece of loop fastener tape 1-inch wide by $5\text{-}1/4$ -inches in cut length, sewn on to accommodate the name tape and U.S. Army tape. The loop tape shall be placed horizontal (see pattern for loop tape placement). Both loop tapes shall be in alignment with each other when coat is buttoned. The name tape, and the U.S. Army tape, may cover the sleeve seam on the smaller sizes.

3.8.9 Identification Friend or Foe (IFF) configuration. The IFF material shall be on both sleeves. A 1-inch width loop fastener tape finishing $3\text{-}1/4$ -inches in length shall be stitched onto the sleeve base material. A 1-inch width nylon tape finishing $1\text{-}7/8$ ($\pm 1/16$) inches in length shall have a $1/2$ -inch length hook fastener tape sewn onto the nylon tape. The nylon tape shall be of sufficient length to cover the IFF material when the hook is engaged. See IFF webbing details in Figure 4, and Figure 5 and pattern for IFF placement. The IFF material shall be in accordance with 3.8.9.1.

3.8.9.1 Identification Friend or Foe (IFF) material. The IFF material as specified in 3.7.3 shall finish $3/4$ -inch wide and $3/4$ ($\pm 1/16$) inch in cut length.

3.8.10 Rank patch. The rank patch shall be a piece of loop fastener tape, 2-inches wide by 2-inches in cut length. See pattern for placement.

3.9 Labels (all types and classes). Labels are for all classes unless otherwise noted. All garments shall have a size label and a combination identification/care label sewn into the coat. All coats shall have an additional insect protection/identification/care label sewn into the coat and a hang tag. The printing for all labels shall be black. The font size for the inscription of the size label shall be 10 points. The inscription shall have a minimum font size of 8 points for identification/care label and insect protection/identification/care label only. Inscription shall be legible.

3.9.1 Size label. The size label shall conform to Type VI, Class 2 of MIL-DTL-32075 and shall be sewn on the inside center back approximately $1/2$ -inch below the neckline. The label shall be sewn on all four (4) sides and the stitching shall not cover the printing. The color of the size labels for the coat shall be white. The size label shall include the information in Table VI for Type I and Table VI–A for Type II for the applicable size:

TABLE VI. Size label - Type I (Unisex)

X-Small - XX-Short Height: 55 to 59 in. Chest: 29 to 33 in. NSN No. NATO Size: 4050/7484	X-Small - X-Short Height: 59 to 63 in. Chest: 29 to 33 in. NSN No. NATO Size: 5060/7484	X-Small - Short Height: 63 to 67 in. Chest: 29 to 33 in. NSN No. NATO Size: 6070/7484
X-Small - Regular Height: 67 to 71 in. Chest: 29 to 33 in. NSN No. NATO Size: 7080/7484	X-Small - Long Height: 71 to 75 in. Chest: 29 to 33 in. NSN No. NATO Size: 8090/7484	X-Small - X-Long Height: 75 to 79 in. Chest: 29 to 33 in. NSN No. NATO Size: 9000/7484
Small – XX-Short Height: 55 to 59 in. Chest: 33 to 37 in. NSN No. NATO Size: 4050/8494	Small – X-Short Height: 59 to 63 in. Chest: 33 to 37 in. NSN No. NATO Size: 5060/8494	Small – Short Height: 63 to 67 in. Chest: 33 to 37 in. NSN No. NATO Size: 6070/8494
Small – Regular Height: 67 to 71 in. Chest: 33 to 37 in. NSN No. NATO Size: 7080/8494	Small – Long Height: 71 to 75 in. Chest: 33 to 37 in. NSN No. NATO Size: 8090/8494	Small – X-Long Height: Above 75 in. Chest: 33 to 37 in. NSN No. NATO Size: 9000/8494
Medium – XX-Short Height: 55 to 59 in. Chest: 37 to 41 in. NSN No. NATO Size: 4050/9404	Medium – X-Short Height: 59 to 63 in. Chest: 37 to 41 in. NSN No. NATO Size: 5060/9404	Medium – Short Height: 63 to 67 in. Chest: 37 to 41 in. NSN No. NATO Size: 6070/9404
Medium – Regular Height: 67 to 71 in. Chest: 37 to 41 in. NSN No. NATO Size: 7080/9404	Medium – Long Height: 71 to 75 in. Chest: 37 to 41 in. NSN No. NATO Size: 8090/9404	Medium – X-Long Height: 75 to 79 in. Chest: 37 to 41 in. NSN No. NATO Size: 9000/9404
Medium – XX –Long Height: 79 to 83 in. Chest: 37 to 41 in. NSN No. NATO Size: 0010/9404	Large – XX-Short Height: 55 to 59 in. Chest: 41 to 45 in. NSN No. NATO Size: 4050/0414	Large – X-Short Height: 59 to 63 in. Chest: 41 to 45 in. NSN No. NATO Size: 5060/0414
Large – Short Height: 63 to 67 in. Chest: 41 to 45 in. NSN No. NATO Size: 6070/0414	Large – Regular Height: 67 to 71 in. Chest: 41 to 45 in. NSN No. NATO Size: 7080/0414	Large – Long Height: 71 to 75 in. Chest: 41 to 45 in. NSN No. NATO Size: 8090/0414

TABLE VI. Size label - Type I (Unisex). - Continued

Large – X-Long Height: 75 to 79 in. Chest: 41 to 45 in. NSN No. NATO Size: 9000/0414	Large- XX-Long Height: 79 to 83 in. Chest: 41 to 45 in. NSN No. NATO Size: 0010/0414	X-Large – XX-Short Height: 55 to 59 in. Chest: 45 to 49 in. NSN No. NATO Size: 4050/1424
X-Large – X-Short Height: 59 to 63 in. Chest: 45 to 49 in. NSN No. NATO Size: 5060/1424	X-Large – Short Height: 63 to 67 in. Chest: 45 to 49 in. NSN No. NATO Size: 6070/1424	X-Large – Regular Height: 67 to 71 in. Chest: 45 to 49 in. NSN No. NATO Size: 7080/1424
X-Large – Long Height: 71 to 75 in. Chest: 45 to 49 in. NSN No. NATO Size: 8090/1424	X-Large - X-Long Height: 75 to 79 in. Chest: 45 to 49 in. NSN No. NATO Size: 9000/1424	X-Large - XX-Long Height: 79 to 83 in. Chest: 45 to 49 in. NSN No. NATO Size: 0010/1424
XX-Large - Regular Height: 67 to 71 in. Chest: 49 to 53 in. NSN No. NATO Size: 7080/2435	XX-Large - Long Height: 71 to 75 in. Chest: 49 to 53 in. NSN No. NATO Size: 8090/2435	XX-Large - X-Long Height: 75 to 79 in. Chest: 49 to 53 in. NSN No. NATO Size: 9000/2435
XX-Large - XX-Long Height: 79 to 83 in. Chest: 49 to 53 in. NSN No. NATO Size: 0010/2435	-----	-----

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TABLE VI-A. Size label - Type II (Female).

30 – X Short Height: 54 to 58 in. Chest: 30 to 33 in. NSN No. NATO Size: 4050/7484	33 – X Short Height: 54 to 58 in. Chest: 33 to 36 in. NSN No. NATO Size: 4050/8494	36 – X Short Height: 54 to 58 in. Chest: 36 to 39 in. NSN No. NATO Size: 4050/9404	-----
30 – Short Height: 58 to 62 in. Chest: 30 to 33 in. NSN No. NATO Size: 5060/7484	33 – Short Height: 58 to 62 in. Chest: 33 to 36 in. NSN No. NATO Size: 5060/8494	36 – Short Height: 58 to 62 in. Chest: 36 to 39 in. NSN No. NATO Size: 5060/9404	39 – Short Height: 58 to 62 in. Chest: 39 to 42 in. NSN No. NATO Size: 5060/9404
30 – Regular Height: 62 to 66 in. Chest: 30 to 33 in. NSN No. NATO Size: 6070/7484	33 – Regular Height: 62 to 66 in. Chest: 33 to 36 in. NSN No. NATO Size: 6070/8494	36 – Regular Height: 62 to 66 in. Chest: 36 to 39 in. NSN No. NATO Size: 6070/9404	39 – Regular Height: 62 to 66 in. Chest: 39 to 42 in. NSN No. NATO Size: 6070/9404
-----	33 – Long Height: 66 to 70 in. Chest: 33 to 36 in. NSN No. NATO Size: 7080/8494	36 – Long Height: 66 to 70 in. Chest: 36 to 39 in. NSN No. NATO Size: 7080/9404	39 – Long Height: 66 to 70 in. Chest: 39 to 42 in. NSN No. NATO Size: 7080/9404
-----	-----	36 – X Long Height: 70 to 74 in. Chest: 36 to 39 in. NSN No. NATO Size: 8090/9404	39 – X Long Height: 70 to 74 in. Chest: 39 to 42 in. NSN No. NATO Size: 8090/9404

3.9.2 Identification and care label. The combination identification/care label shall conform to Type VI, Class 15 of MIL-DTL-32075. The color of the combination identification and care label shall be white. The label shall be stitched on the inside of the coat starting 1 ($\pm 1/4$) inch above the hem, on the right front (as worn) vertically with the top part of the label facing the top of the coat. The stitching shall not penetrate the printing but will penetrate the coat front. The label shall include the information in Figure 1.

Coat, Improved Hot Weather Combat Uniform – Unisex or Coat, Improved Hot Weather Combat Uniform – Female Fiber Content: Basic material: 57% Nylon/ 43% Cotton Reinforcement material: 100% Nylon Contractor Name: Lot Number <u>1</u>/
<u>USE AND CARE</u> <u>PRIOR TO LAUNDERING:</u> Empty pockets and remove patches. Close buttons and hook and loop fasteners. Pre-treat stains with commercially available pre-treatments. <u>HOME LAUNDERING:</u> Use cold water detergent. Wash in cold water using permanent press cycle. Rinse in cold water. Tumble dry low. <u>WASHING BY HAND:</u> Use cold water detergent. Wash in cold water. Rinse completely. Never twist or wring dry. Hang dry on a rust-proof hanger. Do not hang dry in direct sunlight. <u>NOTE:</u> Wash garment separate from other garments. In military field operations, garment may be washed with other garments. <u>CAUTION:</u> DO NOT USE BLEACH, BLEACH ALTERNATIVES, FABRIC SOFTENER, OR STARCH. DO NOT DRY CLEAN OR COMMERCIALY HOT PRESS. DO NOT APPLY HEAT OR AN IRON TO ANY HOOK AND LOOP FASTENER. <u>DO NOT REMOVE THIS LABEL</u>

1/ Lot number shall be stamped with indelible black ink prior to shipment.

FIGURE 1. Combination identification, use and care label (all types).

3.9.3 Insect repellent protection label. The insect repellent protection label shall conform to Type VI, Class 15 of MIL-DTL-32075. The label placement shall be as specified in 3.9.3.1. The label shall include both permanent insect protection and brand labeling information; and shall comply with the approved EPA registration (see 6.4). The color for the insect repellent protection label shall be white. The label shall be the approved EPA label (see example in Figure 2).

3.9.3.1 Label placement. The label shall be stitched on the inside of the coat starting 1 (± 1/4)-inch above the hem on the left front. The label shall be stitched on all four (4) sides. The stitching shall not penetrate the printing and shall be visible on coat front. The label shall be stitched vertically with the bottom edge of the label parallel to the hem of the coat.

Insect Repellent Brand Name: INSECT REPELLENT APPAREL Refer to hangtag for more information Coat, Improved Hot Weather Combat Uniform – Unisex or Coat, Improved Hot Weather Combat Uniform – Female Contractor Name: EPA REG. NO.: EPA EST. NO.:								
- Do Not Dry Clean - Dry Cleaning removes active ingredient - Wash separate from other clothing - In military field operations, garment may be washed with other garments. - Do Not Re-treat - Dispose of garment in trash in accordance with Army regulations Repels mosquitoes Repellency remains effective for 50 washings <table> <tr> <td>ACTIVE INGREDIENT</td> <td>%W/W</td> </tr> <tr> <td>Permethrin</td> <td>0.52%</td> </tr> <tr> <td>OTHER INGREDIENTS: (Garment).....</td> <td>99.48%</td> </tr> <tr> <td>TOTAL.....</td> <td>100.00%</td> </tr> </table> It is a violation of Federal Law to use this product in a manner inconsistent with its labeling DO NOT REMOVE THIS LABEL	ACTIVE INGREDIENT	%W/W	Permethrin	0.52%	OTHER INGREDIENTS: (Garment).....	99.48%	TOTAL.....	100.00%
ACTIVE INGREDIENT	%W/W							
Permethrin	0.52%							
OTHER INGREDIENTS: (Garment).....	99.48%							
TOTAL.....	100.00%							

FIGURE 2. Insect repellent label (example) (all types).

3.9.4 Hang tag, Mosquito bite protection. Each coat shall have an individual paper tag attached to the garment conforming to Type VIII, Class 15 of MIL-DTL-32075. The color for the hang tag shall be white. The paper tag shall be Swift tacked at center back on inside collar joining seam. The tag shall provide additional Mosquito bite protection information in accordance with and as required by EPA registration and labeling. The hang tag shall be the approved EPA hang tag (see example in Figure 3).

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Insect Repellent Brand Name: INSECT REPELLENT APPAREL Contractor Name: Contractor Address: EPA REG. NO.: EPA EST. NO.:									
- Do Not Dry Clean - Dry Cleaning removes active ingredient - Wash separate from other clothing - In military field operations, garment may be washed with other garments. - Do Not Re-treat - Dispose of garment in trash in accordance with Army regulations - For protection of exposed skin, use in conjunction with a repellent registered for direct application to the skin. Repels mosquitoes Repellency remains effective for 50 washings <table> <tr> <td>ACTIVE INGREDIENT</td> <td>%W/W</td> </tr> <tr> <td>Permethrin</td> <td>0.52%</td> </tr> <tr> <td>OTHER INGREDIENTS: (Garment).....</td> <td>99.48%</td> </tr> <tr> <td>TOTAL.....</td> <td>100.00%</td> </tr> </table> It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Retain hangtag for future reference on proper handling of this garment. THIS TAG NOT TO BE REMOVED EXCEPT BY CUSTOMER		ACTIVE INGREDIENT	%W/W	Permethrin	0.52%	OTHER INGREDIENTS: (Garment).....	99.48%	TOTAL.....	100.00%
ACTIVE INGREDIENT	%W/W								
Permethrin	0.52%								
OTHER INGREDIENTS: (Garment).....	99.48%								
TOTAL.....	100.00%								

FIGURE 3. Insect repellent hang tag (example) (all types).

3.9.5 Barcode hang tag (all types, styles and classes). Each coat shall have a white paper barcode hang tag conforming to Type VIII, Class 17 of MIL-DTL-32075. The hang tag shall be Swift tacked at center back on inside collar joining seam and shall be completely visible on the coat when it is folded and/or packaged as specified and so it causes no damage to the coat. The bar coding element shall be a 13 digit National Stock Number (NSN) or Management Control Number (MCN). There shall be a 12 digit Universal Product Code (UPC) number assigned for all MCNs by the contracting activity. The initials "UPC" must appear beneath the code.

NOTE: The hang tag for insect protection and barcode may be applied jointly with the use of one (1) Swift tack.

3.10 Figures. Figures 4 through 6 are furnished for informational purposes only. To the extent of any inconsistencies between the written document and the figures, the written document shall govern.

3.11 List of pattern parts. The Government shall furnish patterns, which show directional line markings for proper cutting and assembly, and are to be used as a guide for cutting contractor's working patterns. The Government patterns provide a seam allowance of 1/2-inch for side seams, shoulder seams, and sleeve seams, 3/8-inch allowance for collar and all other seams, except where otherwise specified. Pockets, pocket flaps, pencil pocket, elbow patches, cuffs, collar, patch loop tape, other hook and loop fastener tape, and bar-tacks shall be located in accordance with marks on patterns and table references. Minor modifications to the pattern are permitted where necessary to accommodate manufacture's processes to include garment treatments and use of automatic equipment. These modifications shall not alter the final design, serviceability, appearance or final finished measurements. The pattern lists in Table VII and VII-A are provided to insure that the pattern sets are complete (see 6.2).

TABLE VII. List of pattern parts - Type I (Unisex).

Material	Nomenclature	Pattern Abbreviation	Cut Number
Basic Material (see 3.4.1)	Front Right	PD15_04C-FRT-RT	1
	Front Left	PD15_04C-FRT-LFT	1
	Back	PD15_04C-BACK	1
	Sleeve	PD15_04C-SLEEVE	2
	Collar	PD15_04C-COLLAR	2
	Sleeve Pocket	PD15_04C-SLV-PKT	2
	Sleeve Pocket Flap	PD15_04C-SLV-PKT-FLP	2
	Cuff	PD15_04C-CUFF	2
	Cuff Tab	PD15_04C-CUFF-TAB	2
	Left Front Placket	PD15_04C-LFT-FT-PLKT	1
	Left Pencil Pocket	PD15_04C-PENCIL-PKT	1
Interfacing (see 3.4.2)	Collar Interfacing	PD15_04C-CLR-INTR	1
	Front Placket Interfacing	PD15_04C-FT-PLK-INTR	1
Cloth, Duck Texturized Nylon (see 3.4.3)	Elbow Patch	PD15_04C-ELBOW-PATCH	2
Templates	IFF Webbing Template	PD15_04C-IFF-WEB-TEM	-

TABLE VII-A. List of pattern parts - Type II (Female).

Material	Nomenclature	Pattern Abbreviation	Cut Number
Basic Material (see 3.4.1)	Front Right	PD15_04F-FRT-RT	1
	Front Left	PD15_04F-FRT-LFT	1
	Back	PD15_04F-BACK	1
	Sleeve	PD15_04F-SLEEVE	2
	Collar	PD15_04F-COLLAR	2
	Sleeve Pocket	PD15_04F-SLV-PKT	2
	Sleeve Pocket Flap	PD15_04F-SLV-PKT-FLP	2
	Cuff	PD15_04F-CUFF	2
	Cuff Tab	PD15_04F-CUFF-TAB	2
	Left Front Placket	PD15_04F-LFT-FT-PLKT	1
	Left Pencil Pocket	PD15_04F-PENCIL-PKT	1
Interfacing (see 3.4.2)	Collar Interfacing	PD15_04F-CLR-INTR	1
	Front Placket Interfacing	PD15_04F-FT-PLK-INTR	1
Cloth, Duck Texturized Nylon (see 3.4.3)	Elbow Patch	PD15_04F-ELBOW-PATCH	2
Templates	IFF Webbing Template	PD15_04F-IFF-WEB-TEM	-

3.12 Configuration. Each coat shall conform to design, appearance (see Figures 4 - 6), the finished measurements in Table X and Table X-A and the construction methods specified in 3.12.1 through 3.12.3, and Tables VI, VI-A, VII and VII-A in order to maintain configuration compliance.

3.12.1 Seams and stitching. All seams shall be consistent and exhibit a uniform appearance and conform to the ASTM D6193 seam and stitch types listed in Table VIII. The backside of seams (inside garment) shall be flat with no protruding seam allowance to create irritation or discomfort. All material edges shall be clean finished, either, turned-in, turned-under or serged. Needle and bobbin thread tension shall be balanced such that neither is too tight nor too loose relative to each other. The seams for all outside visible stitching shall be sewn with 11 ($\pm$ 1) stitches per inch. Overedge or pre-hemming shall be 10 ($\pm$ 2) stitches per inch. Buttons shall be attached with 16 stitches per button. Buttonholes shall be 54 ($\pm$ 2) stitches per inch including tack. All hook and loop tape shall be sewn with 10 ($\pm$ 2) stitches per inch. The IFF material shall be sewn with 8 ($\pm$ 1) stitches per inch. The sewn eyelets for the bellows pockets shall have a minimum of 16 stitches. The width of the bight of stitching shall not be less than 1/16-inch. The eyelet stitching shall have at least four (4) overlapping stitches with the purling on the outside. All stitches per inch and gauge requirements shall be met prior to any applicable garment treatments.

3.12.1.1 Repair of stitch.

3.12.1.2 Repairs of stitching. Repairs of stitching shall be as follows:

- a. When thread breaks or bobbin run-outs occur during stitching, the stitching shall be repaired by restarting the stitching a minimum of 1/2-inch in back of the end of the stitching.
- b. Thread breaks or two (2) or more consecutive skipped or run-off stitches noted during end item inspection shall be repaired by overstitching. The stitching shall start at a minimum of 1/2-inch in back of the defective area and continue a minimum of 1/2-inch beyond the defective area onto the existing stitching. Loose or excessively tight stitching shall be repaired by removing the defective stitching, without damaging the materials, and restitching in the required manner.

NOTE: When making the above repairs, the ends of the stitching are not required to be backstitched. The loose ends shall be trimmed with scissors. **Caution:** Pulling or breaking the loose ends is not allowed.

3.12.1.3 Repairs of type 401 stitching only. All repairs shall be in accordance with 3.12.1.1 and 3.12.1.2, except substitute 3/4-inch for 1/2-inch wherever 1/2-inch appears. Repairs to stitch type 401 may be accomplished by use of stitching type 301.

3.12.2 Stitching for hook and loop tape. The hook and loop tape shall be sewn with the use of a straight stitch, box stitch or box-X stitch with special stitched corners as specified in Table VIII.

TABLE VIII. Seam and stitch types (all types).

Seam placement	Seam type	Gauge	Stitch type
Side seams, back sleeve seams, set in sleeves, armhole, shoulder seams	LSc-2 or Ssa2-2 and LSq-3	3/16 to 1/4-inch gauge (double lap seam)	301 or 401
Top stitching of pencil pocket, collar and front edge	OSf-1	1/16 to 1/8-inch from edge	301
Top stitching of placket with buttonholes	OSf-1	1/16 to 1/8-inch from edge	301
Top stitching of sleeve cuff tabs	OSf-1	3/16 to 1/4-inch from folded edge	301
Upper sleeve pocket bellows, inside pleat	OSf-1	1/16 to 1/8-inch from edge	301

TABLE VIII. Seam and stitch types (all types).- Continued

Seam placement	Seam type	Gauge	Stitch type
Attachment of pockets (When using automatic pocket setting equipment topstitching shall be 1/6, 1/8, or 3/16 gauge)	LSd-1	1/16 to 1/8-inch from edge	301
Attachment of pocket flaps	LSbl-2 or LSd-2	3/16 to 1/4-inch Two (2) rows 3/16 to 1/4 - inch apart	301 or 401 and 301
Top stitching of, pocket flaps	OSF-1	3/16 to 1/4-inch gage	301
Attachment of elbow reinforcements	LSd-2	Two (2) rows 3/16 to 1/4-inch apart	301
Bottom hemming	EFb-1	1/2 to 3/4-inch wide hem, double turned clean finished, stitching 1/16 to 1/8-inch from hem fold	301
Setting cuffs	LSd-1	1/16 to 1/8-inch from edge	301
Topstitch collar	SSa-1	1/16 to 1/8-inch from edge	301
Name tape, U.S. Army tape, IFF, Rank tape,	LSbj-1	Box, 1/8 to 3/16-inch from selvage edge	301
Nylon tape attachment onto IFF loop tape	LSbj-1	1/16 to 1/8-inch from edge of nylon tape (see IFF pattern template)	301
Hook fastener tape attachment onto IFF tab nylon tape cover	LSbj-1	Box, 1/8 to 3/16-inch from selvage edge (see IFF pattern template)	301
Labels	LSbj-1	1/8 to 3/16-inch from edge	301

3.12.3 Bar-tacks and back-tacks. To maintain durability and functionality, bar-tacks shall be placed as specified in Table IX. Bar-tacks shall be 1/8 to 3/16-inch wide. Nominal lengths and stitches per tack shall also be as specified in Table IX. Back-tacks shall have two (2) to four (4) rows of stitching.

TABLE IX. Bar-tack and back-tack placement (all types).

Bar-tack or back-tack placement	Size of tack (inches)	Stitches per tack <u>1/</u>	# of Bar-tacks per garment	# of Back-tacks per garment	Horizontal	Vertical
Lower sleeve cuff tab at ends	1/2	30	4	----	----	X
Upper sleeve pocket						
Top Front through all layers	5/8	36	2	----	----	X
Top back	5/8	36	2	----	----	X
Front bottom edge through all layers	5/8	36	2	----	X	----
Pencil pocket						
a. Top (left, center, right)	5/8	36	3	----	----	X
b. Bottom (center)	5/8	36	1	----	----	X
Upper sleeve pocket flap	5/8	36	4	----	X	----
End of cuff (underarm seam)	5/8	36	2	----	X	
Name Tape loop tapes <u>2/</u>	----	----	----	4	----	X
U.S. Army loop tapes <u>2/</u>	----	----	----	4	----	X
Rank loop Tape <u>2/</u>	----	----	----	4	----	X
IFF hook and loop	----	----	----	4	----	X
Front bottom hem stitch line at center front	1/2 - 5/8	30 - 36	1 or 1		X	----
Front buttonhole placket bottom	1/2 - 5/8	30 - 36	1 or 1		X	----
Front placket between buttonholes	5/8	36	4	----	X	----
Front facing top Top of buttonhole placket				1		X

1/ The tolerance shall be (± 2) stitches per tack except where range is given.

2/ The bar-tack/back-tack shall catch both loop and basic material, as long as it does not interfere with the garment construction/feature or if there is interference, the bar-tack or back-tack shall be set on loop tape and loop tape selvage. When back-tack is used the number of stitches onto the basic material shall be no less than two (2) stitches.

3.13 Measurements. All measurements referenced in this document, except for end item measurements specified in 3.13.1 shall be made prior to garment treatment if applicable.

3.13.1 Finished measurements. The coat shall conform to the finished measurements specified in Table X for Type I (Unisex) and Table X-A for Type II (Female).

TABLE X. Finished measurements (inches) Type I (Unisex).

Size	Back Length, <u>1/</u>						Half Chest, <u>2/</u>						Sleeve Length, <u>3/</u>					
	XS	S	M	L	XL	2XL	XS	S	M	L	XL	2XL	XS	S	M	L	XL	2XL
XX-Short (XXS)	25-1/2	26	26-1/2	27	27-1/2	----	19-1/8	21-1/8	23-1/8	25-1/8	27-1/8	----	19	19-1/4	19-1/2	19-3/4	20	----
X-Short (XS)	26-1/2	27	27-1/2	28	28-1/2	----	19-1/8	21-1/8	23-1/8	25-1/8	27-1/8	----	20	20-1/4	20-1/2	20-3/4	21	----
Short (S)	27-1/2	28	28-1/2	29	29-1/2	----	19-1/8	21-1/8	23-1/8	25-1/8	27-1/8	----	21	21-1/4	21-1/2	21-3/4	22	----
Regular (R)	29	29-1/2	30	30-1/2	31	31-1/2	19-1/8	21-1/8	23-1/8	25-1/8	27-1/8	29-1/8	22	22-1/4	22-1/2	22-3/4	23	----
Long (L)	30-3/8	30-7/8	31-3/8	31-7/8	32-3/8	32-7/8	19-1/8	21-1/8	23-1/8	25-1/8	27-1/8	29-1/8	23	23-1/4	23-1/2	23-3/4	24	24-1/4
X-Long (XL)	31-3/4	32-1/4	32-3/4	33-1/4	33-3/4	34-1/4	19-1/8	21-1/8	23-1/8	25-1/8	27-1/8	29-1/8	24	24-1/4	24-1/2	24-3/4	25	25-1/4
XX-Long (XXL)	----	----	34-1/8	34-5/8	35-1/8	35-5/8	----	----	23-1/8	25-1/8	27-1/8	29-1/8	----	----	25-1/2	25-3/4	26	26-1/4
TOL	± 1/2						± 1/2						± 3/4					

1/ Back length - Measure along center back from collar joining seam to bottom edge of coat.

2/ Half chest - With buttons closed, lay coat flat on table and measure in line with arm pit of armhole from outside folded edge to opposite outside folded edge.

3/ Sleeve length - Measure along underarm seam from sleeve joining seam to bottom of sleeve (including cuff).

TABLE X-A. Finished measurements (inches) Type II (Female).

Size	Back Length, <u>1/</u>				Half Chest, <u>2/</u>				Sleeve Length, <u>3</u>				Half Sweep <u>4/</u>			
	30	33	36	39	30	33	36	39	30	33	36	39	30	33	36	39
X-Short	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Short	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Regular	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Long	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
X-Long	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
TOL	± 1/2				± 1/2				± 3/4				TBD			

1/ Back length - Measure along center back from collar joining seam to bottom edge of coat.

2/ Half chest - With buttons closed, lay coat flat on table and measure in line with arm pit of armhole from outside folded edge to opposite outside folded edge.

3/ Sleeve length - Measure along underarm seam from sleeve joining seam to bottom of sleeve (including cuff).

4/ Half sweep – Measure from outer edge at bottom hem to outer edge at bottom hem from one side of the garment to the other.

3.13.1.1 Methods of measurement. The measurements in Table X and Table X-A shall be taken in accordance with the footnotes. The coat shall be buttoned at the front placket and placed flat upon a table for measuring.

3.14 Toxicity. The finished coat shall not present a health hazard and shall show compatibility with prolonged, direct skin contact when tested as specified in 4.6.3. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.14.1 Toxicity documents. Finishes/chemicals used in the process of this garment shall be identified and accompanied by the appropriate Safety Data Sheet (SDS) information.

3.15 Workmanship. After completion of the final assembly, the coat shall be thoroughly cleaned and all thread scraps, lint and foreign matter shall be removed and all closures engaged prior to packaging. The coat shall not contain any fabric defects. The coat shall be uniform in quality and shall be free from irregularities or defects which could adversely affect performance, reliability or durability. The coat shall conform to the quality established by this specification.

4. VERIFICATION

4.1 Classification of inspection. 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. First article, submitted in accordance with 3.1.1 shall be inspected for design, configuration in Tables VII through IX and overall workmanship. The first article shall also include the finished measurements in Table X and X-A, examination for defects in Table XI and the testing in Table XII. The presence of excessive defects, as defined in the contract (see 6.2) or failure of any testing shall be cause for rejection of the first article.

4.3 Conformance inspection. Conformance inspection (see 3.1.2) shall include shade and appearance of all components, finished measurements in Table X and X-A, examination for defects in Table XI and the testing in Table XII. Sampling for inspection shall be performed in accordance with ANSI/ASQ Z1.4, as defined by contract, except where otherwise indicated.

4.4 Component and end item inspections. In accordance with 4.3, components and end items shall be tested in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified or qualified in this document or applicable procurement documents. The Government reserves the right to inspect and test all components and end items to determine conformance to requirements.

4.4.1 End item visual examination. Each coat shall be subjected to visual examination. In accordance with Table XI, fabric and garment defects shall be scored which are clearly noticeable at normal viewing distance (3-feet) and which affect the serviceability or appearance of the garment. Material defects are defined in ASTM D3990. If needed, closer inspection will be performed to verify compliance to specification requirements. Shade shall be evaluated at a distance of 3-feet.

TABLE XI. Coat visual examination (all types).

Examination	Defect	Classification	
		Major	Minor
Materials	Incorrect, not as specified (see 3.4.1, 3.4.1.1 and 3.4.1.2)	101	
	Hole, cut, tear, smash, burn, needle chew, run, exposed drill hole, thin place, dye streak, color not as specified, misweave, visible mend or otherwise damaged	102	
	Knots greater than Fabric Defect Scale Level C		201
	Slubs greater than Fabric Defect Scale Level D		202
Fusible interlining	Omitted or added where not specified Bubbling, delaminating, wrinkling, puckering or misplaced	103	
Shade	Shade variation within part or between parts of coat, affecting appearance or serviceability	104	
Components	Component not in accordance to the specification	105	
Tape	Omitted or misplaced	106	
	Any tape distorted, full, tight, frayed, damaged or twisted		204
	Color or type not as specified		205
Fastener tape - hook and loop	Misplaced, damage, frayed, spliced or omitted	107	
	Color or type not as specified		206
	Tape piece edges not cut straight (at approximately 90 degrees)		207
IFF material	Omitted, damage or frayed	108	
Thread	Color or type not as specified		208
Buttons	Omitted, damaged or ragged	109	
	Not specified type, size or color		209
Labels, hangtags, bar code/UPC/ HRI Codes	Omitted, illegible	110	
	Color or type not as specified		210
	Human readable interpretation (HRI) illegible	111	
Construction	Any construction part of the coat omitted (3.8.1 to 3.8.10)	112	
Hook and loop attachment	Twisted or distorted when closed	113	
	Out of alignment causing bulge		211
	Joining pieces out of alignment with each other by more than 1/4-inch	114	
	Not stitched to coat as specified	115	
	Stitching on tape selvage rather than hook or loop	116	
	Tape piece not securely stitched to coat cloth	117	
	Tape stitched less than 1/8-inch or more than 3/16-inch from edge	118	
Collar	Incorrect design not as specified in patterns, not specified width	119	

TABLE XI. Coat visual examination (all types). - Continued

Examination	Defect	Classification	
		Major	Minor
Construction Continued			
Front closure	Buttons and buttonholes not lining up or incorrect placement	120	
	Length of coat fronts uneven by more than 1/4-inch at top or bottom when closed	121	
Sleeve cuff	Incorrect design, grainline not as specified in patterns, not specified width	122	
	Sleeve lengths vary by more than 1/2-inch	123	
	Cuff and cuff tab out of alignment with bottom folded edge of sleeve hem by more than 1/4-inch	124	
Upper sleeve pocket	Omitted or incorrect size	125	
Pocket and flaps (all)	Pocket construction and openings not as specified	126	
	Pocket companions and openings not uniform in size by 1/4-inch	127	
	Pocket flaps or openings not as specified	128	
	Pocket flaps twisted, curled or puckered, not stitched as specified or not well formed	129	
	Pocket flaps not completely covering pocket opening left to right, positioned or grain line not as specified	130	
	Pocket flap finished uneven from left to right more than 1/4-inch	131	
Pencil pocket	Omitted or incorrect size	132	
	Channels varying more than 1/8-inch in width		212
Front name and U.S. Army loop tapes	Not in horizontal alignment or uneven by more than 1/4-inch	133	
Elbow reinforcement	Omitted, not attached as specified	134	
Coat hem	Ends of hem not sewn closed, twisted, puckered, pleated, wavy, or distorted	135	
	Side seam lengths varying by more than 1/2-inch (prior to treatment)	136	
Bar-tacks, back-tacks	Omitted, misplaced, or improper size	137	
	Loose stitching, not specified size, incorrect number of stitches		213

TABLE XI. Coat visual examination (all types). - Continued

Examination	Defect	Classification	
		Major	Minor
Construction Continued			
Buttonholes and eyelets	Omitted, misplaced, or improper size	138	214
	Buttonholes not in specified direction		
	Buttonhole thread loose, purling on wrong side, not clean cut or securely caught in fabric	139	
	Alignment of buttonholes and buttons causing bulge, twist or distortion when engaged	140	
	Buttonholes or eyelet not cleanly cut to required size		215
Rank loop patch	Omitted or misplaced	141	
IFF tab cover	Incorrect tab design or IFF material placement	142	
Labels, hangtags, UPC/HRI Codes	Size, combination identification/care labels not placed correctly		216
	Hangtags/UPC labels not securely attached in correct location		217
	Barcode/UPC code not visible on folded, packaged item		218
	Any label or tag having incorrect printed content	143	
	Any label, hangtag, or barcode attachment causing damage to item	144	
Seams and stitching	Open seams, puckered, distorted, wavy, twisted, or irregular	145	219
	Loose or tight stitch tension		
	Less than 1/2-inch in length		
	Greater than 1/2-inch in length	146	
	Missing stitches greater than 1/4-inch length	147	
	Edge or raised stitching sewn too close to the edge or needle chew resulting in damage to fabric over 1/4-inch in length	148	
	Seam allowance not as required by stitch type		220
	Visible raw edge on outside of coat (inside raw edge greater than 1-inch)	149	
	Stitching not as specified	150	
	Double needle intersecting seams staggered by more than 1/4-inch	151	
	Run off of stitching more than 1/2-inch for edge or raised stitching	152	
	Stitching caught in components or fabric causing unwanted permanent folds, pleats or fullness in the garment	153	

TABLE XI. Coat visual examination (all types). - Continued

Examination	Defect	Classification	
		Major	Minor
Construction Continued			
Seams and stitching Continued	Free floating stitching not secured in a seam or other stitching by less than 1/4-inch or ends of a continuous line of stitching not overlapped over 1/4-inch (except label stitching)	154	
	Stitching of seams incorrectly repaired	155	
	Missing stitches less than 1/4-inch length		221
Cleanness and workmanship	Spot/Stain affecting appearance or serviceability	156	
	Odor	157	
	Thread ends (more than three (3)) Between 1/4 to 1-1/2-inches		222
	Thread ends (more than three (3)) Over 1-1/2-inches	158	
	All closures on coat not engaged except top center front button		223
	Internal repair tags, tickets or tape not removed from finished garment		224
Packaging	Any coat not packaged in accordance with contract or purchase order		225

4.4.2 Finished measurements. The coat shall conform to the finished measurements specified in Tables X and X-A.

4.5 Basic material and component testing. The basic materials specified in 3.4 through 3.4.2, and the components in 3.7.4 through 3.7.5, shall be tested for the characteristics listed in Table XII in accordance with the test methods cited.

TABLE XII. Basic material and component testing (all types).

Characteristic	Reference paragraph	Test method
Basic Material 3.4.1 & 3.4.2		
Fiber identification, <u>1</u> /	3.4.1 & Table I	AATCC -20A
Weave	3.4.1 & Table I	Visual
Weight	3.4.1 & Table I	ASTM D3776/D3776M Option C
Construction/ fabric count	3.4.1 & Table I	D3775
Break strength	3.4.1 & Table I	ASTM D5034 (GE or GT)
Tearing strength	3.4.1 & Table I	ASTM D1424

TABLE XII. Basic material and component testing (all types).- Continued

Characteristic	Reference paragraph	Test method
Basic Material 3.4.1 & 3.4.2		
Dimensional stability After 5 laundering cycles	3.4.1 & Table I	AATCC-135, 3,V, Aiii
Air Permeability	3.4.1 & Table I	ASTM D737
Pattern execution	3.4.1.1-3.4.1.2.1	Visual
Labile Sulfur	3.4.1.3	4.5.1
Visual shade matching	3.4.1.4	<u>2/</u>
Colorfastness to: Laundering (after three (3) cycles) Light (40 AFU or 170kJ/(m ² nm) @ 420 nm) Perspiration (acid & alkaline) Crocking (Dry and Wet)	3.4.1.5 & Table II	4.5
		AATCC-61 Test 3A <u>3/</u>
		AATCC 16.3 <u>4/</u>
		AATCC 15 <u>3/</u>
		AATCC-8 <u>5/</u>
Spectral reflectance	3.4.1.6 - 3.4.1.6.1 & Table III	4.5.2
pH	3.6	AATCC 81
Components (Thread 3.7.4 and Buttons 3.7.5)		
Color Matching	3.7	Visual
Toxicity	3.14 & Table I	4.6.3

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

2/ The color and appearance of the cloth shall match the standard sample when viewed using the AATCC Evaluation Procedure 9, Option A, with sources simulating artificial daylight D75 illuminant with a color temperature of 7500K (± 200) 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 2856K (± 200).

3/ Rated using the AATCC Gray Scale for Color Change and AATCC Gray Scale for Staining.

4/ Rated using the AATCC Gray Scale for Color Change.

5/ Rated using the AATCC 9-Step Chromatic Transference Scale

4.5.1 Presence of labile sulfur test. In the determination of presence of labile sulfur in textile materials with lead acetate, two (2) 1.50 (± 0.01) gram samples from each material submitted for evaluation shall be tested. Each of the two (2) samples shall be cut into very small pieces and placed into separate test tubes. The samples shall be submersed in a stannous chloride solution that contains 100 grams of stannous chloride crystals ACS in 100 milliliters of hydrochloric acid ACS (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 top of the test tube. The lead acetate solution contains 5.0 grams of lead acetate CP reagent grade and enough distilled water to make up a 100

milliliter solution; if the solution is not clear, add a few drops (one at a time) of glacial acetic acid 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 to black stain on the filter paper should be evaluated as follows:

- Free - The filter paper shows no discoloration or staining of any kind.
- Slight - The filter paper shows a light tan to light brown discoloration stain.
- Moderate - The filter paper shows a dark brown discoloration stain.
- Severe - The filter paper shows a black color stain.

4.5.2 Spectral reflectance test. Spectral reflectance data shall be obtained from 600 to 860 nanometers (nm) at 20 nm 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 either CIE Source A or CIE Source D65. Measurements shall be taken on a minimum of two (2) different areas and the data averaged. The measured areas should be at least 6-inches away from the selvage. The specimen 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, with the specular component included. Measurements shall be taken on a minimum of two (2) different areas. Specimens shall be oriented in different directions during testing. When possible, the specimens tested shall not contain the same Warp or filling yarns/ Wales or courses when presented to the sample port. Photometric accuracy of the spectrophotometer shall be within one (1) percent and wavelength accuracy within two (2) nm. The diameter for standard aperture size used in the color measurement device shall be 0.3725-inches. 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.

4.6 End item testing. The finished coat shall be tested for the characteristics as specified in 3.5 and Table XIII. The methods of test shall be as specified in Table XIII. All test reports shall contain the individual values utilized in expressing the final results. The testing requirements and test sampling plan shall be as specified in the contract and or purchase order.

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TABLE XIII. End item testing (all types).

Characteristic	Requirement paragraph	Test method
Insect repellent content <u>1/</u>		
Initial	3.5.1	4.6.1
After 20 launderings	3.5.1	4.6.1 <u>2/</u>
% Mosquito bite protection <u>1/</u>		
Initial	3.5.2	4.6.2
After 20 launderings	3.5.2	4.6.2 <u>2/</u>
After 50 launderings	3.5.2	4.6.2 <u>3/</u>
pH	3.6	AATCC 81
Button pull/break	3.7.5	ASTM D5034
Toxicity	3.14 & 3.14.1	4.6.3

1/ If fabric is pre-treated, this testing can be done prior to cut and sew.

2/ After 20 launderings as per AATCC 135, 3, V, Aiii, except laundering cycles 5, 10, 15, 19 and 20 shall be performed without adding any detergent to minimize detergent accumulation in specimen.

3/ After 50 launderings as per AATCC 135, 3, V, Aiii, except laundering cycles 5, 10, 15, 19, 20, 25, 30, 35, 40, 45, 49 and 50 shall be performed without any detergent.

4.6.1 Insect repellent content analysis. The insect repellent content of treated fabric or garments shall be determined by gas chromatographic procedure and directly compared to an external standard containing a known Permethrin content. Testing shall be conducted according to the following test method. Alternate method(s) of extraction and analysis, and specimen size are subject to Government approval and laboratory cross correlation prior to implementation.

Evaluation of insect repellent treated fabric materials: extraction and analysis by Gas Chromatography-Mass Spectrometry (GC/MS)

NOTE: The conditions described in this method are optimum for the accelerated solvent extractor and the gas chromatograph employed. These conditions may vary based on the gas chromatograph used. The carrier gas flow rate shall be adjusted so the elution of the first insect repellent isomer is greater than five (5) minutes. Alternate methods of extraction and analysis are subject to government approval and laboratory cross correlation prior to implementation.

A. Apparatus.

A.1 Analytical Balance. 0.0001g sensitivity, Mettler Toledo, or equal

A.2 Analytical Balance. 0.000001g sensitivity, Mettler Toledo, or equal

A.3 Glassware.

A.3.1 10-100mL volumetric flasks

A.3.2 Funnel

A.3.3 Pipettes

A.4 Automatic Die Cutter. Freeman Atom, or equal

A.4.1 3-Inch Cutting Die. 3-inch diameter circular steel die cutter

A.5 Extraction Apparatus.

A.5.1 Accelerated Solvent Extractor (ASE) Dionex Corporation or equal

A.5.1.1 Liquid Nitrogen Cylinder to Deliver High Pressure Gas, 230psi

A.5.1.2 Complete Extraction Cells

A.5.1.3 Cellulose filters, to fit extraction cells

A.5.1.4 60mL Amber Glass Collection Vials

A.5.1.5 Solvent Resistant Teflon-Silicone Coated Septa

A.5.1.6 3mm-4mm borosilicate glass beads

A.5.2 Soxhlet.

A.5.2.1 Electric heater with variable control

A.5.2.2 Heat resistant glass flask when using Soxhlet extractor. The flask shall be a 250mL, flat or round bottom, and single neck.

A.5.2.3 Extractor condenser

A.5.2.4 Boiling condenser

A.5.2.5 Cellulose extraction thimbles

A.6 Agilent 6890N (G1530N) Series Gas Chromatograph (GC). Gas Chromatograph equipped with ChemStation software, or equal

A.6.1 Carrier Gas Cylinder, Appropriate Regulator Set at 80psi

A.6.2 Hewlett-Packard Capillary Column, 5% Phenyl Methyl Siloxane/30.0m x 250µm x 0.25µm nominal, 325°C Max, or equal.

A.6.3 Split Inlet Liner, Packed with Silanized Glass Wool/5mm

A.6.4 Injector Microliter Syringe, Capable of Delivering 1µL

A.6.5 GC Amber Injection Vials and Rinse Vials

A.7 Agilent Series 5973N (G2579A) Mass Spectrometer(MS) or equal.

A.7.1 Performance Turbo Pump MSD (EI Mode), or equal

A.8 Ultrasonic cleaner. Branson, or equal

A.9 High temperature convection oven. 500°C Max

A.10 Refrigerator storage. 4°C

B. Reagents.

B.1 Permethrin analytical standard. Permethrin standard shall be $\geq 97\%$, purity/specified technical, or equal, mixture of Cis/Trans Isomers.

B.2 Solvent mixture. Solvent mixture shall be 80% Acetonitrile/Analytical Grade and 20% Methanol/Analytical Grade

B.3 High purity helium carrier gas. Carrier gas shall be $\geq 99.999\%$

B.4 Cleaning solutions. Cleaning solutions shall be as follows:

B.4.1 Micro-90 Ultra Cleaning Solution, or equal

B.4.2 Reversed Osmosis Water, 98% Rejection Rate

C. Calibration of apparatus.

C.1 Analytical balance.

C.1.1 Pre-Weighing procedures. Prior to weighing, initiate the internal weight calibration function or use an external certified weight set to verify that the balance is operating properly.

C.1.2 Manufacturer calibrations. Obtain manufacturer certifications within 12 months prior to taking measurement.

C.2 Gas Chromatography equipped with Mass selective detector (see A.6, A.7).

C.2.1 Perform the manufacturer's recommended calibration procedures prior to analyses.

C.2.2 Before samples or required blanks can be analyzed, the instrument must meet the initial calibration acceptance criteria (see G).

C.3 Cleaning techniques. Establish cleaning techniques to ensure that no insect repellent carries over from experiment to experiment. The techniques listed below have been determined to be suitable:

C.3.1 Evaporate excess solvent from extraction glassware and wash using conventional methods (see B.4).

C.3.2 Bake off residual organic substances from glassware in high temperature convection oven, 500°C, for three (3) to six (6) hours (see A.9).

C.3.3 Sonicate A.S.E. Cells in the solvent that was used for the extraction (see A.8).

D. Sampling and test specimens.

D.1 Sample size. The sample size to be tested shall be selected in accordance with ANSI/ASQ Z1.4, Special Inspection Levels S-1 and AQL of 1.5 unless otherwise noted in the contract or purchase order.

D.2 Test specimens.

D.2.1 From each sample being evaluated (unlaundered and after 20 launderings), select three (3), 3-inch diameter specimen (use a 3-inch circular cutting die having surface area of 45.6037 cm²) for each test condition. Cut specimen from single ply areas so that no two (2) specimen shall contain the same warp and filling yarns (for example, for the Coat areas-front left, front right, back, right sleeve, left sleeve; and for the Trouser areas-front left leg, back left leg, right front leg, back front leg, and front left or right fly). Specimen for the measurement of insect repellent content after laundering shall be cut after the finished sample has been laundered according to AATCC 135, 3, V, Aiii to the specified number of cycles. Laundered specimen shall be cut from different ply areas across the garment.

D.2.2 Weigh each specimen to the nearest milligram (see A.1).

E. Standard Preparation.

E.1.1.a Prepare six (6) concentrations of Permethrin standards which are 20, 50, 75, 100, 150, and 200 ng/μL, [1 ng/μL is equal to 1 part-per-million (ppm)]

E.1.2.a Using the balance specified in A.2, weigh 10 mg (± 1) mg of Permethrin crystals and place into a 50 mL volumetric flask and fill with 80% acetonitrile/20% methanol solvent to obtain the standard of 200 ng/μL. Make all appropriate dilutions from this flask to obtain the additional standards.

E.1.3 Calculate the actual concentrations of the standards based on the weight of the Permethrin.

F. Extraction procedure (see A.5).

F.1 ASE

F.1.1 Preparing specimens. Roll each specimen and place into an ASE cell fitted with a cellulose filter. Fill the void with glass beads to conserve solvent. Place all cells onto ASE cell tray.

F.1.2 Quality control. Extract a specimen blank for every run to detect if any carryover of insect repellent is significant.

F.1.3 Accelerated solvent extraction procedures.

F.1.3.1 Parameters.

Cell Size	Machine type dependent
Collection vials	60 mL, light blocking/amber
Solvent	80% Acetonitrile, 20% Methanol
Approximate Gas Pressures:	
System	50 psi
System Solvent	10 psi
Oven Compression	130 psi

Parameters:

Preheat	0 min
Heat	5 min @ 100°C
Static w/Solvent	10 min @ 1500 psi
Flush Volume	90%
Purge	90 sec
Cycles	2

F.1.3.2 Preparation for analyses. Dilute or concentrate each vial to 40 mL and prepare a 1 mL aliquot from every specimen extraction for GC analysis. Insect repellent recovery must be 95% or greater (see F.4).

F.2 Soxhlet. Place each specimen into cellulose Soxhlet extraction thimble. Add 160 mL of the acetonitrile/methanol mixture and boiling chips into a 250 mL flask. Assemble the Soxhlet apparatus and extract the treated specimens for six (6) hours or until an extraction recovery of 95% or greater has been achieved (see F.4). Concentrate the extract by rotoevaporation, or equal, at 35°C to a final volume of 40 mL.

F.3 Storage. After the specimen are extracted, store in light blocking amber vials in refrigerator until ready to inject (see A.10). Specimen extractions shall be stored in a refrigerator for no longer than three (3) months. When ready to analyze, allow the temperature of the GC vials to equilibrate in the area of evaluation before injection into GC.

F.4 Extraction efficiency.

F.4.1 Select three (3) random specimen from any treated fabric sample and perform three (3) consecutive extractions.

F.4.2 Quantify the level of insect repellent recovered from each specimen for each consecutive extraction, through GC/MS analysis.

F.4.3 Verify that the percent recovery of insect repellent for any specimen size and composition, is 95% or greater by comparing the recovery level from the first extraction, to that of subsequent extractions. Combine the insect repellent concentrations obtained from each of the three (3) extractions, if the initial

extraction yields insect repellent levels 95% or greater than the total percent of insect repellent extracted three (3) sequential times, then the extraction efficiency is 95% or greater. NOTE. To ensure that the extraction efficiency is being accurately calculated, the insect repellent levels in the second extraction should be minimal, and the level by the third extraction should be trace or zero.

NOTE. Initial verification of extraction efficiency of this test method must be performed. Once an extraction efficiency of 95% or greater is established, no further demonstration of the extraction efficiency is needed.

G. Analytical procedure.

G.1 Quality control. Laboratory blanks that contain no analyte are used to ensure specimens are free of contaminants or to ensure there is no cross contamination during a run. Inject a blank containing 80% acetonitrile/20% methanol before every set of standards and before and after every ten (10) specimens. If any blank, after multiplying concentration by five (5), is greater than any specimen result, the specimen data points are invalid and a system check must be run to identify the source of the carryover. After system maintenance has been performed, repeat injections of the standards for the calibration curve, new blanks, and new aliquots of the specimens affected by the previous carryover.

G.2 Standard injection.

G.2.1 All six (6) standards will be injected at the beginning and at the end of each series of specimen to "bracket" the specimen injections. Check linearity of the standards for each set of injections by plotting the responses (area counts) on the x-axis vs. the calculated standard concentrations on the y-axis. A 3rd order polynomial regression line with R-squared value of 0.99 or greater is acceptable. Derive the equation of the 3rd order polynomial for sample calculations.

G.3 Specimen injection. Run specimen injections in duplicate. Sample extracts, standards, and blanks must be analyzed within an analytical sequence such as listed below:

Initial calibration (Standards)
 Instrument blank at the end of the initial calibration
 Specimen Series 1 (extracts 1-10, 1st quantitation)
 Instrument blank
 Standard Series 1
 Instrument blank
 Standard Series 2
 Instrument blank
 Subsequent specimen series, (ex. 11-20, including blanks, and standard series)
 Final calibration (Standards)

NOTE. After the initial calibration, the analytical sequence may continue as long as acceptable instrument blanks and the standards are analyzed at the required frequency. If any specimen count

does not fall on the standard calibration curve, the evaluator may dilute that specimen by 1:10 and re-run; calculations of the insect repellent level must be adjusted using the factor of 10.

G.4 Gas Chromatograph/Mass spectrometer parameters (see A.6).

G.4.1 Injection procedures.

G.4.1.1 Place all GC vials into auto sampler tray. To avoid vapor pressure differences, all vials must be at room temperature and containing identical volumes.

G.4.1.2 Inject 1 μL into the Gas Chromatograph equipped with Mass Spectrometer. Use high purity helium carrier gas (see B.3) and appropriate column.

G.4.1.3 Ensure that rinse vials in the injector port contain 80% acetonitrile/20% methanol above the minimum solvent line.

G.4.2 Instrument settings. The following parameters will be used in the analysis:

Oven Temperature	250 °C
Injector Temperature	275 °C
Detector Temperature	280 °C
Injection volume	1 μL
Carrier Gas Flow Rate	1.3 mL/min
GC Run Time	10 min
Split Ratio	3:1
MS Single Ion Monitoring	
Scan Parameters	EM Voltage Gain Factor of 1
Real Time Plot	10 min
Resolution	Low
Solvent Delay	4 min
Start Time	4 min, 4.26 Cycles/sec
Ions Monitored	183 (quantitation) for Permethrin
	163 (confirmatory) for Permethrin

G.4.3 Evaluation procedures.

G.4.3.1 Quantify the Permethrin content detected by the mass spectrometer by extracting ion chromatograms 183 (quantitation ion) and 163 (confirmatory ion).

G.4.3.2 Integrate peaks manually from baseline to baseline using the software, or generation of report.

H. Calculations.

H.1 Concentration. The insect repellent concentration will be calculated from the area counts of the chromatographic curve and expressed in terms of mass per surface area (mg/cm^2), with the option of expressing in terms of weight per weight of specimen (W/W%):

H.1.1 Concentration calculation. The concentration of insect repellent in milligrams per square centimeter shall be calculated as follows:

Concentration (mg/cm^2) =

$$40 \text{ mL} \times (ax^3 + bx^2 + cx + d) \times (1,000 \text{ } \mu\text{L}/1 \text{ mL}) \times 1 \text{ mg}/1,000,000 \text{ ng}) \times (1/45.6037 \text{ cm}^2)$$

Where:

40 mL = Final Volume

a, b, c and d = numbers derived from 3rd degree polynomial equation from standard series following specimen series

x = area count of the specimen curve

45.6037 cm^2 = area of specimen

H.1.2 Conversion to weight percent content (W/W%).

Concentration (W/W%) = [Concentration (mg/cm^2) multiplied by (surface area) cm^2 divided by (weight of specimen) mg] multiplied by 100.

I. Report. Report the insect repellent concentrations in milligrams per square centimeter squared to the nearest 0.001 mg of the three (3) individual specimen per sample unit for all units sample units tested. A single individual specimen within a sample unit shall be allowed to fall outside of the minimum to maximum range of the insect repellent levels as specified in paragraph 3.5.1 as long as the average of the three (3) specimens meet the specified levels. Although, for initial testing only the single individual specimen allowed to fall outside the specified range in 3.5.1 shall not fall below 0.049 mg/cm^2 or above 0.146 mg/cm^2 for Permethrin in which case the sample unit shall be considered a failure whether or not the sample average falls within the minimum/maximum range specified and 3.5.1. A single retest shall be allowed; when a sample fails, a complete set of specimens shall be pulled from an additional sample unit and retested. The retest shall then be used to rate pass or fail.

4.6.2 Percent (%) mosquito biting protection assay. Percent (%) mosquito bite protection shall be measured on a finished insect repellent treated sample, under three (3) test conditions and using a control specimen (non- insect repellent treated, sample against the two (2) selected mosquito species specified in 4.6.2.3. The three (3) test conditions shall be one (1) unlaundered, two (2) after 20 launderings, and three (3) after 50 launderings, from cloth or garments produced in the same lot. Corresponding insect repellent content for each of these conditions will be measured as specified in 4.6.1 to correlate biological toxicity with the particular cloth or garment treatment used to meet requirements specified in 3.5.1.

4.6.2.1 Number of determinations. Three (3) determinations will be run for each of the two (2) mosquito species (see 4.6.2.3.3). Each determination for each mosquito is conducted with three (3) volunteers using three (3) different fabric conditions; unlaundered, after 20 launderings and after 50 launderings and compared to non-treated control. A single untreated unlaundered control sleeve can be used for the three (3) determinations for each volunteer provided that the control is run against the same mosquito population, on the same day the specimen being tested, and tested on an arm that has not been used for testing a treated sleeve (see 4.6.2.3.6). The total number of specimen for the three (3) determinations is outlined below. It is estimated that one (1) coat yields three (3) specimen and one (1) trouser yields three (3) specimen consisting of largely a single ply fabric area (see 4.6.2.2). See 6.6.

<u>Number of Insect tests X</u>	<u>Number of Determinations X</u>	<u>Number of Fabric conditions</u>	<u>=</u>	<u>Total Specimens per sample</u>
Mosquitoes <u>1/</u>	3 x	3 x	=	9 <u>2/</u>
Control <u>2/</u>	1 x	1 x	=	1 <u>2/</u>

1/ One (1) set of treated specimens will be used twice to test each mosquito species

2/ Total garments estimated, required to conduct three (3) determinations are;

Three (3) treated coats and one (1) untreated coat

4.6.2.2 Specimen size. Specimen will be cut to the shape and dimensions illustrated in Figure 7. Specimen shall be cut from single fabric ply areas. To minimize the number of garments needed for each determination, multiple ply areas such as seam areas or hems may occur limitedly in the perimeter areas provided multiple plies of fabric in these areas shall not create a gap between subject's arm and fabric (see 4.6.2.3.5). Specimen will be cut with gloved hand and placed in a plastic bag and the glove disposed of to avoid residual contamination of controls. When failure point is being quantified, the laundered samples may be used to accomplish the additional launderings needed.

4.6.2.3 Procedure. The procedure to conduct biting protection assay is derived from the "EPA Product Performance Test Guidelines, OPPTS 810.3700, Insect Repellents For Human Skin and Outdoor Premises, December 1999 (see 2.2.2), and is described in part below, noting any exceptions to this procedure.

4.6.2.3.1 Applicable protocol. Within OPPTS 810.3700, Section 3 addresses treated fabric material and section (3) (iii) specifies that laboratory studies are conducted as described in (d)(1) of the OPPTS 810.3700 guideline.

4.6.2.3.2 Fastening test specimen. Section (3) (iii) recommends "fastening a strip of the impregnated material to the test subject's forearm". This will be accomplished by utilizing specimen size specified in 4.6.2.2 (see Figure 7) and ensure it covers the entire forearm of the test subject without gaps for insect access. With the arm in the pronated position, the fastening seam that closes the specimen on the volunteer's arm shall be located on the top of the forearm. Attachment of the treated specimen will be done with gloved hand, which will be disposed of prior to attaching the control to alternate arm.

4.6.2.3.3 Test mosquitoes. OPPTS 810.3700 section (d) (1) addresses laboratory tests conducted with mosquitoes and stable except this test shall utilize two (2) species of mosquito. The results of this evaluation for the mosquitoes is a contractual requirement. Insect genus, species and subspecies, colony origin and approximate age shall be used as specified below in 4.6.2.3.3.1.

Mosquitoes:
Aedes (Stegomyia) aegypti
Anopheles albimanus

4.6.2.3.3.1 Mosquito characteristics. Mosquito ages employed for these studies shall be 5 to 11 days old after emergence from the pupal stage. Mosquitoes shall be laboratory-reared and disease free, and have been kept in stock cages containing both males and females. The mosquitoes will be maintained on 10% sugar water and have not been provided a blood meal. Methods should be used to preselect females for the studies. Use either a hand draw box or suitable aspirating device to collect host-seeking mosquitoes for the required cage density (see 4.6.2.3.3.3).

4.6.2.3.3.2 Mosquito rearing. Mosquitoes for these studies shall be reared under optimal conditions for larvae, as described in OPPTS 810.3700, section (d)(1)(iii).

4.6.2.3.3.3 Cage conditions. A cage density of 200 (± 25) female mosquitoes per cage is required to meet the biting pressure density of at least one (1) female mosquito per 300 cm³ cage volume. (Cages shall be 60,000 ($\pm 6,000$) cm³, with a sleeved opening for the arm of the volunteer to be inserted.) Cages shall be constructed of a lightweight clear plastic on three (3) sides, or an aluminum bottom panel with light weight clear plastic on two (2) sides. The top of the cage and side opposite the cloth sleeve should consist of screen rather than plastic. Tests shall be conducted with fluorescent lights on and under room conditions (22-27°C, and 30-80% RH). Tests should not be conducted if the temperature or humidity is outside of the specified range.

4.6.2.3.4 Subjects. A minimum of three (3) test volunteers shall be used in each study for each mosquito species at each test facility. The same three (3) subjects can be used to evaluate different mosquito species done at the same facility. Due to the replication, the number of volunteers is now decreased from the five (5) or more recommended in OPPTS 810.3700, section (c)(3)(i). Collection of data from both females and males are preferred for the study. Cosmetics and alcohol shall be avoided 12 hours prior and during the test. Volunteers shall read and sign the appropriate Institutional Review Board (IRB)-Human Use protocol forms, required for their consent, prior to being used in the test. IRB protocols shall be approved through the appropriate agencies' IRB mechanisms.

4.6.2.3.5 Volunteer's test area. The test area shall consist of the region from the wrist to approximately 1/2-inch before the elbow. Fabric material shall be secured around the forearm to eliminate gaps between the arm and material and with the fastened seam positioned on the top of the forearm as specified in 4.6.2.3.2. The ends of the garment, near the wrist and elbow shall be sealed with protective tape of adequate thickness to prevent mosquitoes from biting through the tape. The hand shall be gloved with a glove of appropriate thickness to prevent biting through to the hand.

4.6.2.3.6 Controls. For each set of specimen, a control shall be conducted. The control shall consist of the same fabric as the specimen, will not be laundered and will not contain the mosquito bite protection treatment. It will be identical in size to the test swatch (see 4.6.2.2). Controls will be cut in clean area and stored in separate plastic bags to avoid residual permethrin contamination. The controls will be tested on the arm opposite the treated specimen, or on the same arm used for experiments provided that the control is tested prior to testing treated specimens.

4.6.2.3.7 Biting exposure. Arms containing the controls and treated specimen shall be exposed to a cage of mosquitoes for 15 minutes. The order of testing specimens on the arm will be sequential and in order of the most laundered to least laundered. Therefore, if the same arm will be used to test the control and specimens, the order of testing shall be control, followed by the specimen laundered 50 cycles, followed by the specimen laundered 20 cycles, and then conclude with testing the unlaundered treated specimen. Tests should be conducted with as little elapsed time as possible in between testing of a volunteer's arms.

4.6.2.3.8 Raw data. Raw data shall consist of the mosquito information as described in 4.6.2.3.3, the number of mosquitoes used per cage, and method of selection of these mosquitoes. The number of male and female mosquitoes shall be counted and only the number of females used for purposes of identifying mosquitoes that bite compared to non-biting mosquitoes. The number of bites received for each sample (treatment or control) shall be counted and recorded.

4.6.2.4 Report. Calculation of the reduction in bites for the treatment, compared to the control, shall be expressed as a percentage that represents the percentage bite protection as shown below. Individual subject results for each trial (three (3) for each treatment type or control), shall be averaged with all trials for the other volunteer subjects in the study. An overall average % mosquito bite protection shall be calculated by Abbott's equation below and reported in this manner for each insect and for all volunteers tested. Total % mosquito bite protection will be calculated by averaging the overall results for each species and meet the requirements set forth in paragraph 3.5.2.

$$\% \text{ Bite Protection} = \frac{(B_{NC}/F_C) - (B_T/F_C)}{(B_{NC}/F_C)}$$

where:

B_{NC} = bites recorded on the arm covered by the negative control fabric

F_C = female mosquitoes in the cage that are capable of biting at the start of the 15-minute period

B_T = bites recorded on the arm that was covered by the treated fabric.

4.6.3 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 coat 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 3.14) can be demonstrated with historical use data, 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 packaging of material is to be performed by DoD or in-house 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 command. 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.

5.2 Insect repellent packaging. Every roll/box containing insect repellent treated fabric/uniforms must be labeled according to EPA requirements as stated in Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) (see 2.2.2).

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 coat is for wear by military personnel in the United States Army as an improved hot weather combat uniform in garrison and combat missions in hot weather environments.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this Purchase Description document.
- b. Type, class and sizes, required (see 1.2).
- c. The specific issue of individual documents referenced (see 2.2).
- d. When first article sample is required (see 3.1.1, 4.2 and 6.3).
- e. Conformance inspection acceptance quality limits (see 3.1.2 and 4.3).
- f. Camouflage pattern required (see 3.4.1, 3.4.1.1).
- g. Pattern required (see 3.11).
- h. When toxicity testing is required (see 3.14 and 4.6.3).
- i. Inspection conditions (see 4.4).
- j. Packaging requirements (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 pre-production 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 all acquisitions documents regarding arrangements for selection, inspection and approval of the first article.

6.4 Standard sample. For access to samples and pattern drawings, address the contracting activity issuing the invitation for bids or request for proposal.

6.5 Approved EPA registrations. Samples of approved treatment registrations and labels are shown at the EPA web site: <http://oaspub.epa.gov/pestlabl/ppls.home>

NOTE: EPA registration does not certify that the insect repellent treatment meets the specification requirements.

6.6 Insect repellent garment application. To assist in minimizing defects that may be caused during the permethrin garment application process, all garment closures should be engaged prior to the application.

6.7 Percent mosquito bite protection. The following facilities are known to perform percent mosquito bite protection testing in conformance with 4.6.2.

Aedes aegypti and Anopheles albimanus:

USDA-Center for Medical, Agricultural & Veterinary Entomology Agricultural Research Service
1600/1700 SW 23rd Drive
Gainesville, FL 32608
POC: Kenneth J. Linthicum, PhD, BCE Center Director
Tel: (352) 374-5700 / Fax : (352) 374-5850
Kenneth.Linthicum@ars.usda.gov

6.8 Replica Set. The SDL Atlas Slub/Knot Replica Set is not available from their website at this time. Recommend calling customer service, 1-803-329-2110.

6.9 Subject term (key word) listing.

Bite
Clothing
Insect protection
Jacket
Jungle
Mosquito
Operational Camouflage Pattern (OCP)
Permethrin

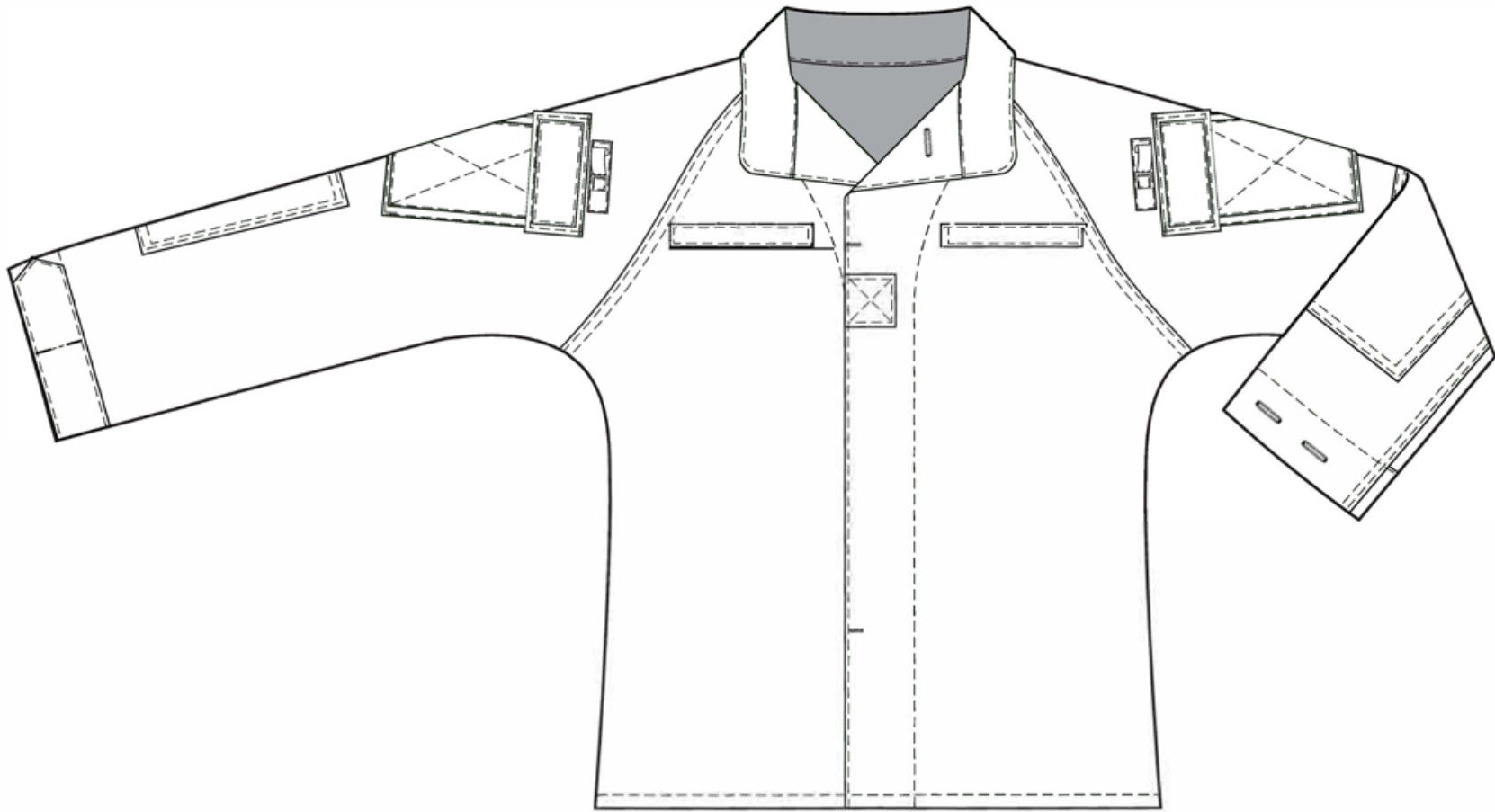


FIGURE 4. Coat Front, Improved Hot Weather Combat Uniform Type I and Type II.

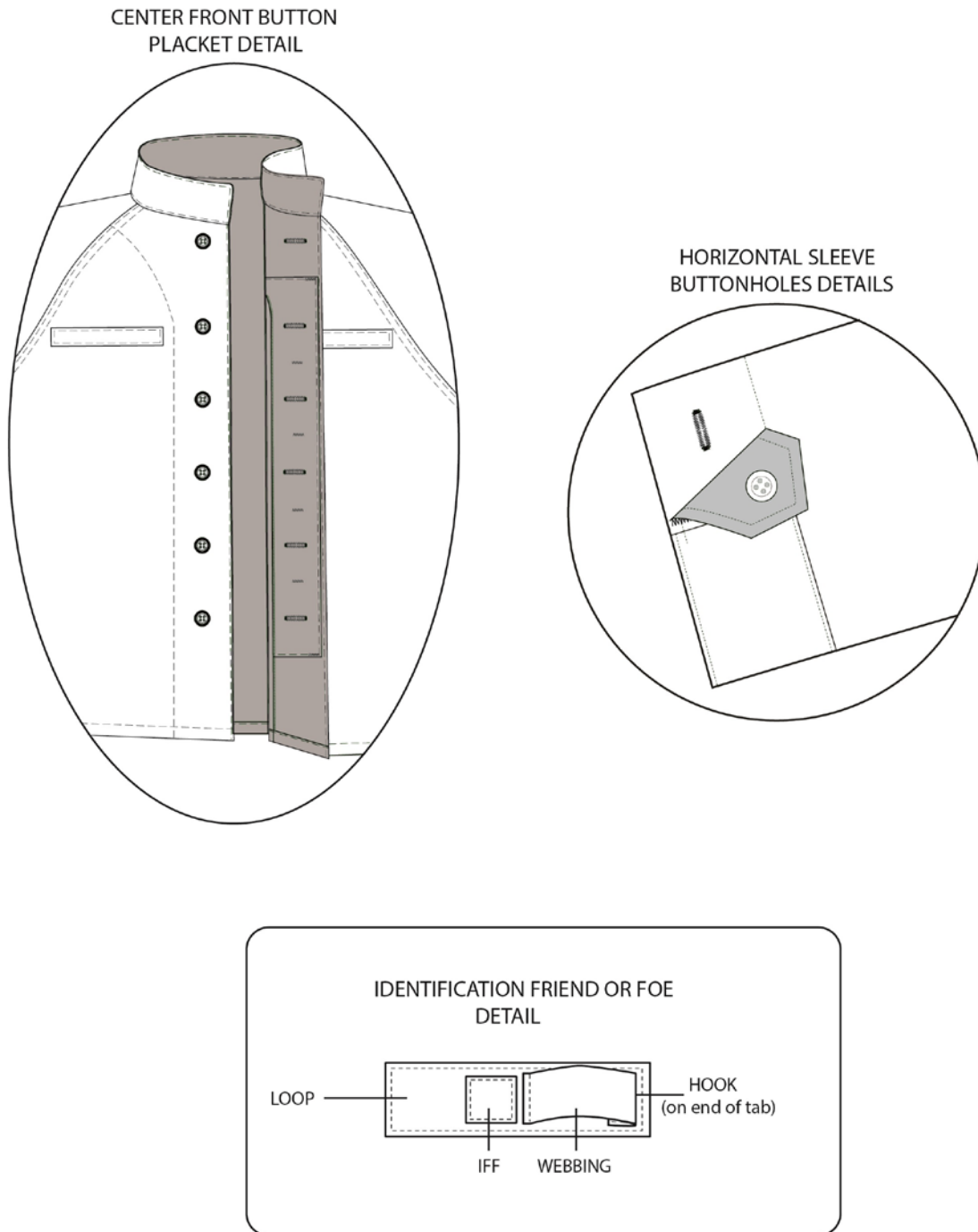


FIGURE 5A. Coat Improved Hot Weather Combat Uniform Details (Front Placket, Sleeve Buttonholes and Identification Friend or Foe), Type I and Type II.

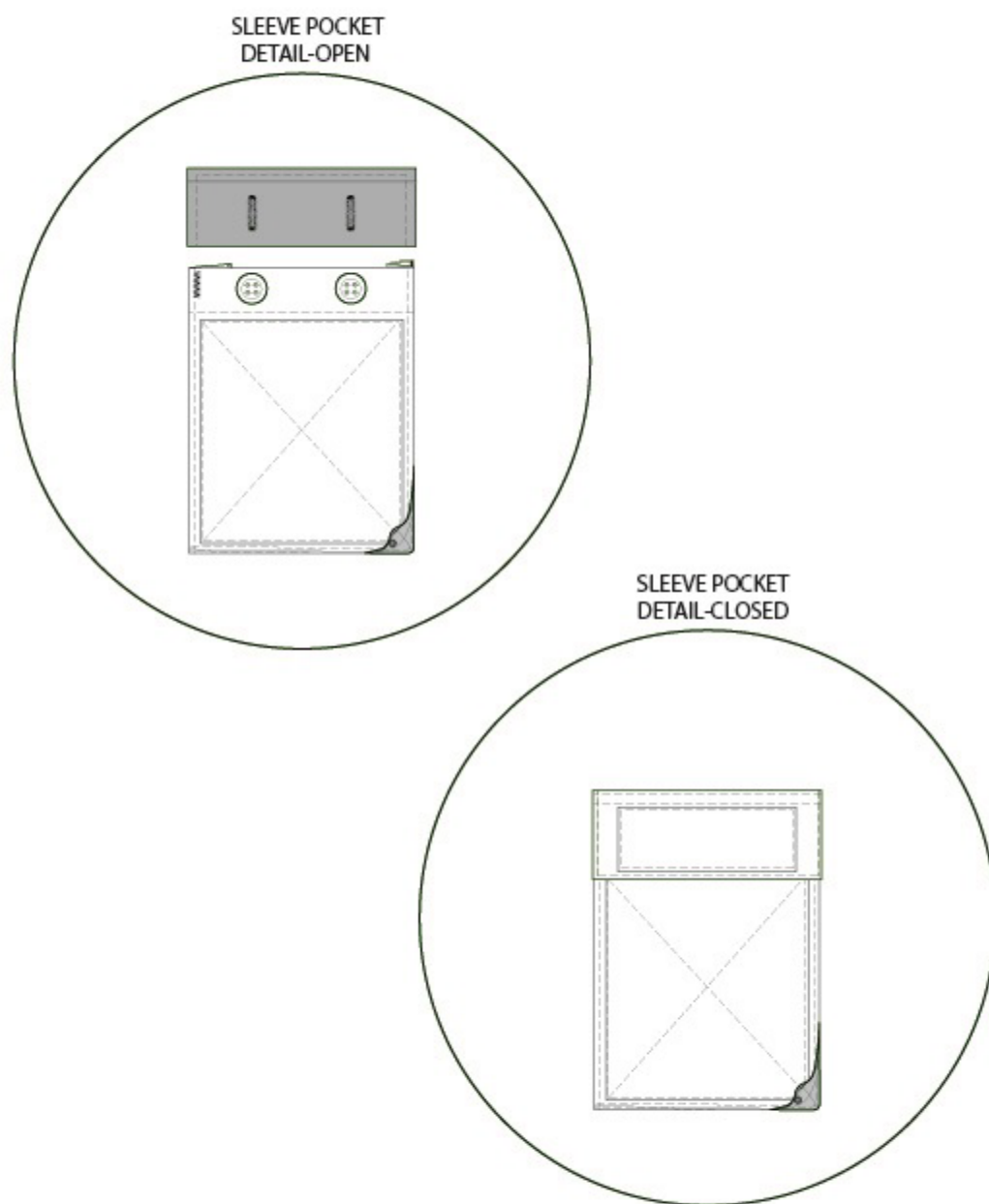


FIGURE 5B. Coat, Improved Hot Weather Uniform Details (Sleeve pocket details),
Type I and Type II.

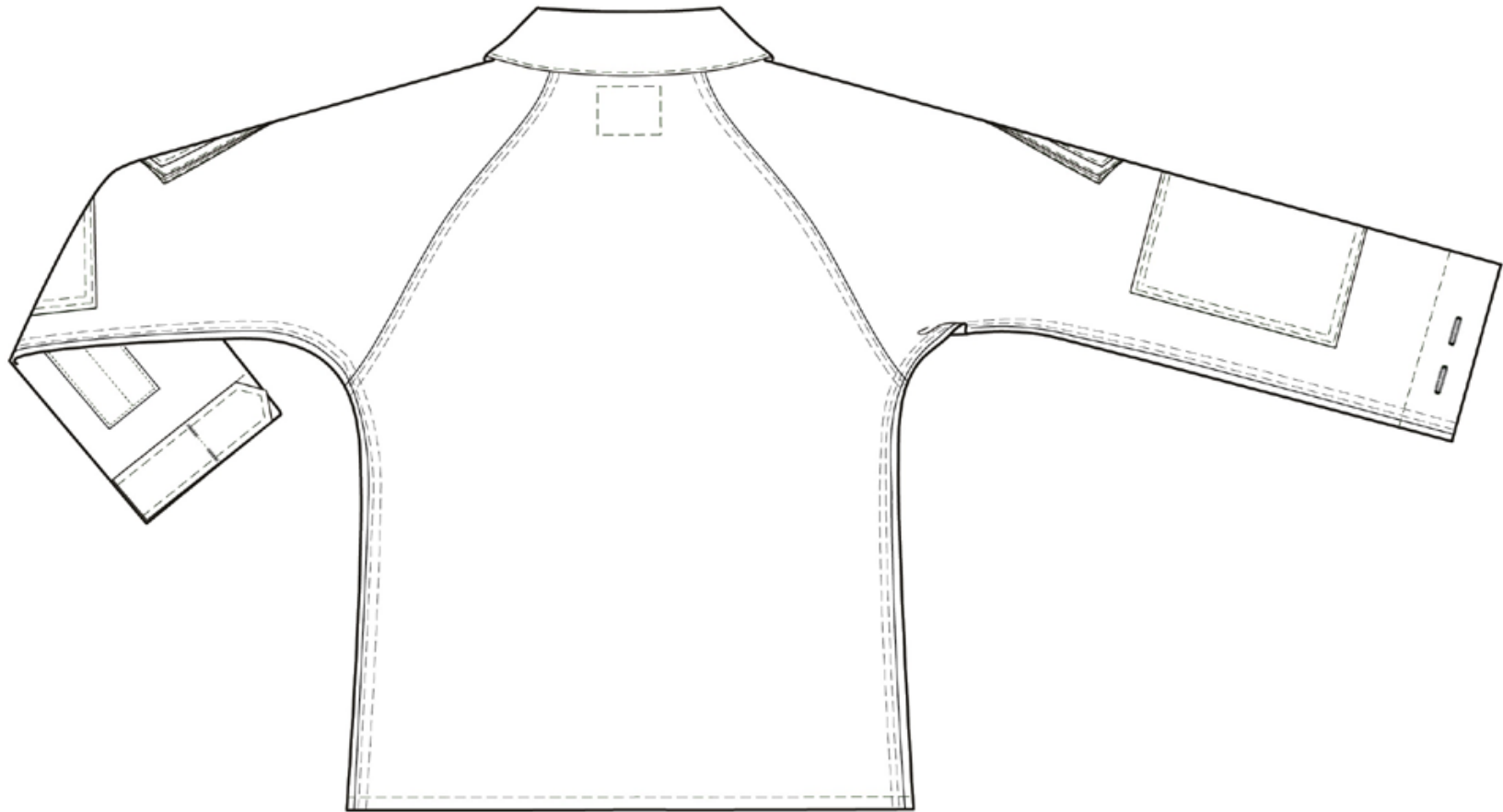


FIGURE 6. Coat Back, Improved Hot Weather Combat Uniform, Type I and Type II.

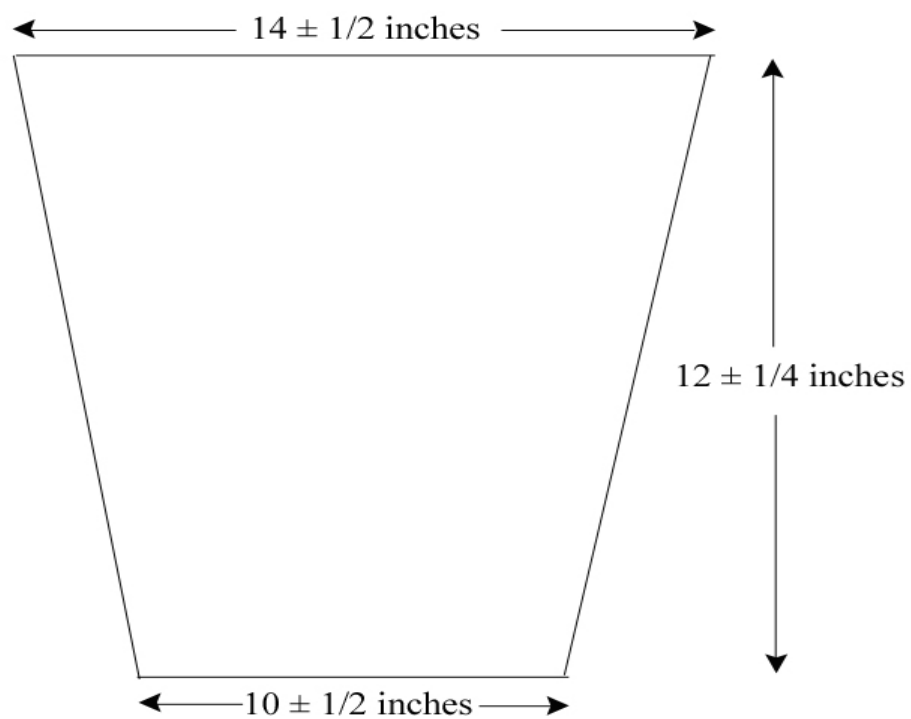


FIGURE 7. Test specimen, % Mosquito Bite Protection Test.

CUSTODIAN:
Army – GL

PREPARING ACTIVITY:
Army-GL