INCH-POUND

MIL-DTL-32158
19 JANUARY 2004

DETAIL SPECIFICATION

TROUSERS, ALL-PURPOSE, ENVIRONMENTAL, CAMOUFLAGE

This specification is approved for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers a three layer laminated waterproof and moisture vapor permeable trousers used as a component of the All-Purpose Environmental Clothing System (APECS).

1.2 Classification. The trousers will be of one type and four classes in the following sizes as specified (see 6.2).

Class 1- Woodland MARPAT Camouflage
Class 2- Desert MARPAT Camouflage
Class 3 – Woodland Camouflage
Class 4 – Desert Camouflage

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center Philadelphia, Clothing and Textiles Directorate, Attn: DSCP-COCT (Bldg 6), 700 Robbins Ave., Philadelphia, PA 19111-5092 or emailed to Colleen.M.Robinson@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil

AMSC N/A FSC 8415
DISTRIBUTION STATEMENT A. Approved for public release; Distribution is unlimited.

Size	X-Short	Short		Regular	Long	X-Long
	X-Small	X	X	X	X	
	Small	X	X	X	X	
	Medium	X	X	X	X	
	Large	-	X	X	X	X
	X-Large	-	-	X	X	
	XX-Large				X	

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4 or 5 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 documents cited in sections 3, 4 or 5 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 listed in the solicitation or contract.

FEDERAL

A-A-50083 - Bag, Plastic, Folded Garment
A-A-50198 - Thread, Gimp
A-A-50199 - Thread, Polyester Core, Cotton or Polyester-Covered
A-A-55126 - Fastener, Tapes, Hook and Loop, Synthetic
A-A-55634 - Fasteners, Slide, Interlocking
V-B-871 - Button, Plastic

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-32142 - Cloth, Waterproof and Moisture Vapor Permeable
MIL-C-43701 - Cord, Elastic, Nylon
MIL-F-10884 - Fasteners, Snap
MIL-DTL-32075 - Label: For Clothing, Equipage, and Tentage (General Use)
MIL-PRF-5038 - Tape, Textile and Webbing, Textile, Reinforcing Nylon
MIL-T-3530 - Thread and Twine: Mildew Resistant or Water Repellent Treated
MIL-W-5664 - Webbing, Elastic
MIL-DTL-32072 - Thread, Polyester

(Copies of these documents are available online at http://assistdaps.dla.mil/quicksearch/ or www.dodssp.daps.mil or from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following document(s) 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.

ASTM International

ASTM-D-1974-1988	– Boxes, Shipping Fiberboard
ASTM-D-3951	- Standard Practice for Commercial Packaging
ASTM-D-5118	– Practice for fabrication of Fiberboard Shipping Boxes
ASTM-D-6193	– Stitches and Seams

(Copies of these documents are available from www.astm.org or American Society For Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQC Z1.4 – Sampling Procedures and Tables For Inspection by Attributes

(Application for copies should be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018-3308.)

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC-8	- Colorfastness to Crocking: AATCC Crockmeter Method
AATCC-16	- Colorfastness to Light
AATCC-22	- Water Repellency: Spray Test
AATCC-61	- Colorfastness to Laundering, Home and Commercial: Accelerated
AATCC-96	- Dimensional Changes in Commercial Laundering of Woven and Knitting Fabrics Except Wool
AATCC- 119	– Resistance to Frosting
AATCC-135	- Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics

(Copies of these documents are available from http://www.aatcc.org or American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI/ASCQ Z1.4- SAMPLING PROCEDURES AND TABLES FOR INSPECTION OF ATTRIBUTES

(For all inquires please contact the American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036). Website address http://www.ansi.org

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI Method T-451-Flexure Properties of Paper (Clark Stiffness)

(Applications for copies of referenced documents should be addressed to TAPPI Press, Technology Park/Atlanta, PO Box 105113, Atlanta, GA 30348-5113.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

3.2 Guide samples. Samples, when furnished, are solely for guidance and information to the contractor (see 6.4). Variations from the specification may appear in the sample in which case this specification shall govern.

3.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable 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.

3.3.1 Disposal of seconds/rejected garments. Rejected trousers shall be disposed in one of the following manners: 1) contact the USMC to determine if there is an alternate use for the rejected finished trousers, or 2) if the USMC does not identify any alternate use, the contractor may sell the trousers on the secondary market. Rejected trousers shall be labeled or indelibly marked on the label as "seconds/rejected by USMC" and the embroidered label "Made Expressively For USMC" shall be cut out of the trousers.

3.3.2 Basic material. The basic material for the trousers shall be a waterproof and moisture vapor permeable cloth conforming to MIL-PRF-32142. The color of the face side of the cloth shall be Woodland MARPAT Camouflage, Class 1, Desert MARPAT Camouflage, Class 2, Woodland Camouflage, Class 3 or Desert Camouflage, Class 4, as required (see 6.2). The color of the back side of the cloth shall be Camouflage Green 483 for the Classes 1and 3 cloth and Tan 492 for Classes 2 and 4 cloth.

3.3.2.1 Cloth, reinforcement. The cloth for use as knee patches, seat patches, cargo pockets, and cargo pocket flaps shall be Woodland MARPAT Camouflage, Class 1, Woodland Camouflage, Class 3, Desert MARPAT Camouflage, Class 2 or Desert Camouflage, Class 4, as required (see 6.2), water repellent treated and must resist fraying. The requirements for the reinforcement cloth are in the following tables:

Table I – Requirements for reinforcement cloth

Characteristic	Requirement
Weight	6.0 oz/sq. yd Max
Breaking strength: Warp Fill	 200 lbs. (min) 155 lbs. (min)
Colorfastness to: Crocking Laundering Light Perspiration Alkaline/Acid	 Dry and wet: 3.5 min. except for Black 477 and 357, 1.5 min. for Black Equal to or better than "3-4" rating on AATCC Gray Scale for Color Change Equal to or better than "3-4" rating on AATCC Gray Scale for Color Change Woodland: Lt. Green 354 and Khaki 475 – Good. Black 477 & 357, Coyote 476, Green 474, Dk. Green 355, and Brown 356 – Fair Desert: Lt. Khaki 494, Lt. Coyote 481, Urban Tan 478, Highland 480, Lt. Brown 493 and Lt. Tan 479 & 492 – Good.
Spray rating: Initial After 1 laundering	 100, 100, 90 min. 90, 90, 80 min.
Characteristic	**Requirement**
Stiffness (cm)	Warp – 11.0 max Filling - 11.0 max.
Puncture Propagation Tear	Warp - 7.0 kgf min. Filling - 6.0 kgf min.
Resistance to Organic liquid	No wetting by N-Tetradecane
Resistance to Frosting	Equal to or better than the standard sample
Dimensional Stability: Warp Fill	 4.0% (max) 4.0% (max)

Abrasion Resistance	800 cycles (min)

Table II – Spectral reflectance requirements for Classes 1 and 3 Reinforcement Cloth Reflectance Values (percent)

Wavelength,	Black 477& Black 357		Coyote 476, Khaki 475& Light Green 354		Green 474, Dark Green 355 & Brown 356	
Nanometers (nm)	min	max	min	max	min	max
600	-	-	8	20	3	9
620	-	-	8	20	3	9
640	-	-	8	20	3	9
660	-	-	8	20	3	12
680	-	-	10	30	3	16
700	-	20	18	50	5	32
720	-	30	22	54	7	44
740	-	33	30	56	12	52
760	-	33	35	58	18	56
780	-	34	40	62	26	56
800	-	34	55	80	34	56
820	-	35	55	80	42	60
840	-	35	55	84	44	60
860	-	35	60	84	44	60

Table III – Spectral reflectance requirements for Classes 2 and 4 Reinforcement Cloth Reflectance Values (percent)

Wavelength,	Light Tan 479 & Light Tan 492		Lt Coyote 481, Highland 480 & Light Brown 493		Urban Tan 478 & Light Khaki 494	
Nanometers (nm)	min	max	min	max	min	max
700	38	53	19	36	25	48
720	38	58	20	36	25	52
740	39	62	20	36	25	54
760	40	66	21	36	26	56
780	41	72	21	38	27	57
800	43	76	22	43	28	58
820	45	76	23	45	30	58
840	48	78	24	46	33	58
860	50	78	25	46	36	59

3.3.2.2 Cloth, three-layer knit. As an alternate to basic material, the leg insert may be fabricated from a three layer-knit. If used, the cloth shall conform to the physical characteristics listed in table IV when tested in accordance with paragraph 4.4.1.1:

Table IV – Requirements for three-layer knit cloth

Characteristic	Requirement
Weight	4.0 ± 0.4
Stiffness, cm	8.0 Max
Hydrostatic Resistance, psi Initial Taffata Restraint After deet	 220 Min. 120 Min.
Puncture Propagation Tear, kgf Warp Fill	 3.5 Min. 3.5 Min.
Water permeability Initial After Synthetic Perspiration	 No leakage No leakage
Moisture Vapor Transmission Rate (g/sq. m/24 hours) Procedure B – Initial Procedure BW – Initial	 600 Min. 5000 Min.
Physical surface appearance after laundering	No changes after 20 launderings

3.3.3 Seam sealing tape. The tape for covering and sealing all designated seams and stitching shall be cut in 1 ± 1/16 inch wide strips from material that is compatible with the back side of the cloth specified in MIL-PRF-32142.

3.3.4 Tape, nylon. The tape for suspender loops shall be a 1/2-inch flat nylon tape, black, conforming to type III of MIL-PRF-5038. As an alternate, the suspender loops may be fabricated from the basic material.

3.3.5 Drawcord, elastic. The trouser waist drawcord shall be a Camouflage Green 483 or Black, 3/16-inch diameter nylon or polyester elastic conforming to type II of MIL-C-43701 and in the lengths specified in the table below. All ends shall be seared and knotted.

Table V – Elastic drawcord lengths

Size	Length (in inches)	Tolerance
X-Small	38	
Small	42	

Medium	46	±1
Large	50	
X-Large	54	
XX-Large	**56**	

3.3.6 Fastener tape, hook and loop. The nylon fastener tape shall be Camouflage Green 483 for classes 1 and 3 and Tan 380 for classes 2 and 4 conforming to type II, class 1 of A-A-55126 and in the widths specified in table VI below:

Table VI – Fastener tape lengths

Location	Width	Length (in inches)
Leg tabs (hook)	1-1/2 inches	1-1/2 ± 1/4 (all sizes)
Leg fastener tapes (pile)	1-1/2 inches	6-3/4 ± 1/4 (all sizes)

3.3.7 Webbing, elastic. The elastic webbing for the cargo pocket hem shall be 1 inch wide conforming to MIL-W-5664 and shall be Natural or Black in color for all classes.

3.3.8 Buttons. The button for the cargo pocket shall conform to type II, class D, style 26, 30-line of V-B-871 and shall have a dull finish. The color for classes 1 and 3 shall be Olive Green BP cable 62016 and for classes 2 and four shall be Tan AJ cable 62028.

3.3.9 Fastener, slide, interlocking. The leg opening and fly slide fasteners shall be continuous element polyester monofilament coil, Size 5-7, equipped with a single pull, automatic locking slider conforming to A-A-55634, in the lengths specified. The leg opening slide fasteners shall have a plastic bottom stop permanently secured and without prongs protruding through the tape and a reverse bale slider. The color shall be black. Each fly slide fastener slider shall be equipped with either a 3/8-inch black webbing thong conforming to paragraph 2.2.7 of A-A-55634 or a basic material thong. If available, a subdued colored thong from the basic material supplier may be used. The leg opening slide fasteners shall be 17 inches in length for all sizes. The slide fastener lengths for the front fly are listed in table VII below:

Table VII – Slide fastener lengths

	X-Short	Short	Regular	Long	X-Long
X-Small	7-1/2	7-1/2	7-1/2	9	
Small	7-1/2	7-1/2	9	9	
Medium	7-1/2	9	9	10	
Large		9	10	10	10

X-Large		9	10	10	
XX-Large				10	

3.3.10 Barrel lock. The barrel locks for the ends of the waist drawcord shall be a black, toaster ellipse conforming to ITW NEXUS part # 350-2000 or equal.

3.3.11 Fastener, snap. The stud and post part of the snap fastener shall be style 2, finish 2 male and female complete, consisting of stud and eyelet size 1 or 2 with button size 1 or 2, conforming to MIL-F-10884, except that the socket shall conform to Scoville style#93XB-10224 Easy Action or equal. An uncapped button may be used in areas where the surface will be concealed by a layer of base cloth.

3.3.12 Thread. The thread for all seaming and stitching shall be polyester, size B, 2 or 3 ply, conforming to type I, class 1, subclass B, of MIL-DTL-32072. As an alternate, size 40, 2 or 3 ply polyester core, thread conforming to A-A-50199 may be used. All thread shall be water repellent treated in accordance with MIL-T-3530. The thread color shall be Camouflage Green 483 (approximating color chip 34094 of FED-STD-595) for classes 1 and 3 and Khaki P-1 (C.A. 66019 or approximating color chip 30277 of FED-STD-595) for classes 2 and 4.

3.3.13 Gimp. The gimp for reinforcing the pocket buttonhole shall conform to type I or type II, ticket #8 of A-A-50198. The color of the gimp shall be Camouflage Green 483 (approximating color chip 34094 of FED-STD-595) for classes 1 and 3 and Khaki P-1 (C.A. 66019 or approximating color chip 30277 of FED-STD-595) for classes 2 and 4.

3.3.14 Labels. Each trouser shall have a class l identification label, a class 2 size label, and a class 3 instruction label, or a class 14 combination size, identification and instruction label conforming to type VI of MIL-DTL-32075. The label color shall be Medium Green, C.A. 70034, 70130, or 70131 for classes 1 and 3 and Khaki, Cable No. 70188 for classes 2 and 4. The labels shall show fastness to laundering. The labels shall show fastness to laundering.

3.3.14.1 Identification label. The identification labels shall read.

"**TROUSERS, ALL-PURPOSE ENVIRONMENTAL, CAMOUFLAGE**"

3.3.14.2 Size label. The size label information shall be as follows:

X-Small X-Short	Small X-Short	Medium X-Short
Inseam: Up to 26-1/2 in.	Inseam: Up to 26-1/2 in.	Inseam: Up to 26-1/2 in.
Waist: Up to 27 in.	Waist: 27 to 31 in.	Waist: 31 to 35 in.
Stock No: 8415- XX-XXX-XXXX	Stock No: 8415-XX-XXX-XXXX	Stock No: 8415-XX-XXX-XXXX

X-Small Short
Inseam: 26-1/2 to 29-1/2 in.
Waist: 27 to 31 in.
Stock No: 8415- XX-XXX-XXXX

Small Short
Inseam: 26-1/2 to 29-1/2 in.
Waist: 27 to 31 in.
Stock No: 8415- XX-XXX-XXXX

Medium Short
Inseam: 26-1/2 to 29-1/2 in.
Waist: 31 to 35 in.
Stock No: 8415- XX-XXX-XXXX

Large Short
Inseam: 26-1/2 to 29-1/2 in.
Waist: 35 to 39 in.
Stock No: 8415- XX-XXX-XXXX

X-Small Regular
Inseam: 29-1/2 to 32-1/2 in.
Waist: Up to 27 in.
Stock No: 8415- XX-XXX-XXXX

Small Regular
Inseam: 29-1/2 to 32-1/2 in.
Waist: 27 to 31 in.
Stock No: 8415- XX-XXX-XXXX

Medium Regular
Inseam: 29-1/2 to 32-1/2 in.
Waist: 31 to 35 in.
Stock No: 8415- XX-XXX-XXXX

Large Regular
Inseam: 29-1/2 to 32-l/2 in.
Waist: 35 to 39 in.
Stock No: 8415- XX-XXX-XXXX

X-Large Regular
Inseam: 29-1/2 to 32-1/2 in.
Waist: Over 39 in.
Stock No: 8415- XX-XXX-XXXX

X-Small Long
Inseam: 32-1/2 to 35-1/2 in.
Waist: Up to 27 in.
Stock No: 8415- XX-XXX-XXXX

Small Long
Inseam: 32-1/2 to 35-1/2 in.
Waist: 27 to 31 in.
Stock No: 8415- XX-XXX-XXXX

Medium Long
Inseam: 32-1/2 to 35-1/2 in.
Waist: 31 to 35 in.
Stock No: 8415- XX-XXX-XXXX

Large Long
Inseam: 32-1/2 to 35-1/2 in.
Waist: 35 to 39 in.
Stock No: 8415- XX-XXX-XXXX

Large X-Long
Inseam: Over 35-1/2 in.
Waist: 35 to 39 in.
Stock No: 8415- XX-XXX-XXXX

X-Large Long
Inseam: 32-1/2 to 35-1/2 in.
Waist: Over 39 in.
Stock No: 8415- XX-XXX-XXXX

XX-Large Long
Inseam: 32-1/2 to 35-1/2 in.
Waist: Over 43 in.
Stock No: 8415- XX-XXX-XXXX

3.3.14.3 Combination identification/size label. A combination identification/size label conforming to type VI, class 4 of MIL-DTL-32075 may be used.

3.3.14.4 Care instruction label. The care instruction label shall be as follows:

TROUSERS, ALL-PURPOSE, ENVIRONMENTAL, CAMOUFLAGE

WARNING!!
DO NOT STARCH, BLEACH, DRY CLEAN OR PRESS THE APECS TROUSERS

A. Home Laundering (machine/hand): Permanent press or normal cotton sturdy machine setting or hand washing using a detergent. Rinse thoroughly in warm water. Note: Any residual detergent on the trousers will decrease the water repellency.

Home Drying: Tumble dry on permanent press or cotton sturdy setting. Remove immediately from dryer. To drip dry, place on a rust-proof hanger.

B. Post Laundry: Trousers shall be laundered utilizing "Formula II" FM 42-414.

C. Field Laundry/Restoration of Water Repellent Finish: Trousers shall be laundered utilizing "Formula XII" of FM 42-414.

Post/Field Drying: Tumble dry at low temperature setting. Remove immediately from dryer. Do not overheat or over dry. For Restoration of Water Repellent Finish, dry at a temperature not to exceed 150°F.

3.3.14.5 Combination size, identification, and instruction label. The identification label, size label, and instruction label may be combined into one label, conforming to type IV, class 14 of MIL-DTL-32075. The three labels shall be printed as one continuous label with the size label first and the identification and instruction labels placed below the size label. The size and identification labels may be combined and the contents placed above the instruction label. A space of 1/2-inch minimum shall be maintained between the labels. In addition, a solid line, 1/16-inch minimum width, shall extend across the entire label, approximately in the middle of the 1/2-inch blank space. The coating requirement shall conform to the class 3 label.

3.3.14.6 Label/tag. Each of the trousers shall be individually barcoded with a type VIII, class 17 label/tag of MIL-DTL-32075. The label/tag shall be attached to the slide fastener thong of the front fly.

3.4 Design. The trousers have an elastic drawcord at the waist, a front slide fastener fly opening, ankle openings with a slide fastener closure and adjustment tabs, two front pass-thru opening with flaps, two leg cargo pockets with flaps and reinforcement patches at the seat and knees.

3.5 Patterns. The standard patterns provide an allowance of l/4 inch for all sealed seams and 3/8 inch for all other seams and will be furnished by the Government. The Government patterns shall not be altered in any way and are to be used only as a guide for cutting the contractor's working patterns. The working patterns shall be identical to the Government patterns.

3.5.1 Pattern parts. The component parts shall be cut from the material specified and according to the number of parts listed in Table VIII.

TABLE VIII. List of Pattern Parts

Material	Pattern Nomenclature	Computer Nomenclature	Cut Parts
Cloth, laminated	Front	FRONT	2
	Back	BACK	2
	Pocket flap	POCKET_FLAP	2
	Ankle tab	ANKLE_TAB	2
	Pocket facing	POCKET_FAC	2
	Leg opening flap (outer)	LG_OP_FL_OUT	2
		LG_OP_FL_INN	2
	Leg opening flap (inner)	LOOP	2
	Suspender loop		
Cloth, reinforcement	Cargo pocket	CARGO_POCKT	2
	Cargo pocket flap	CRG_PKT_FLP	2
	Cargo pocket facing	CRG_PKT_FAC	2
	Cargo pocket tab	CRG_PKT_TAB	2
	Seat patch	SEAT_PATCH	2
	Knee patch	KNEE_PATCH	2
	Reinforcement	REINFORCEMENT	4
Cloth, 3-layer knit (May be used as an alternate)	Leg opening flap (outer)	LG_OP_FL_OUT 1/	2
	Leg opening flap (inner)	LG_OP_FL_INN 1/	2

1/ Use the pattern parts listed under Cloth, laminate, when using the Cloth, 3-layer knit.

3.6 Construction. The construction shall conform in all respects to the requirements specified in Table II and herein.

3.6.1 Stitches, seams, and stitching. All stitches, seams and stitching shall conform to ASTM-STD-751. The type of seam, stitching and stitches per inch shall be as specified in Table IX. Seam allowances shall be maintained with seams sewn so that no raw edges, run-offs, pleats, puckers or open seams occur. When two or more methods of seams or stitches are given for the same operation, any one may be used.

3.6.1.1 Type 301 stitching. Ends of all stitching shall be backstitched or overstitched not less than 1/2 inch except where ends are turned under or caught in other seams or stitching. Ends of a continuous line of stitching shall over-lap not less than 1/2 inch. Thread tensions shall be maintained so that there will be no loose stitching resulting in loose bobbin or top thread or excessively tight stitching resulting in puckering of the materials sewn. The lock shall be embedded in the materials sewn.

3.6.1.1.1 Repairs of type 301 stitching.

a. When thread breaks, skipped stitches, run-offs, or bobbin run-outs occur during sewing, the stitching shall be repaired by restarting the stitching a minimum of 1/2 inch back of the end of the stitching. 1/

b. Except for pre-stitching, thread breaks, and/or two or more consecutive skipped or run-off stitches noted during inspection shall be repaired by the use of overstitching. The stitching shall start a minimum of l/2 inch in back of the defective area, continue over 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 removal of the defective stitching without damaging the materials, and re-stitching in the required manner. 1/

1/ When making the above repairs, ends of stitching do not need to be backstitched.

3.6.1.2 Types 504, 515, and 516 stitching. Thread tension shall be maintained so that there will be no loose stitching. All repairs shall be in accordance with 3.6.1.1.1a and b. thread tension shall be maintained so that there will be no loose or excessively tight stitching resulting in puckering of the materials sewn.

3.6.1.3 Bartacks. Unless otherwise specified, all bartacks shall be 3/8 ± 1/16 inch long and 1/8 ± 1/32 inch wide, and shall contain 28 stitches. Bartacking shall be free from thread breaks and loose stitching.

3.6.1.4 Buttonhole. The buttonholes shall be eyelet end, tapered bar, 3/4 to 7/8 inch in length with 52-56 stitches. The buttonhole purling shall be between the tab and flap plies.

3.6.1.5 Sewn eyelets. All eyelets shall be 3/16 inch in diameter with a minimum of 19 stitches per eyelet with purling on the outside.

3.6.1.6 Automatic stitching. Automatic machines may be used to perform any of the required stitch patterns provided the requirements for the stitch pattern, stitches per inch, and size and type of thread are met; and at least three tying, overlapping or back stitches are used to secure the ends of the stitching.

3 6 1.7 Thread ends. All thread ends shall be trimmed to a length of not more than l/4 inch unless otherwise specified.

3.7 Heat sealing. Seams and stitching as indicated in Table II shall be sealed with heat seal tape on the inside of the trousers. The entire width of the seam tape shall be uniformly sealed over the seam or stitching. All seam tapes shall be applied without tension and shall be applied so that a minimum of 1/8 inch overlap is on both sides of the sewn seam and the back knit of the fabric adjacent to the seam tape shall not be melted to expose the plastic film layer of the fabric. All seam tapes shall overlap a minimum of 3/4 inch at joining points and all ends of seam tape or taped cross-over areas shall be spot sealed without additional repair tape in accordance with seam tape manufacturer temperature, time and pressure recommendations for application with cross-over heat sealing machine. As an alternate, spot sealing for taped ends can be eliminated if hot-air seam tape machine can automatically cut and seal ends of seam tape without any loose ends. However, spot sealing for taped cross-over areas shall remain sealed. Seams, cross-over areas and sealed stitching show no leakage, tape ends shall show no

signs of lifting, and the tape itself shall show no sign of lifting, curling, bubbling or separation more than 1/8 inch of tape top knit shrinkage such that the tape middle layer is exposed when tested initially and after five laundering cycles as specified in 4.4.4.

3.7.1 Appearance after laundering: after five laundering cycles as specified in 4.4.4, the fabric shall show no loss in color in the black printed areas of the woodland camouflage pattern greater than a visual rating of 3-4 on the AATCC gray scale for evaluating change in color and also shall show no significant change in physical surface appearance when compared to an unlaundered trousers in both fabric and taped areas. Minor defects not affecting appearance, such as puckering or seam line or creases around taped area due to manufacturing operations are acceptable and shall be used for comparison to laundered sample.

3.8 Manufacturing operations requirements. The trousers shall be manufactured in accordance with the operation requirements specified in Table II. The contractor is not required to follow the exact sequence of operations listed. Any holding or basting stitch is permissible provided it is removed, does not show on the finished trousers, and does not interfere with proper seam taping of the trousers.

3.8.1 Repairs. Repairing the trousers by mending, patching, or darning is not allowed and at no time is the removal of heat sealing tape permitted. However, up to 25 inches of heat sealing tape may be used for repairing leaking seams, missing yarns in the tricot knit, and for repair areas where the original tape does not overlap sewn seams by the minimum 1/8 inch on both sides of the inside of the trousers. Up to five repair areas totaling 25 inches in length will be allowed. No more than five inches of repair using more than two layers of seam sealing tape is permitted.

3.9 Abbreviations in Table of Operations. The abbreviations used in Table II are as follows:

Stch	- Stitch	Lpr	- Looper
Btn	- Button	Mchne	- Machine
Btnhl	- Buttonhole	Brtck	- Bartack
Incl	- Including	Comrcl	- Commercial
Dbl	- Double	Smlr	- Similar
In	- Inch		
Ndl	- Needle		
Bob	- Bobbin		

TABLE IX. MANUFACTURING OPERATIONS REQUIREMENTS

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
1.	Cutting and marking. a. Cut the trousers in strict accordance with patterns furnished which show size, shape, directional lines, and notches for proper assembly of parts. The directional lines indicate the warp, unless otherwise specified. The directional lines may vary from the warp direction by not more than 2-1/2 inches on both fronts and backs. Measurements shall be taken from top and bottom of directional lines on pattern to selvage edge of the fabric and the difference between the two measurements shall not exceed 2-1/2 inches. Cut all parts of the trousers from one piece of material, except under side of leg insert, belt and suspender loops, and pocket facings. b. Cut fastener tapes in lengths specified in 3.3.5. c. Hot wire cut waist drawcords in the lengths specified in 3.3.4. Note: As an alternate to hot wiring, drawcord ends may be dipped or impregnated with cellulose acetate or cellulose butyrate				
2.	Replacement of damaged parts. Care shall be exercised during the spreading, that material defects and damages, as specified in 4.4.2, are removed and replaced with non-defective and properly matched material.				
3.	Marking. Mark, ticket, or bundle all component parts to insure correct shade and size throughout the trouser. Markings shall not be visible on the outer shell of the trousers. Drill holes shall not be used.				

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL	THREAD BOB/ LPR
4.	Assemble ankle tabs.					
	a. Position hook fastener tape on face side of tab in accordance with marks on pattern. Stitch on all four sides 1/8 to 3/16 inch from edge.	301	LSbj-1	10-13	B	B
	b. Fold tab in half and with face side out, fold under raw edges 3/8 inch. Stitch l/8 to 3/16 inch from folded edges.	301 or 401	EFn-2	10-13	B	B
	-or-					
	c. Fold tab in half lengthwise with face sides together. Stitch sides 3/8 inch from edge.	301 or 401	SSe-2(a)	10-13	B	B
	d. Turn tabs and force out corners and edges. Stitch 1/8 to 3/16 inch from folded edges.	301 or 401	SSe-2(b)	10-13	B	B
5.	Assemble leg opening flap.					
	a. Align outer leg opening flap face side to back side of inner leg opening flap. Stitch together 1/4 inch from edges along top, sides and bottom.	301 or 401	SSe-2(a)	10-13	B	B
	b. Turn leg opening flap, work out corners and top stitch 1/16 to l/8 inch from edges.	301	SSe-2(a)	10-13	B	B
6.	Make pocket flaps.					
	a. Position reinforcement and snap on pocket flap, according to marks on pattern. Set snap with cap on backside of fabric.					
	b. Fold flap in half (face sides together) and stitch 3/8 inch from side edges.	301 or 401	SSe-2(a)	10-13	B	B
	c. Turn flap, work out edges and corners. Stitch 3/16 to 1/4 inch from edges.	301 or 401	SSe-2(a)	10-13	B	B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
7.	Make cargo pocket flaps.				
	a. Fold flap tab in half (face sides together) in accordance with mark on patterns and stitch 3/16 to 1/4 inch from side edges. Turn and work out corners. Place a buttonhole in accordance with mark on patterns.	301 Buttonhole	LSbj-1	10-13 52-56	B B B B
	b. Place tab on flap, align edges and stitch 1/4 inch from top edge. Fold flap in half (with face sides around tab) and stitch 3/8 inch from side edges.	301	SSe-2(a)	10-13	B B
	c. Turn flap and tab, force out corners and top stitch 1/4 inch from edges. Making sure to catch tab in topstitching of flap sides but not in bottom.	301	SSe-2(b)	10-13	B B
	d. Overedge top raw edges of cargo pocket flap.	515 or 516	SSa-2	10-13	B B
8.	Assemble cargo pocket				
	a. Make a 3/16 to 1/4 inch eyelet in lower edge of cargo pocket in accordance with mark on pattern.	Eyelet		19-24 per eyelet	
	a. Form pleats by folding cargo pocket in accordance with marks on pattern. Stitch l/16 to 1/8 inch from folded edge of each pleat.	301	EFa-1	10-13	B B
	b. Stitch facing to top of cargo pocket catching pleats in stitching. Bartack ends of elastic to pocket. Turn facing to inside of pocket encasing elastic and stitch 1/8 inch from facing edge.	301 Bartack	SSa-1	10-13 28 per bartack	B B B B
	c. Place a horizontal bartack across fold of each cargo pocket pleat superimposed on cargo facing stitching.	301		28 per bartack	B B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
8. cont'd	Assemble cargo pocket d. Form bellow by folding bottom edge of pocket in accordance with marks on pattern and stitch l/16 to 1/8 inch from folded edge.	301	EFa-1	10-13	B B
9.	Attach knee patches. a. Position knee patch face side up, to face of trousers and line up with leg flap opening of right front, per marks on patterns. b. With raw edges aligned, stitch knee patch along leg flap opening, 1/8 inch from edge. c. Fold under top and bottom of knee patch 1/2 inch, position in accordance with notches on pattern and topstitch in place 1/16 to 1/8 inch from folded edges. (The cutout sides of knee patch will remain open.) Repeat for the left side.	301 or 401 301 or 401	SSa-1 LSd-1	10-13 10-13	B B B B
10.	Attach seat patch. Position seat patches face side up on face of trouser backs in accordance with notches. Raw edges of patches shall be even with center back seam. Pre-stitch side and top edges of patches to trouser 1/8 inch from edge. Turn under bottom, side and top edges of patches 1/2 inch, and stitch 1/16 to 1/8 inch from fold.	301 301	SSa-1 SSb-1	10-13 10-13	B B B B
11.	Set pocket flaps and facings for pocket openings. a. Position back side of pass thru facing on trouser face. Slash through trouser front and pocket facing as indicated by marks on pattern and tongue notch ends. (Front pocket opening and facing may be slashed during cutting operations.) Align raw edges of trouser & facing along slash line, and stitch around opening 1/4 inch from raw edges.	301	SSa-1	10-13	B B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
11. cont'd.	Set pocket flaps and facings for pocket openings.				
	b. Turn facing to inside of trousers. Stitch 1/16 to 1/8 inch from turned edges and ends of opening	301	SSe-2(b)	10-13	B B
	c. Place raw edge of flap 3/8 inch above pocket opening and stitch 1/8 to 3/16 inch from edge. Turn flap down toward pocket opening and stitch 1/4 to 5/16 inch from fold.	301	LSbk-(a)	10-13	B B
	d. Set one stud at each pocket opening, matching snap on pocket flap.				
12.	Join side seams.				
	a. Place trouser front and trouser back face to face, and with top of slide fastener opening even and raw edges in alignment, stitch side seam from top of slide fastener opening to trouser top.	301 or 401	Ssa-1	10-13	B B
	b. Heat seal side seams.				
13.	Set cargo pockets and cargo pocket flaps.				
	a. Position pocket on leg in accordance with marks on pattern. Turn under edges of pocket 3/8 inch and stitch to trouser 1/8 inch from folded edges.	301	SSb-1	10-13	B B
	b. Place a vertical bartack, at each side of the cargo pocket opening, 1/8-3/16 inch from top edge of pocket, superimposing bartack on pocket stitching. Place a vertical bartack on the front and back edge of the cargo pocket, 1/8-3/16 inch from bottom of pocket, superimposing bartack on pocket stitching.	Bartack		28 per bartack	B B
	c. Position cargo pocket flap on trouser, per marks on pattern. Stitch 3/16 to 1/4 inch from raw edge of flap.	301	LSbk-(a)	10-13	B B
	d. Fold pocket flap down and top stitch 1/4 to 5/16 inch from folded edge.	301	LSbk-(a)	10-13	B B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
13. cont'd	Set cargo pockets and cargo pocket flaps. e. Bartack the lower front corner of the cargo pocket flap to the trousers with a vertical bartack superimposed on the flap top stitching.	Bartack		28 per bartack	B B
14.	Attach leg opening flap/slide fastener. a. Position closed slide fastener face up on face of leg opening flap. With raw edges of leg opening flap and slide fastener tape even, position ankle tab and pre-stitch all layers together 1/8-3/16 inch from edge.	301	SSa-1	10-13	B B
	b. Tongue notch top of leg opening. Position face side of slide fastener/flap/tab assembly on face side of front leg opening and with raw edges even, stitch 1/4 inch from edge of leg opening.	301	LSq-2(a)	10-13	B B
	c. Position face side of slide fastener to face side of back leg opening. With raw edge of back leg opening and slide fastener tape even, stitch 1/4 inch from edge.	301	LSq-2(b)	10-13	B B
	d. Topstitch slide fastener 1/16 to 1/8 inch from folded under edges on both sides of slide fastener and across notch, tacking ends.	301	LSq-2	10-13	B B
15.	Heat seal knee patches, leg inserts, seat patches, slide fastener seam cargo pocket and cargo pocket flap. a. Lay all seam sealing tape on inside of trousers, completely covering seam or stitching and heat seal. b. Heat seal knee patch stitching across top and bottom. c. Heat seal cargo pocket and flap stitching. d. Heat seal top of slide fastener seam. Seal the length of the slide fastener seam on the front leg slide fastener seam, and to the top of the knee patch.				

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR	
15. cont'd	Heat seal knee patches, leg inserts, seat patches, slide fastener seam cargo pocket and cargo pocket flap. e. Spot seal corner of knee patch. f. Spot seal heat seaming tape across top of insert g. Heat seal seat patch stitching. The tape shall be cut and repositioned at each corner. h. Spot seal corner and end by side entry.					
16.	Assemble front fly. a. With slide fastener closed and face up, position to right side of right front of trousers and stitch 1/16 to 1/8 inch from edge of slide fastener tape, from top to bottom of slide fastener stop & tacking ends.	301	SSa-1	10-13	B	B
	b. Position left slide fastener tape to left front of trousers with right sides together and stitch 1/8 inch from tape edge tacking ends.	301	SSa-1	10-13	B	B
	c. Position left and right trouser fronts with right sides together and crotch seam edge aligned. Stitch 1/4 inch from raw edge from inseam edge to 1/2 inch past curved edge tacking both ends. Turn to face side and with seam turned to the left side, edge stitch 1/8 inch from fold seam.	301	SSa-1	10-13	B	B
	d. Fold the left front fly to the inside per marks on pattern and stitch through trousers and slide fastener and fly, from top to form J curve under slide fastener stop, tacking end.	301	SSb-1	10-13	B	B
	e. Stitch the bottom of fly extension together with edges aligned for l-1/2 inch (max) at curve or to within no more that 1/4-1/2 inch above slider.	301	SSa-1	10-13	B	B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
16. cont'd	Assemble front fly. f. Place a 3/8-inch horizontal bartack across the right side of the zipper tape and bottom of "j" at 1/8 inch from tape fold.	Bartack		28 per bartack	
17.	Close trousers and heat seal seams. a. Align seat seam edges and join with a row of stitching 1/4 inch from edge.	301 or 401	LSb-1	10-13	B B
	b. Align edges of inseam and close with a row of stitching 1/4 inch from edge. Crotch and seat seams shall not be staggered more than 1/4 inch (measurement taken from center of seams.)	301 or 401	SSa-1	10-13	B B
	c. Lay all seam sealing tape on inside of trousers, completely covering seam or stitching and heat seal. The inseam may lie towards either side of the trousers. The center back seam shall lie on same side of trousers as crotch seam.				
	d. Starting at top edge of trouser back, heat seal seat and crotch seam to bottom of front fly.				
	g. Starting at bottom of leg, heat seal inseam to crotch. Repeat on opposite leg. As an alternate, heat seal seam from bottom of leg to crotch, and continue down inseam of opposite leg.				
	h. Spot seal crotch.				
18.	Hem waist. a. Position eyelet reinforcement on inside of right side (as worn). Stitch a 3/16-1/4 inch eyelet through reinforcement piece and trousers. The eyelet shall be centered on the reinforcement piece. Thread end of drawcord through eyelet.	304		19 per eyelet	B B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
18. cont'd.	Hem waist. b. Overedge top raw edge of trousers.	515 or 516	SSa-2	10-13	B B
	c. Turn top of trousers over drawcord and stitch 3/16 inch to l/4 inch from edge, catching the combination label (left of seat seam). Attach barrel locks and knot drawcord ends. NOTE: The drawcord shall not be caught in the waist stitching.	301	EFt-1	10-13	B B
	e. Position suspender loops on trouser fronts in accordance with marks on patterns. Fold under raw edges 3/8 inch and bartack in place with a 3/8 inch vertical bartack. The suspender loops shall finish 5-1/4 ± 1/8 inches in length between bartacks.	3/8 inch bartack		28 per bartack	B B
19.	Set snaps. a. Set cap on outside of left front waist in center of fly. b. Set three studs, one on right waist to match the cap on left side and one on each side opening to match cap on flaps.				
20.	Make and attach belt loops. a. Make belt and suspender loops by folding stripping with the edges abutted at center. Stitch with two rows of stitching with each row of stitching not less than 1/8 inch from edge. The covering stitch shall finish on the underside. The finished loop stripping shall measure 3/8 to 1/2 inch wide.	406	EFh-1	10-13	B B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
20. cont'd.	Make and attach belt loops. b. Fold ends of belt loops under 3/8 inch and place top fold of loop even with top of trousers. Bartack loop in place with a horizontal bartack 1/8 inch from each fold. All belt loop openings shall finish 1-7/8 ± 1/8 inches between bartacks. Bartacks shall extend the width of the loops. All loops shall be vertically straight. The center back loop shall be centered on seat seam. Sizes: X-Small, Small and Medium Position the 5 belt loops on trouser waist as follows: (1) One on each front trouser panel, 2-1/2 inches from each front edge. (2) One on or adjacent to center back joining seam. (3) One on each trouser back panel, 5-1/2 inches from center back seam Sizes: Large and X-Large Position the 7 belt loops on trouser waist as follows: (1) Two on each front trouser panel, one 3 inches from each front edge and a second one near each side seam. (2) One on or adjacent to center back joining seam. (3) One on each trouser back panel, 6 inches from center back seam.	3/8 inch Bartack		28 per bartack	B B
21.	Hem trouser and attach fastener tape. a. Position 6-3/4 inches strip of 1-1/2 inch loop fastener tape on bottom of leg back in alignment with ankle tab hook tape. Stitch on all four sides 1/8 to 3/16 inch from edge. b. Turn under bottom edge of leg 1/4 inch and fold up hem in accordance with notch. Stitch 1/16 to 1/8 inch from fold.	301 301	LSbj-1 EFb-1	10-13 10-13	B B B B

NO.	OPERATION	STCH TYPE	SEAM/ STCH TYPE	STCH/ IN	THREAD NDL BOB/ LPR
22.	Exam and trim thread ends Trim thread ends to a minimum of 1/4 inch and remove any spots, and insert zipper thongs.				

3.9 Finished measurements. The measurements of the trousers shall conform to the requirements specified in Table X.

TABLE X. Finished measurements (inches)

	1/2 Waist 1/	Inseam 2/	Outseam 3/
X-Short			
X-Small	15	26-1/2	36-1/2
Small	17	26-1/2	36-1/2
Medium	19	26-1/2	36-1/2
Short			
X-Small	15	28-1/2	38-1/2
Small	17	28-1/2	38-1/2
Medium	19	28-1/2	40
Large	21	28-1/2	40
Regular			
X-Small	15	30-1/2	40-1/2
Small	17	30-1/2	42
Medium	19	30-1/2	42
Large	21	30-1/2	43
X-Large	23	30-1/2	43
Long			
X-Small	15	32-1/2	44
Small	17	32-1/2	44
Medium	19	32-1/2	45
Large	21	32-1/2	45
X-Large	23	32-1/2	45
XX-Large	25	32-1/2	45
X-Long			
Large	21	34-1/2	46
Tolerance			
Plus/ Minus	1/2	3/4	3/4

1/ With trouser fly fastened measure along center of waistband from folded edge to folded edge.

2/ Measure along inseam of trousers from crotch seam to bottom edge of trouser leg hem.

3/ Fasten slide fastener and ankle tab at leg opening and button pocket flap. With trouser laid flat, measure from top edge of waistband to bottom of leg hem.

3.10 Workmanship. The finished trousers shall conform to the quality of product established by this specification. The occurrence of defects shall not exceed the applicable acceptable quality level.

4. VERIFICATION

4.1 Classification of inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as other wise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements

4.1.1 Classification of compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept of defective material.

4.4.1.1 Component testing. The components specified in paragraphs 3.3.2.1 and 3.3.2.2 and 3.3.3 shall be tested for the characteristics listed in Table XI in accordance with the test method cited.

TABLE XI. Component tests

Requirement Characteristic	Reference paragraph	Test method
Cloth, Reinforcement		
Weight	3.3.2.1	ASTM-D-3776 (METHOD C)
Breaking strength	3.3.2.1	ASTM-D-5034
Colorfastness to:		
Crocking	3.3.2.1	AATCC 8
Laundering	3.3.2.1	AATCC 61-1A
Light	3.3.2.1	AATCC 16 Opt A or E
Perspiration	3.3.2.1	AATCC 15
Spray rating		

initial	3.3.2.1	AATCC 22
after one laundering	3.3.2.1	AATCC 135 and AATCC 22
Stiffness	3.3.2.1	TAPPI-T-451 7/
Puncture Propagation Tear (kgf)	3.3.2.1	ASTM D 2852 8/
Resistance to organic liquid	3.3.2.1	AATCC 118
Resistance to Frosting	3.3.2.1	AATCC 119
Dimensional stability	3.3.2.1	AATCC 96 opt, lC/AATCC 135
Abrasion Resistance	3.3.2.1	ASTM-D-3884
Infrared reflectance	3.3.2.1	9/
Requirement Characteristic	**Reference paragraph**	**Test method**
Cloth, three-layer knit		
Weight	3.3.2.2	ASTM- D3776 (METHOD C)
Stiffness	3.3.2.2	TAPPI -T-451
Hydrostatic Resistance		
(initial taffeta restraint)	3.3.2.2	ASTM-D-751 1/
(after deet taffeta restraint)	3.3.2.2	ASTM-D-3393 1/
Puncture Propagation Tear (KGS)	3.3.2.2	ASTM-D-2582 8/
Water permeability		
Initial	3.3.2.2	AATCC 127 2/
After synthetic perspiration	3.3.2.2	AATCC 127 3/
Moisture Vapor Transmission Rate (g/m2/24 Hrs)		
(B)	3.3.2.2	ASTM-E-96 4/
(BW)	3.3.2.2	ASTM-E-96 5/
Physical Surface Condition changes after laundering	3.3.2.2	6/
Reinforcement tape (Seam sealing tape)	3.3.3	4.5.2.1 (b)
Water permeability after seam tape	3.3.3	ASTM-D-3776
Weight		

1/ Five 4 by 4 inch specimens shall be laid flat, face side up on a glass plate, 4 by 4 inches by 1/4 inch thick. Three drops of diethyltoluamide shall be applied to the center of each specimen. A glass plate shall be placed on each specimen and a four-pound weight placed on top. After 16 hours, remove the specimens and test immediately for water permeability.

2/ The water permeability shall be measured as specified in AATCC 127, except that a fixed hydrostatic head of 50 centimeters shall be held for 10 minutes, the face side of the test cloth shall contact the water and five specimens shall be tested. The report shall only include measurement of the appearance of water droplets. Leakage is defined as one (1) or more droplets any place within the 4-1/2 inch diameter area.

3/ The specimen, 8 inches by 8 inches, shall be cut and exposed to synthetic perspiration as follows: the synthetic perspiration solution shall be made by combining 3.0 grams sodium chloride, 1.0 gram trypticase soy broth powder, 1.0 gram normal propyl propionate, C.5 gram of liquid lecithin and 500 ml of distilled water. Cover the solution and stir while heating to 60°c until all ingredients are dissolved. Then, cool the solution to 35°C, remove cover and dispense it immediately with a pipette or other suitable measuring device. Dispense 2 ml of perspiration solution at 3s°c, onto the center of an 8 inch by 8 inch by 1/4 inch glass plate. Place the specimen on the glass plate with the knit side contacting the glass. Dispense an additional 2 ml of the synthetic perspiration solution onto the center of the specimen. Place a second 8 inch by 8 inch by 1/4 inch glass plate on top of the specimen and then place a 4 pound weight on top of and in the center of the assembly. After 16 hours, remove the specimen (do not rinse) and air dry the specimen before testing. Test the specimen for water permeability as specified in AATCC 127.

4/ The back side of the test cloth shall face the water, the free stream air velocity shall be 5so ± so FPM as measured 2 inches above the fabric specimen. The air flow shall be measured at least 2 inches from any other surface. The test shall be run for 24 hours and weight measurements shall be taken at only the start and completion of the test. At the start of the 24 hour test period, the air gap between the water surface and the back of the specimen shall be 3/4 ± 1/16 inch. Five (5) initial specimens shall tested.

5/ The back side of the test cloth shall face the water. The free stream air velocity shall be 550 + 50 FPM as measured two (2) inches from any other surface. The test shall run for two (2) hours and weight measurements shall be taken at the start and completion of the test. Five (5) initial specimens shall be tested. The specimens shall be sealed in any manner, which prevents wicking and/or leaking out of the cup.

6/ Conduct 20 laundering and drying cycles in accordance with 4.4.7. Each sample, 48 inches in length by full width shall be cut in half across the width of the cloth. One half of the sample (24 inches in length) shall be laundered and the remaining half retained as the unlaundered portion for the final evaluation, as necessary. After each drying cycle, examine both sides of the cloth for changes in physical surface appearance when compared to the unlaundered sample.

7/ Preferred Procedure (1) except that five specimens shall be tested under standard textile test conditions as specified in ASTM D-1776.

8/ Five warp and five filling specimens shall be tested. Specimen size shall be 8 inches by 8 inches. Only one tear shall be made on a single specimen. The specimen shall be positioned with the face side toward the probe and with the designated yarns of the face fabric at right angles to the direction of the tear. The test shall be conducted using the standard drop height of 508 ± 2 mm. If the tear is not straight on the face side of the specimen, the result shall be considered invalid and another specimen shall be tested. The thickness of the specimen is not measured.
Note: **This test will be performed at least once at the beginning of each new contract**. The government reserves the right to test this characteristic when samples are sent for verification testing.

9/ Infrared reflectance data shall be determined on the face side of the material and shall be obtained from 600 to 860 nanometers (nm), at a 20 nm intervals on a spectrophotometer relative to a barium sulfate standard, the preferred white standard. Other white reference materials may be used, provided they are calibrated to absolute white, e.g., magnesium oxide, or vitrolite tiles. The spectral

band width shall be less than 26 nm at 860 nm. Reflectance measurements may be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a source that simulates either CIE Source A or CIE Source D65. The specimen shall be measured as a single layer, backed with six layers of the same fabric and shade. Measurements shall be taken on a minimum of two different areas and the data averaged. The measurement areas should be at least 6 inches away from the edges of the finished cloth. The specimen shall be viewed at an angle no greater than 10 degrees from normal, with the specular component included. Photometric accuracy of the spectrophotometer shall be within 1 percent and wavelength accuracy within 2 nm. The standard aperture size used in the color measurement device shall be 1.0 to 1.25 inches in diameter. Any color having infrared reflectance values falling outside the limits at four or more of the wavelength specified shall be considered a test failure.

4.4.1.1 Component and material certification. A certificate of compliance will be acceptable as evidence that the textured nylon cloth conforms to the requirements specified for yarn type, scouring, dying, printing, heat setting, and that an approved, water repellency treatment was used.

4.1.2 Responsibility for dimensional requirements. Unless otherwise specified in the contract or purchase order, the contractor is responsible for ensuring that all specified dimensions have been met. When dimensions cannot be examined on the end item, inspection shall be made at any point, or at all points in the manufacturing process necessary to ensure compliance with all dimensional requirements.

4.1.3 Certificates of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).
b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When a first article is required (see 3.1 and 6.2), it shall be examined for the defects specified in 4.4.2 and 4.4.3 for compliance with design, construction, workmanship and dimensional requirements and tested as specified in 4.4.4.

4.4 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be in accordance with ANSI/ASQC Z1.4.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.1.2 Component and material certification. Unless otherwise specified, a certificate of compliance will be acceptable as evidence that the heat sealing tape conforms to the requirements specified in 3.3.2. A certificate of compliance will be acceptable as evidence that the textured nylon cloth conforms to the requirements specified for yarn type, scouring, dying, printing, heat setting, and that an approved, water repellency treatment was used.

4.4.2 End item visual examination. The end items shall be examined for the defects listed in Table XII. The lot size shall be expressed in units of trousers. The sample unit shall be one of the trousers. The inspection level shall be II and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 1.5 for major defects and 10.0 for total (major and minor combined) defects.

TABLE XII. End item visual defects

Examine	Defect	Classification	
		Major	Minor
Materials defects and damages	Any smash, multiple float or loose slub	101	
	Cut, tear, mend, burn, needle chew, or hole	102	
	Misweave area of poor dye penetration dyestreak, broken or missing yarn, visible mend, thin place, or shade bar 1/	103	201
Cleanliness	Any spot, streak, or stain of a permanent nature on any portion of trousers which would be visible when trousers are worn		202
	Removable spot, streak, or stain on outside of trousers		203
	Thread ends not trimmed throughout trousers		204
	Any holding or basting threads visible on the outside of the finished trousers when applicable		205
Component and assembly	Any defective component 1/	104	206
	Any component part omitted	105	
	Any required operation omitted or improperly performed 1/	106	207
Drawcord	Any drawcord caught in waistband stitching restricting use of drawcord	107	
	Any end not heat sealed		208
	Any drawcord omitted	108	
	Any end not knotted or not having a barrel lock		209
	Any drawcord insufficient in length	109	
	Any drawcord not caught in center back bartack		210
Slide fastener	Any part of slide fastener bent, broken, or otherwise defective	110	
	Not closing and locking properly	111	
	Length not as specified	112	
	Color not as specified		211
	Thong not as specified		212
Labels	Missing, illegible or incorrect	113	
	Incorrectly placed or attached 1/		213

TABLE XII. End item visual defects (cont.)

Examine	Defect	Classification Major	Minor
Accuracy of seaming	Seam twisted, pleated, or puckered 1/	114	214
	Part of trouser caught in any unrelated operation or stitching 1/	115	215
	Thread break secured by stitching back of the break less than 1/2 inch		216
	Ends of all seams and stitches when not caught in other seams or stitching, uneven or backtack less than 1/2 inch		217
	Thread color of thread not as specified		218
	Gage of stitching not as specified		219
	Edge of seam tape less than 1/8 inch from seam allowance	116	
Heat sealed seams	Any sealing tape with wrinkle, turn under, or pleat 1/	117	220
	Any seam tape not located as specified		221
	Any required stitching not covered by seam tape	118	
	Any area where heat sealing tape has been removed 1/	119	222
	Any seam tape not 1/8 inch overlap on each side of sewn seam	120	
	Any seam tape not overlapped 3/4 inch minimum	121	
	Any needle punctures that have not been repaired using heat sealing tape		223a
	Any area of knit fabric bordering the seam tape that is melted exposing film	122	
	More than two layers of heat sealing tape in any one area 1/	123	223b
Repairs	Any heat sealing repairs greater than 25 inches in length 1/	124	224
	More than five repairs on any one item 1/	125	225
Seam tape adhesion	Seam tape lifting off fabric within 3/4 inch of seam 1/	126	226
	Visible scorching (heat degradation of the fabric on the laminate) in excess of 3/16 inch in width or 1/2 inch in length at any location along a taped seam. The length requirement shall		

TABLE XII. End item visual defects (cont.)

Examine	Defect	Classification Major	Minor
not apply to the leg insert seams 1/		127	227
Open seams	More than 1/8 inch up to 1/4 inch		228
	More than 1/4 inch	128	
NOTE:	One or more broken or two or more continuous skipped or run-off stitches constitute an open seam. On double stitched seams, a seam is considered open when one or both sides of the seam is open. Raw edge not securely caught in stitching shall be classified as an open seam.		
Seams and stitchings	Not specified seam or stitch type	129	
	Missing, broken, or skipped stitches 1/	130	229
Stitch tension	Loose tension in any area:		
	- more than 1 inch but not more than 2 inches		230
	- more than 2 inches	131	
	Tight tension (stitches break when normal strain is applied to the seam or stitching)	132	
Stitches per inch (to be scored only when the condition exists on major portion of the seam)	Less than minimum specified:		
	- one stitch		231
	- two or more stitches	133	
	More than maximum specified		232
Shaded parts	Variation in shade within an outside part 1/	134	233
	Any part required to be cut from one piece of material, shaded 1/	135	234
NOTE:	Parts suspected as being shaded shall be examined at a distance of three feet against the background of the other parts and colors of the garment. When shade difference is readily discernible under these examining conditions, it shall be scored as a shaded part.		
Bartacks	Bartack omitted	136	
	Any bartack not in specified location,		

TABLE XII. End item visual defects (cont.)

Examine	Defect	Classification Major	Minor
insecure, or not serving			
	intended purpose:		
	- more than two	137	
	- two or less		237
	Any loose stitching, incomplete or broken		238
	Length or width not as specified		239
Inseams	Inseam staggered at crotch more than ¼ inch (center to center)		240
	Crotch and seat seam staggered at inseam more than ¼ inch (center to center)		241
Ankle tab	Missing	138	
	Improperly located or not width specified 1/	139	242
Snap fasteners	Any part of assembly missing, mismated, broken, cracked, bent, not securely clinched, affecting function:		
	- two or more snap fasteners	140	
	- one snap fastener		243
	One or more clinched too tightly cutting surrounding fabric	141	
	Loose, i.e., socket or stud spins freely or wobbles in connection portions		244
	One or more having rough or sharp edges	142	
Label/tag bar-code	Omitted or not readable by scanner		245
	Causes damage to trousers	143	
Fastener tape hook & pile	Not properly placed	144	
	Not specified length	145	

1/ This defect shall be scored as major when seriously affecting serviceability and as minor when affecting serviceability but not seriously.

4.4.3 End item dimensional examination. The end items shall be examined for conformance to the dimensions specified in Table XI. Any dimension not within the specified tolerance shall be classified as a defect. The lot size shall be expressed in units of trousers. The sample unit shall be one pair of trousers. The inspection level shall be S-3 and the AQL, expressed in terms of defects per hundred units, shall be 4.0.

4.4.4 End Item Testing. The end items shall be tested as specified in 4.5 for their conformance to the requirements for the black print color of the camouflage pattern, hydrostatic resistance of seam tape, tape end lifting, tape integrity and physical surface appearance changes specified in para 3.7 and 3.7.1 the lot size shall be expressed in units of trousers. The sample unit shall be one pair of trousers. The inspection level shall be S-2 and the AQL**,** expressed in terms of defects per hundred units, shall be 4.0 for test failures.

4.4.5 Packaging examination. The fully packaged end items shall be examined for the defects listed below. The lot size shall be expressed in units of shipping containers. The sample unit shall be one shipping container fully packaged. The inspection level shall be S-2 and the AQL, expressed in terms of defects per hundred units, shall be 2.5.

Examine	Defect
Marking (exterior and unit packs)	Omitted; incorrect; illegible; of improper size, location, sequence, or method of application.
Materials	Any component missing, damaged, or not as specified.
Workmanship	Inadequate application of components, such as: incomplete closure of container flaps, loose strapping, inadequate stapling, or improper taping. Bulged or distorted container.
Content	Number per container is more or less than required. 1/ Size shown on one or more trousers not as specified on shipping container. 1/

1/ For this defect, one container in the sample shall be examined.

4.4.6 Palletization examination. An examination shall be made to determine that palletization complies with the section 5 requirements. Defects shall be scored in accordance with the list below. The sample unit shall be one palletized load fully packaged. The lot size shall be the number of palletized unit loads in the end item inspected lot. The inspection level shall be S-1 and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 4.0 in accordance with ANZI/ASQC Z 1.4.

Examine	Defect
Finished dimension	Length, width, or height exceeds specified maximum requirement.
Palletization	Pallet pattern not as specified. Load not bonded as specified.
Weight	Exceeds maximum load limits.

Marking	Omitted; incorrect; illegible; of improper size location, sequence, or method of application.

4.5 Methods of testing.

4.5.1 Hydrostatic resistance test. The hydrostatic resistance of sealed seam areas of the trousers, before and after five laundering cycles (see 4.5.2), shall be tested in accordance with AATCC 127, except for the following: the test specimen need not be conditioned and does not need to be tested in a conditioned environment (ambient conditions may be used). The test may be performed on any device which tests the same specimen area at the equivalent pressure. The hydrostatic head shall be 50 centimeters pressure (or 0.8 psi) for 3 minutes. The trousers shall be tested at three different locations as follows: one on top seam of knee patch, one leg seam, and one seat seam. The water shall contact the outside of the garment. The sealed seam shall be centered in the 4-1/2 inch diameter test area of the testing machine. Evidence of leakage in one or more seam locations shall be considered a test failure. Leakage is defined as the appearance of one droplet of water anywhere in the 4-1/2 inch diameter test area in cases of dispute the apparatus described in AATCC 127 shall be used.

4.5.2 Trouser laundering test. Select trousers in accordance with the criteria in paragraph 4.3.3. Prior to laundering, one pair of trousers shall be retained for use as the unlaundered sample in evaluating the trousers after laundering. Taped areas of the trousers shall be visually examined prior to laundering for physical surface appearance characteristics and initial tape end and integrity conditions. The sliders, hook/loop tapes and snap fasteners of each trouser shall be closed with the right side of each trouser out during the wash and drying cycles. Place two (2) pairs of trousers, (one pair may be ballast) (approximately 4 pounds total load), in an automatic washing machine set on permanent press cycle, high water level and warm (100 + 10, - 0° F) wash temperature. Place 28 grams of detergent conforming to 1993 AATCC Standard Reference Detergent (non-phosphate) without optical brighteners into the washer. The duration of each laundering cycle shall be 30 to 35 minutes. After laundering, place trousers in an automatic tumble dryer set on permanent press cycle, high heat setting (150-160^{o} F) and run for approximately 30 minutes. Conduct five laundering and drying cycles. After the fifth laundering and drying cycle, test and evaluate the trousers for conformance to the required characteristics in 4.5.2.1. The laundering equipment (washer and dryer) shall be in accordance with AATCC test method 135.

4.5.2.1 Appearance after laundering.

a. Tape ends integrity test. After five laundering cycles, the test trousers shall be examined for any sign of tape ends lifting, within 3/4 inch of sewn seam; tape ends lifting more than 1/8 inch when tape extends beyond 3/4 inch of the sewn seam, tape curling, bubbling, separation along tape edges or across the tape width, or tape outer layer more than 1/8 inch exposing the tape membrane or inner layers (see 3.7). The occurrence of any of these defects shall be considered a test failure. Tape ends lifting more than 1/8 beyond 3/4 inch of the sewn seam shall be tested for hydrostatic resistance in accordance with paragraph 4.5.1 and are acceptable with no leakage.

b. Color loss in black print areas of woodland camouflage pattern. After five laundering cycles the color loss shall be determined by comparing the test trouser and the unlaundered sample. Any black color change on any are of trouser less than the required rating (see 3.7.1) on the AATCC gray scale for evaluating change in color shall be considered a test failure.

c. Physical surface appearance changes of the fabric. After five laundering cycles the woodland camouflage printed side of the test trouser shall be visually examined on all visible pattern parts of the trouser for any evidence of physical surface appearance changes as compared to the unlaundered sample (see 3.7.1). Any physical surface appearance change shall be considered a test failure. Any physical surface appearance characteristic noted in a taped area on the unlaundered trousers (see 4.5.2) shall not be considered a test failure on the laundered trousers if there is no adverse change in the characteristic. Puckering and creases within taped areas, not adversely affecting appearance, shall not be considered a test failure.

5. PACKAGING

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

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The trousers are intended for use by Marine personnel when weather conditions dictate and as the outer layer of the Extended Cold Weather Clothing System when used during cold weather operations. The APECS trousers will replace the Marine Corps (Gen 2) Extended Cold Weather Clothing System (ECWCS) trousers procured under MIL-T-44189.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number and date of this specification.
b. Type, Class and Size (see 1.2).
c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
d. When a first article is required (see 3.1, 4.3, and 6.3).
e. Levels of preservation and packing (see 5.1 and 5.2).
f. Type and class of unit load required (see 5.2.1).
g. When weather-resistant grade fiberboard shipping containers are required for level B packing (see 5.2.2).
h. When palletization is required (see 5.3).

6.3 First article. When a first article is required, it will be inspected and approved under the appropriate provisions of FAR 52.209. 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 also include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

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

6.5 Alternative seam tape set-up procedures. As with any seam tape, it is always best to consult the seam tape manufacturer for recommended settings depending on type of taping machine utilized. However, it has been determined that the following set-up procedures offer the best results for taping the polyolefin based material with the alternative tape:

Set the seam tape machine nozzle as close to 1/16 inch and evenly aligned as possible to the edges of the seam tape without touching the adhesive layer. Adjust the heat setting and run at the desired roller speed without exceeding 20 feet per minute. Place an unseamed sample of option material face down into the rollers. Set the roller pressure as to create a positive feed with no slippage. While bonding tape onto the material knit backing, adjust the nozzle air pressure such that only the fabric knit backing is scorched within a 3/8-5/8 inch center area relative to heat reflected off the tape. This condition can be achieved using a very low nozzle pressure. Under no circumstances can the option material knit backing be scorched a full 1 inch width, otherwise leakage will occur. Also, any change in heat setting vs. roller speed will create varying reflected heat scorching patters and therefore the nozzle pressure would be expected to be changed. Record the setting to achieve the correct reflected scorching pattern.

NOTE: A CONTRACTOR USING THE ALTERNATE TAPE SHOULD VERIFY THAT THE SEAM SEAL MACHINE SETTINGS FOR APPLYING THE SEAM SEAL TAPE ARE OPTIMIZED TO PRODUCE A PRODUCT THAT PASSES HYDROSTATIC PRESSURE TESTS ON STRAIGHT, CURVED AND CROSSOVER SEAMS.

6.6 Subject term (key word) listing.

APECS
Extended Cold Weather Clothing System
Laminated cloth
Moisture vapor permeable
Waterproof

6.7 Suggested sources of supply.

6.7.1 Slide Fasteners conforming to the requirements of this document may be obtained from YKK USA, Inc. through Diversified Marketing Group, 109 Forrest Avenue, Narberth, PA 19072.

6.7.2 Cord locks conforming to the requirements of this document may be obtained from ITW Nexus USA, 194 E. Algonquin Road, Des Plaines, IL 60016.

Custodians:

Navy - MC

Preparing activity:

DLA-CT
Project 8415-0258

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://www.dodssp.daps.mil.