INCH-POUND
GL-PD-10-02C
1 September 2010
SUPERSEDING
GL-PD-10-02B
1 June 2010

PURCHASE DESCRIPTION

SHIRT, COMBAT, FLAME RESISTANT

This purchase description is approved 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 a flame resistant (FR), Army Combat Shirt (ACS) which is worn under the Outer Tactical Vest in combat operations.

1.2 Classification. This purchase description covers one type of shirt in seven sizes in the following classes.

1.2.1 Classes.

Class 1 - Universal Camouflage Pattern (UCP) / Foliage Green 504
Class 2 – Operation Enduring Freedom Camouflage Pattern (OCP)/ Tan 499 (see 6.6)

1.2.2 Schedule of sizes: X-Small, Small, Medium, Large, X-Large, XX-Large, XXX-Large

Note: The above sizes may be abbreviated as XS, S, M, L, XL, 2XL, and 3XL

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 cited in sections 3, 4 and 5 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Department of the Army, Natick Soldier Research, Development and Engineering Center, Kansas St., Natick MA 01760. ATTN: RDNS-WPW-C.

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.

FEDERAL SPECIFICATIONS

FED-STD-4 - Glossary of Fabric Imperfections
FED STD 595 - Colors used in Government procurement
FED-STD 595/20180. – Tan 499
FED-STD 595/24165. – Foliage Green 504

COMMERCIAL ITEM DESCRIPTIONS

A-A-55217 – Thread, Aramid, Spun Staple
A-A-50195 – Thread, Aramid
A-A-55126 – Fastener Tapes, Hook and Loop, Synthetic
A-A-55634 – Zippers (Fasteners, Slide Interlocking)

(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Ave. Philadelphia, PA 19111-9054.)

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 NATICK SOLDIER CENTER

2-1-2519 Universal Camouflage Pattern
2-1-2519-1 ARPAT Camouflage Pattern Desert Sand 500
2-1-2519-2 ARPAT Camouflage Pattern Urban Gray 501
2-1-2519-3 ARPAT Camouflage Pattern Foliage Green 502

(Copies of drawings are available from the Department of the Army, Natick Soldier Research Development and Engineering Center, Natick, MA 01760 ATTN: RDNS-WPW-C)

NOTE: For other camouflage patterns noted in the solicitation and contract, please contact contracting activity and the necessary drawings and or patterns will be provided.

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 Test Method 8 - Colorfastness to Crocking; AATCC Crockmeter Method
AATCC Test Method 15 - Colorfastness to Perspiration
AATCC Test Method 16 - Colorfastness to Light
AATCC Test Method 61 - Colorfastness to Laundering: Accelerated
AATCC Test Method 81 - pH of Water-Extract from Bleached Textiles
AATCC Test Method 100 - Assessment of Antibacterial Finishes on Textile Materials
AATCC Test Method 135 - Dimensional Changes of Fabrics after Home Laundering
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 of Textiles

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

AMERICAN SOCIETY FOR QUALITY (ASQ)

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

(Copies are available online at http://www.asq.org or from the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

ASTM D 276 -Standard Test Methods for Identification of Fibers in Textiles
ASTM D 412 -Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-tension
ASTM D 737 -Standard Test Method for Air Permeability of Textile Fabrics
ASTM D 1056 -Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber
ASTM D 2256 -Standard Test Method for Tensile Properties of Yarns by the Single Strand Method
ASTM D 2594 -Standard Test Method for Stretch Properties of Knitted Fabrics Having Low Power
ASTM D 3512 -Standard Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Random Tumble Pilling Tester
ASTM D 3575 -Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers
ASTM D 3776 -Standard Test Methods for Mass per Unit Area (Weight) of Fabric

ASTM D 3787 -Standard Test Method for Bursting Strength of Textiles-Constant-Rate-of Traverse (CRT) Ball Burst Test
ASTM D 3884 -Standard Guide for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)
ASTM D 6193 -Standard Practice for Stitches and Seams
ASTM D 6413 -Standard Test Method for Flame Resistance of Textiles (Vertical Test)
ASTM F 1930 -Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Flash Fire Simulations Using an Instrumented Manikin

(Copies of documents are available online at http://www.astm.org or from ASTM INTERNATIONAL, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

OTHER PUBLICATIONS

Repeat Insult Patch Test - Modified Draize Procedure –
Principles and Methods of Toxicology, (fourth edition), A Wallace Hayes (editor), pp 1057 – 1060, 2001.

(Copies are available online at http://www.taylorandfrancis.co.uk/ or from Taylor and Francis, 325 Chestnut Street, Philadelphia PA 19106.)

Sears Roebuck and Co.
Sears Fabric Defect Replica Scales

(Copies available from Sears Roebuck and Co., "Fabric Defect Replica Kit" Dept. 817 (ATTN: FC 554B), 3333 Beverly Road, HG, FC568B, Hoffman Estates, IL 60179. For information call (847-286-8952.)

2.4 Order of precedence. Unless otherwise noted here 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.2.

3.2 Standard sample. The finished shirt shall match the standard sample for shade and appearance, and shall, unless otherwise indicated, be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.4).

3.3 Recycled, recovered or environmentally preferable 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.

3.4 Materials.

3.4.1 Basic material. The shirt shall be made out of 4 basic fabrics.

3.4.1.1 Torso and neck material. Torso and neck cloth for the shirt shall be knitted flame resistant cloth. The material must be comfortable next to the skin on the torso and neck. The color shall be Foliage Green 504 for Class 1 and Tan 499 for Class 2, unless otherwise specified in the solicitation and or contract (see 6.2) and shall meet the requirements of Table I, Table III, Table IV and Table V and the tests specified in 4.6.

3.4.1.2 Sleeve and side panel. Sleeve and side panels of the shirt shall be knitted flame resistant cloth. The cloth shall be Universal Camouflage Pattern (UCP) for Class 1 or Operation Enduring Freedom Camouflage Pattern (OCP) for Class 2 unless otherwise specified in the solicitation and or contract (see 6.2) and shall meet the requirements of Table I, Table II, Table IV, Table V and the tests specified in 4.6.

3.4.1.3 Modesty panel. The modesty panel component of the shirt shall be knitted flame resistant cloth. The material must be comfortable next to the skin on the torso. The color shall be Foliage Green 504 for Class 1 and Tan 499 for Class 2 unless otherwise specified in the solicitation and or contract (see 6.2) and shall meet the requirements of Table I, Table III, Table IV, Table V and tests specified in 4.6.

3.4.1.4 Backing material. The backing material shall be used as an interfacing for the forearm pocket, sleeve cuff and shoulder pocket to reinforce the structure. The material used for the backing shall be a flame resistant woven cloth. The color shall be neutral and shall meet the requirements of Table IV, and Table V and the tests specified in 4.6.

3.4.2 Elbow pads. The shirt shall have elbow pads consisting of foam enclosed in flame resistant fabric in accordance with 3.4.1.2 with an abrasion resistant dot coating. The abrasion dot coating shall have an average of 300 abrasion cycles (minimum 5 repetitions) without rupture when tested as specified in 4.6. Prior to application of the abrasion resistant dots, the elbow pad cover fabric shall meet the same spectral reflectance requirements of the base material as specified in 3.4 when tested as specified in 4.6.4.

3.5 Color

3.5.1 Color Combinations.

3.5.1.1 Universal Camouflage Pattern (print)/ Foliage Green 504 (solid) combination - (Class 1). The Class 1 shirt shall be in a color combination of Universal Camouflage Pattern print and solid Foliage Green 504. The Universal Camouflage Pattern printed finished cloth shall be dyed to a ground shade either matching or approximating Desert Sand 500 and then overprinted with the camouflage pattern by roller or screen printing. When the ground shade is dyed to match

Desert Sand 500, the remaining colors shall be obtained by subsequent printing using two rollers or screens, as appropriate for the Urban Gray 501 and Foliage Green 502 areas of the pattern. When the ground shade is dyed to approximate Desert Sand 500, all three colors of the camouflage pattern shall be obtained by subsequent printing using three rollers or screens to match all three colors. The solid sections shall be dyed to match Foliage Green 504 matching FED-STD 595/24165.

3.5.1.2 Operation Enduring Freedom Camouflage Pattern (print) / Tan 499 (solid) combination – (Class 2). The Class 2 shirt shall be in a color combination of Operation Enduring Freedom Camouflage Pattern print and solid Tan 499. The Operation Enduring Freedom Camouflage Pattern printed finished cloth shall be dyed to a ground shade either matching or approximating Cream 524 and then overprinted with the camouflage pattern by roller or screen printing. When the ground shade is dyed to match Cream 524, the remaining colors shall be obtained by subsequent printing using six rollers or screens, as appropriate for the Tan 525, Pale Green 526, Olive 527, Dark Green 528, Brown 529 and Dark Brown 530 areas of the pattern. When the ground shade is dyed to approximate Cream 524 all seven colors of the camouflage pattern shall be obtained by subsequent printing using seven rollers or screens to match all seven colors (see 6.5). The solid sections shall be dyed to match Tan 499 matching FED-STD 595/20180.

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

3.5.3 Visual shade matching. The color and appearance of the cloths specified in 3.4.1.1, 3.4.1.2, and 3.4.1.3 shall match the standard sample when tested as specified in 4.5.2.1.

3.5.4 Colorfastness. The finished cloths in 3.4.1.1, 3.4.1.2 and 3.4.1.3 shall conform to the colorfastness requirements listed below in Table I unless otherwise specified in the contract or procurement documents when tested as specified in 4.6.

TABLE I. Colorfastness requirements

	Laundering (4 cycles) 1/, 2/ (min.)	Light (40hrs. Or 170 kJ) 2/, 3/ (min.)	Perspiration (acid & Alkaline) 1/, 2/ (min.)	Crocking 2/, 4/ (min.)	
				Dry	Wet
Solids (all colors for neck, torso and modesty panel)	3-4	3-4	3-4	4	3.5
Camouflage Prints(for printed side and sleeve panel)					
UCP: (all colors)	3	3-4	3-4	4	3.5
OCP: 4/ Dk. Green 528, Brown 529 and Dk. Brown 530	3-4	3-4	3-4	3.5	3.5
Cream 524, Tan 525, Pale Green 526 and Olive 527	3-4	3	3-4	3.5	3.5

1/ Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change and AATCC Evaluation Procedure 2, Gray Scale for Staining.
2/ For Operation Enduring Freedom Camouflage Pattern- all color evaluations shall be performed on the solid color area and not the tonal area.
3/ Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change.
4/ Rated using AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale.

3.6 Pattern execution.

3.6.1 Pattern execution (Universal Camouflage Pattern). The pattern on the printed finished cloth (side and sleeve material) shall be reproducible to the standard sample in respect to design, colors and registration of the respective areas. The pattern repeat shall be as designated in the contractor solicitation. 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 and the pattern shall match Drawing 2-1-2519 or the pattern and drawing as obtained from the contracting activity.

3.6.2 Pattern execution (Operation Enduring Freedom Camouflage Pattern). 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 the Operation Enduring Freedom Camouflage Pattern 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 on solid areas. Each pattern area shall show solid coverage and tonal areas. Skitteriness exceeding that shown on the standard sample in any of the printed areas will not be acceptable. (see 2.2.2, 6.2, and 6.3).

3.7 Spectral reflectance.

3.7.1 Spectral Reflectance (camouflage prints) The reflectance values shall conform to the requirements listed below in Table II for the Universal Camouflage Pattern and Table IIA for Operation Enduring Freedom Camouflage Pattern unless otherwise specified in the contract or procuring activity when tested as specified in 4.6 (see 6.2).

TABLE I. Infrared reflectance requirements (side, sleeve and elbow pad cover material) – Class 1

Reflectance values (percent %) Universal Camouflage Pattern 1/						
Wavelength, Nanometers (nm)	Desert Sand 500		Urban Gray 501		Foliage Green 502	
	Min	Max	Min	Max	Min	Max
600	28	40	12	26	8	18
620	30	42	14	26	8	18
640	34	48	14	28	8	20
660	38	56	14	30	10	26
680	44	60	18	34	10	26
700	46	66	24	38	12	28
720	48	68	26	42	16	30
740	48	72	30	46	16	30
760	50	74	32	48	18	32
780	54	76	34	48	18	34
800	54	76	34	50	20	36
820	54	76	36	54	22	38
840	56	78	38	54	24	40
860	56	78	40	56	26	42

1/ Prior to application of abrasion dots

TABLE IIA. Infrared reflectance requirements (side, sleeve and elbow pad cover material) – Class 2

Reflectance values (percent %) Operation Enduring Freedom Camouflage Pattern 1/, 2/						
Wavelength, Nanometers (nm)	Cream 524 & Tan 525		Pale Green 526, Olive 527 and Brown 529		Dark Green 528 and Dark Brown 530	
	Min.	Max.	Min.	Max.	Min.	Max.
600	22	44	12	30	3	11
620	24	45	12	30	3	11
640	24	45	12	32	4	12
660	25	45	12	32	4	12
680	28	45	14	34	4	13
700	28	46	14	34	6	16
720	30	48	16	36	6	20
740	32	50	18	36	10	25
760	36	50	20	40	14	30
780	38	52	22	40	18	35
800	40	54	22	42	22	40
820	44	56	24	44	24	42
840	46	57	26	44	27	43
860	48	58	28	46	29	45

1/ Prior to application of abrasion dots

2/ For Operation Enduring Freedom Camouflage Pattern - all spectral reflectance evaluations shall be performed on the solid color area and not the tonal area.

3.7.2 Spectral Reflectance (solids) The reflectance values for the solid cloths and loop pile of the fastener tapes shall conform to the requirements listed below in Table III unless otherwise specified in the contract or procuring documents when tested as specified in 4.6 (see 6.2).

TABLE III. Infrared reflectance requirements for solids
(torso/neck and modesty panel material & loop (pile) fastener tape only)

Wavelength, Nanometers (nm)	Foliage Green 504		Tan 499	
	Min.	Max.	Min.	Max.
600	8	26	8	20
620	8	26	8	20
640	8	28	8	22
660	10	30	8	24
680	10	34	12	24
700	12	38	12	34
720	16	42	16	42
740	16	46	22	46
760	18	48	30	50
780	18	48	34	54
800	20	50	36	56
820	22	54	38	58
840	24	54	38	58
860	26	56	40	60

3.8 Material requirements. The finished shirt shall conform to the requirements, listed below in Table IV, when tested as specified in 4.6.

TABLE IV. Material requirements

Characteristic	Torso and Neck	Sleeve and Side Panel	Modesty Panel	Backing Material
Weight (oz/yd^2)				
minimum	5.2	6.9	6.2	3.2
maximum	5.9	7.6	6.9	3.9
Bursting strength (pounds)				
minimum	35	60	35	N/A
Air permeability ($ft^3/min/ft^2$)				
minimum	240	30	75	N/A
Wicking (inches/hour) (Length and Width)				
minimum	3.0	3.0	3.0	N/A

TABLE IV. Material requirements - Continued

Characteristic	Torso and Neck	Sleeve and Side Panel	Modesty Panel	Backing Material
Stretch and Recovery (%) minimum Stretch – Length x Width Recovery – Length x Width	 50 x 35 80 x 65	 15 x 15 70 x 70	 45 x 35 80 x 80	 N/A
Pilling	3-4	3-4	3-4	N/A
Dimensional stability (%) 1/ (after 5 washing cycles) Length Width	 +1.0 /-11.0 +1.0 /- 9.0	 +1.0 /- 9.0 +1.0 /- 7.0	 +1.0 /- 11.0 +1.0 /- 9.0	 N/A

1/ Home launderings shall be conducted in accordance with AATCC Test Method 135 (1, V, Ai), 140° F wash.

3.9 Finish.

3.9.1 Material flame resistance. The cloths specified in 3.4.1.1, 3.4.1.2, 3.4.1.3 and 3.4.1.4 shall be tested for flame resistance and shall meet the requirements listed below in Table V, when tested as specified in 4.6.

TABLE V. Flame resistance requirements (all cloths)

Characteristic (In both length and width directions)	Neck & Torso 1/, 2/	Sleeve & Side Panel 1/, 3/	Modesty Panel 1, 3/	Backing Material 1/ 3/
Afterflame, (maximum seconds) 4/ Initial and after 25, 50 or 100 laundering cycles	2	2	2	2
Afterglow, (maximum seconds) 4/, Initial and after 25, 50 or 100 laundering cycles	2	2	2	2
Char length, (maximum inches) 4/, Initial and after 25, 50 or 100 laundering cycles	5	4	4.5	4
Melting or Dripping (observation)	None	None	None	None

1/ Values are maximum average values allowed for each direction (Wales and Courses) when tested in accordance with ASTM D 6413. Flaming melt/drip on any sample constitutes a failure.
2/ 50 wash requirements is only required during First Article inspection and 25 wash requirements is required for lot testing.
3/ 100 wash requirement is only required during First Article Inspection and 25 wash requirement is required for lot testing.
4/ Home launderings shall be conducted in accordance with AATCC Test Method 135 (1, V, Ai), 140° F wash.

3.9.2 Garment flame resistance. Six finished garments (size Large) shall be supplied to the contracting agency for flammability testing as specified in 4.6 and shall meet the requirement of average predicted body burn less than or equal to 35 percent. Garment flame resistance testing is required for First Article Inspection only.

3.10 pH. The pH of the water extract of all cloths shall be a minimum of 5.0 and a maximum of 8.50 when tested as specified in 4.6.

3.11 Toxicity. The finished shirt shall not present a health hazard and shall show compatibility with prolonged, direct skin contact when tested as specified in 4.6. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.12 Antimicrobial properties. The materials used for the torso and neck and the material used for the modesty panel, sleeves and side panels shall contain odor reducing properties showing a 1-log reduction of microbes when tested against Staphylococcus Aureus when tested as specified in 4.6.

3.13 Design and construction.

3.13.1 Design. The shirt shall be a multi-fabric design using three separate cloths for the main garment construction; one for the torso and neck areas, one for the side and sleeve components, and one for the modesty panel. The shirt shall have an elbow pad covered with flame resistant fabric and coated with abrasion resistant dots. The torso and neck material shall be of a knit construction, covering the stomach, back, and the neck area. An additional woven fabric shall be used as seam reinforcement lining where needed. The side panels shall be a knit and will extend the length of the shirt from underneath the armpit to the waist. The sleeve material is made of the same fabric as the side panels. The modesty panel shall be of knit construction and covering the chest area. The shirt shall be long sleeve and extend from the shoulder seam to the wrist area. The right sleeve (as wearing the shirt) shall have a storage pocket (see patterns for exact placement). On the right pocket there shall be three separate loop fastener tapes to accommodate the name tape, rank insignia, and American flag patch. The left sleeve pocket shall have loop fastener tape covering the length and width of the pocket fabric with a loop fastener tape with IFF (Identification Friend or Foe) tape and a fabric cover sewn and centered on flap top. The pocket closure shall be a 6 1/2-inch slide fastener (zipper) and have an opening of 6 1/4-inches for all sizes. There shall be an elbow patch, with flame resistant foam sewn into the sleeve, with an abrasion resistant coating in the elbow area of the garment. The left sleeve shall contain a two-channel pencil pocket located at the lower forearm. The sleeve cuffs shall be of knit construction with a hook and loop tab closure fastener. The bottom hem shall be 3/4 inch wide, single turned, and two-needle cover-stitched.

3.13.2 Components.

3.13.2.1 Slide fastener (zipper). The slide fastener for the pocket closure (both left and right sleeve) shall be a single-pull, two-stop non-separating, non-reversible, size 5, high temperature resistant plastic individual element fastener (IEF), high temperature resistant aramid tape

material conforming to Type I, Style 7 of A-A-55634. The opening for the slider pull-tabs shall be a minimum of 5 millimeters in length and 7 millimeters in width. The thong shall have two bartacks along the width of the thong for secure attachment and to prevent fraying. The thong shall have a finished length after assembly to the pull of 2-3/4 inches (± 1/8) inch and a width of 3/8 inches. The strength of the thong shall comply with A-A-55634. The color of the tape, thong and components shall match the standard sample as specified by the contracting activity and shall meet the same color requirements for laundering as specified in Table I when tested in accordance with AATCC-61.

3.13.2.2 Tape, hook and loop. The hook and loop fastener tape shall conform to A-A-55126, Type II, Class 1 (with additional flame retardant finish). No slit or split edges are permitted. Sew all hook and loop with a minimum of 1/8 inch from bound selvage to prevent needle cutting along edges. To prevent raveling, do not sew directly on selvage. Each required width shall maintain a tolerance of plus 1/16 inch or minus 1/16 inch as to prevent stitching runoffs or improper fit into automatic sewing equipment. The hook and loop shall be flame resistant. The color shall match the standard sample as designated by the contract or solicitation. All hook and loop shall be sewn on shirt as indicated on the figures.

3.13.2.2.1 Sleeve cuff. The loop fastener for sleeve cuff shall be in accordance with 3.13.2.2 and shall be 5/8 inches wide and approximately 4-1/2 inches in length. The hook fastener for sleeve cuff tab shall be 1 inch wide and approximately 2-1/2 inches in length.

3.13.2.2.2 Name tape. The loop fastener for the name tape shall be in accordance with 3.13.2.2 and shall be 1-inch wide by approximately 5-1/2 inches in length.

3.13.2.2.3 American flag patch. The loop fastener for the American flag patch shall be in accordance with 3.13.2.2 and shall be 2 inches wide and approximately 3-1/2 inches in length.

3.13.2.2.4 Rank patch. The loop fastener for the rank patch shall be in accordance with 3.13.2.2 and shall be 2 inches wide and approximately 2 inches in length.

3.13.2.2.5 Identification friend or foe (IFF) cover. The hook fastener located at the end of the IFF cover shall be in accordance with 3.13.2.2 and shall be 1-inch wide and 3/4 inch in length.

3.13.2.2.6 Left sleeve patch. The loop fastener for any left sleeve patches shall be in accordance with 3.13.2.2 and shall be 4 inches wide and approximately 6-1/2 inches in length.

3.13.2.3 IFF material. The IFF material shall be sew-on IR glo-tape, 3/4 inch wide and 3/4 inch in length (See 6.5.1).

3.13.2.4 Foam. The foam shall meet the requirements in Table VI.

TABLE VI. Foam requirements

Characteristic	Requirement
Density, (lb/ft ^{3})	3.0 – 4.5
Tensile strength, (lb/in^2), minimum	40
Compression deflection @ 25%, (lb/in^2)	1.5 – 3.5
Water absorption, (%), maximum	7
Elongation, (%), minimum	125

3.13.2.5 Labels.

3.13.2.5.1 Garment labels. Garment labels shall be either heat transfers or screen prints and shall conform to MIL-DTL-32075, Type III or IV, Class 14. Labels shall be placed inside the garment 3/4 inch below the neck seam. Heat transfer labels, if used, shall be applied using application process recommended by the manufacturer. The label shall be able to stretch with the garment fabric without excessive cracking and/or peeling, durable to 25 launderings when tested as specified in Table XI, and shall conform to all toxicity requirements as specified in 4.6.3. The dimensions of the label (applied) shall be a maximum of 3-1/2 inches wide and 2-1/4 inches in height. The basic design in Figure 1 shall be followed for the use and care label. Label artwork is available upon request.

3.13.2.5.2 Lot numbers. Garment lot numbers shall be stamped inside the left sleeve cuff

3.13.2.5.3 Hang tags. Hang tags with branding or other information may be used at the discretion of the prime contractor. When used, hang tags should be attached to the slide fastener on the upper left sleeve pocket with a swift tack fastener. Use of hang tags should bear no additional cost to the U. S. Government.

FIGURE 1. Basic label design

3.13.2.6 Thread. The thread for all seaming and stitching shall be aramid, Type I or higher, Tex size 27, conforming to A-A-55217 or Tex size 40 or higher conforming to A-A-55195 or A-A-55217. The thread used to attach all pockets, hook and loop fasteners, Identification Friend or Foe (IFF) material, elbow pads, and the bottom waist hem shall be Tex size 40 or higher conforming to A-A-55195 or A-A-55217. All thread shall be non-staining and show a rating of 4 for colorfastness to laundering (4-cycles). Color of the thread shall match the end item cloths and shall be as specified in the contract or procuring documents and shall meet the requirements of Table XI and the tests specified in 4.6.5.

3.13.2.7 Barcoding. Bar codes (if applicable) shall be as specified in the solicitation and/or contract (see 6.2).

3.13.3 Figures. The Figures 1, 2, 3 and 4 are furnished for informational purposes only. If there are any inconsistencies between the written document and the figures, the written document shall control.

3.13.4 Patterns. Standard patterns, which show directional line markings for proper cutting and assembly, shall not be altered in any way and are to be used as a guide for cutting contractor's working patterns. Seam allowances are determined by pattern specifications and may not be altered. Pockets, pencil pocket, elbow patches, cuffs, collar, slide fastener, patch loop tape and other hook and loop fastener tape shall be located in accordance with marks on patterns and table references. Bottom hem shall be single turned and 3/4 inch clean finished.

The pattern list in Table VII is provided to insure that the pattern set provided is complete. The working patterns will be identical to the Government patterns except that additional notching to facilitate manufacture is permissible. Also minor modifications are permitted where necessary to accommodate manufacture's processes and using automatic equipment. These modifications shall not alter the serviceability or appearance requirements.

TABLE VII. Pattern parts

Nomenclature	Pattern Abbreviations	# of Cut Parts
BACK	PD-10-02_BACK	CUT 1
COLLAR	PD-10-02_COLLAR	CUT 1
FRONT BOTTOM	PD-10-02_FRNT_BTM	CUT 1
FRONT TOP	PD-10-02_FRNT_TOP	CUT 1
FRONT CENTER	PD-10-02_FRNT_CTR	CUT 1
UPPER SLEEVE	PD-10-02_SLV_UPPER	CUT 2
MIDDLE SLEEVE	PD-10-02_SLV_MIDDLE	CUT 2
BOTTOM SLEEVE	PD-10-02_SLV_BOTTOM	CUT 2
GUSSET	PD-10-02_GUSSET	CUT 2
SHOULDER PK	PD-10-02_SHLDR_PKT	CUT 2
SHOULDER PKT STRIP	PD-10-02_SLDR_PKT_STRIP	CUT 2
IR TAB COVER	PD-10-02_IR_TAB	CUT 1
FA PKT	PD-10-02_FA_PKT	CUT 1
CUFF TAB	PD-10-02_CUFF_TAB	CUT 2
ELBOW DOTS	PD-10-02_ELBOW	CUT 2
ELBOW PAD	PD-10-02_ELBOW_PAD	CUT 2
SHLDR PKT BACKING	PD-10-02_SHLDR_PKT_BKG	CUT 2
CUFF BACKING	PD-10-02_CUFF_BKNG	CUT 2
FA PKT BACKING	PD-10-02_FA_PKT_BKG	CUT 1
FA PKT FACE	PD-10-02_FA_PKT_FACE	CUT 1

3.13.5 Configuration. Each shirt shall conform to Figures 3 and 4 for construction and appearance and the finished measurements in Table IX and shall be in compliance to end item performance tests in order to provide a uniform appearance, comfort and durability in combat operations.

3.13.6 Stitches and seam types. All seams shall be consistent and exhibit a uniform appearance. The backside of seams (inside garment) shall be flat with no protruding seam allowance to prevent irritation or discomfort. Stitches, seam types and stitch placement specified in Table VIII shall conform to ASTM D 6193. Whenever two or more methods of stitches and seam types are given for the same location, either may be used. Seams shall be sewn so that no raw edges, open seam, run-offs, twists, pleats or puckers will result. Seam shall start and finish evenly.

TABLE VIII. Stitch and seam type and locations

Seam Location	Seam type	Stitch type
Torso, sleeves, side seams (4 in strips) / underarm seams	Fsa-1 (Adjust tension to allow maximum stretch with no thread cracking or breakage)	606/607 with cover over all raw edges
Arm sleeve pocket assembly and attachment	Lsb-1	Slide fastener - attach 301, bartack top and bottom of slide fastener, opens from the top
	SSa-1 (Boxstitch)	Loop tapes - Attach 301, center stitch on 4 inch loop tape
	Osf-1	Form bellow seams - 301
	Lsb-1	Attach pocket - single 301 sides
	EFP-2	Assemble 4 inch ID tab
	Lsb-1	Fold over IFF Tab 1/2 inch. Attach 3/4 inch X 1 inch hook tape – 301 Boxstitch
	7/8 inch Bartack	Attach tab in center of upper loop tape – Fold right edge over 1/2 inch – 7/8 inch Bartack on end
	7/8 inch Bartack	7/8 inch Bartack 1 inch to left
	SSbd-1	Black IFF – Boxstitch 1/2 inch IFF tab
Elbow patch assembly and attachment	BSc-1	Edge of dot patch fabric - Circumvent 3/8 inch binding around edge - 301
	SSv-1	Attach Patch - 5 radial top stitches - 301
	Lsb-1	Attach Assembly – Topstitch to arm sleeve along outer edge of binding, with binding ends attached into side seam - 301

TABLE VIII. Stitch and seam type and locations – Continued

Seam Location	Seam Type	Stitch Type
Arm sleeve cuff assembly	SSbd-1	4 inch long hook tab - Assemble into 1 inch strip and top strip 2-1/2 inches x 1 inch hook tape - 301
	Efa-2	Cuff - fold cuff 2 inches with 402 stitch (No cover on face side), cover stitching shall cover raw fabric inside edge
	SSbd-1	Hook tab - Fold hook tab 3/8 inch and attach with double bartack hook tab to cuff with bartack 3/4 inch apart
	SSa-1 (Boxstitch)	5/8 inch X 4-1/2 inch loop tape - Top stitch loop tape to cuff
Hem	Efa-2 (Adjust tension to allow maximum stretch with no thread cracking or breakage)	Fold over 3/4 inch with 402 with cover on inside to cover raw inside edge
Neck cuff	FSa-1 (Adjust tension to allow maximum stretch with no thread cracking or breakage)	Fold neck pattern in half and attach to body with 607 with cover stitching each side to cover raw edges
Pencil pocket assembly and attachment	Efd-1	
	Ssau-2 (Boxstitch)	Place inside arm sleeve per pattern placement and topstitch with 301
	Efa-2	Top pencil pocket – Topstitch with single 301
	LSb-2	Turn in 3 remaining sides and topstitch with double 301 and 1/4 inch gauge
	SSv-1	Stitch 1-3/8 inches from left pocket edge to create channels (see Figure 2)
Bartacks		Required at ends of all arm sleeve cuff joining seams
		Neck cuff seams - double bartack on hook tab (2), slide fastener ends (2), corners of bellow seams (2), openings of pencil pocket (3), and each side of IFF tab (2)

3.13.6.1 Stitches per inch. The flat seam stitches per inch shall be no less than 14 stitches and no more than 18 stitches and the lockstitch stitches per inch shall be 8-9 stitches with a tolerance of ± 2 stitches as specified in Tables X and XI.

3.13.6.2 Bartacks. No stitch run-off is allowed and no needle cutting by bartack. Double bartacks (one on top of the other) will be avoided to prevent needle cutting and weakening of the attachment point. Bartacks used shall be 1/4, 5/8, or 7/8 of an inch. The 1/4 inch bartacks will be placed across the bottom waist seam, on the neck seam, and sleeve cuff seam. The 5/8 inch bartacks will be used on the sleeve pockets and forearm pocket. 7/8 inch bartacks will be used on IFF cover and sleeve cuff tab.

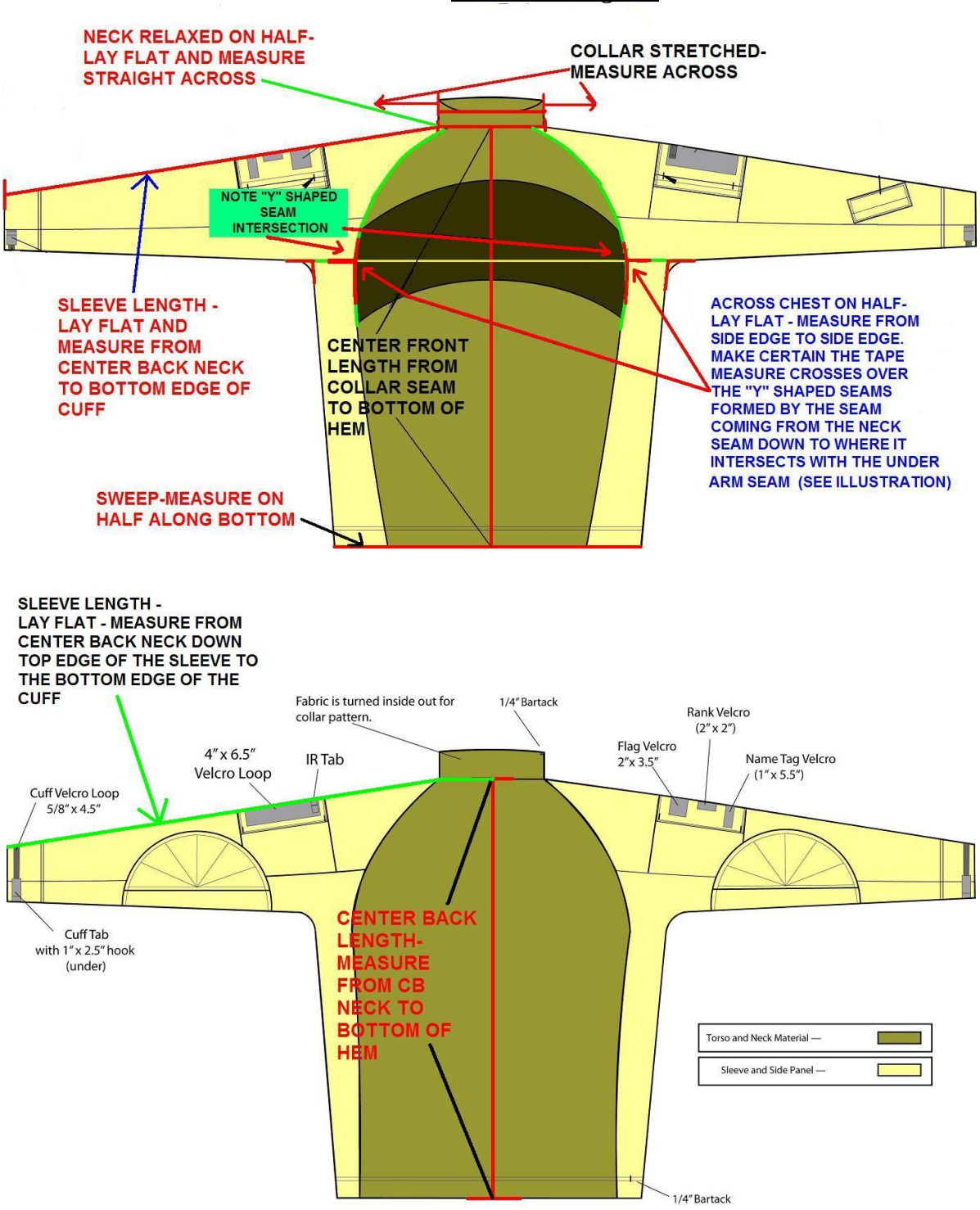
3.13.6.3 Repairs. Repairs such as mends, darns, patches, or splices shall not be permitted.

3.13.7 Finished measurements. The shirt shall conform to the finished measurements specified in Table IX, when measured as illustrated in Figure 2.

TABLE IX. Finished measurements (inches)

	X-Small	Small	Medium	Large	X-Large	XX-Large	XXX-Large	Tolerance
Sleeve Length – From center back collar to end of cuff	31-1/2	32-1/4	33	33-3/4	34-1/2	35-1/4	36	± 1/2
Chest Width - on Half, at Y seam – (See Figure 2)	18-1/2	19-1/2	20-1/2	21-1/2	22-1/2	23-1/2	25-1/2	± 1/2
Center Back Length - From below collar to end of hem	29	29-1/2	30	30-1/2	31	31-1/2	32	± 1/2
Center Front Length – From below collar to end of hem	24	24-1/2	25	25-1/2	26	26-1/2	27	± 1/2
Collar – minimum neck stretch on half	11-1/2	12	12	12	12	12	12	N/A
Neck Relaxed-On Half- Straight across at high point of shoulder (HPS) (See Figure 2)	7-1/2	7-3/4	8	8-1/4	8-1/2	8-3/4	9	± 1/2
Sweep- Measure on Half along Bottom	18	19	20	21	22	23	24	± 1/2

FIGURE 2. Measurement guide



3.14 Use of automated apparel equipment. Automated apparel equipment may be used to manufacture shirts to this purchase description, provided that the stitch and seam types are as specified and the finished components conform to the required configuration. When Government furnished patterns are provided, the components shall conform to the pattern.

3.15 Workmanship. After completion of the final assembly, the shirt shall be thoroughly cleaned and all threads, lint and foreign matter shall be removed. The shirt shall not contain any fabric defects. The shirts shall be uniform in quality and shall be free from irregularities or defects which could adversely affect performance, reliability or durability. The shirt shall conform to the quality of product established by this purchase description.

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. A first article, submitted in accordance with 3.1, shall be inspected, examined for appearance, color and finished defects as specified in 4.5 and tested for the characteristics as specified in 4.6.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.5 and the tests of 4.6.1 through 4.6.6 as specified in 6.2. Sampling for inspection shall be performed in accordance with ANSI/ASQ Z1.4 and with acceptance quality limits as specified in the contract and/or order, except where otherwise indicated (see 6.2).

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

4.5 Examination.

4.5.1 End item examination. The finished examination sample size, acceptance quality limits and acceptance criteria shall be specified in the solicitation or contract (see 6.2).

4.5.2 End item visual examination. Each shirt shall be subjected to visual examination. All defects shall be scored in accordance with Table X which are clearly noticeable at normal viewing and affect serviceability and appearance of the shirt. Material defects are defined in Section 1 of FED-STD-4. If needed, closer inspection will be performed to verify compliance to specification requirements. Shade shall be evaluated at a distance of 3 feet.

4.5.2.1 Visual shade matching. The color and appearance of the cloths shall match the standard sample using AATCC Evaluation Procedure 9, Option A or C, with sources simulating artificial daylight D75 illuminant with a color temperature of 7500 (± 200)°K illumination of 100 (± 20) foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2856 (± 200)°K.

NOTE: For Operation Enduring Freedom Camouflage Pattern all visual evaluations shall be performed on the solid color area and not the tonal area.

4.5.3 End item dimensional examination. The shirts shall be examined for conformance to the finished measurement requirements as specified in 3.13.7. Each size of shirt present in the lot shall be represented in the sample selected for this examination. When a measurement deviates from a dimension and tolerance specified, the shirt shall be scored as a defect (Major/Minor).

TABLE X. End item visual defects

Examination	Defect	Classification	
		Major	Minor
Material defects:	Any hole, cut, tear, smash, burn, needle chew, drill hole, exposed, scorched area, run, or open place		
	- up to 1/4-inch inclusive		201
	- more than 1/4-inch	101	
	Any knot greater than Sears scale level C or slub greater than Sears Scale Level D		202
	Broken and missing section of yarn, visible mend, thin place, or shade bar	102	
	Loose yarn or coarse yarn on outside or knit-in waste	103	
Shaded parts	Variation in shade on outside within a part or between parts, poor dye penetration, dye streak(except for the neck) as observed 3 ft away	104	
Cleanness	Any spot or stain on outside, visible at 3-feet	105	
	Thread ends not trimmed to 1/4-inch or less throughout (more than 3)		203
	Thread end caught for a distance of more than 1/4-inch in line of stitching on outside		204
	Two or more shade or size tickets or loose threads not removed		205
	Any size or shade marking or residue on outside, score as spot or stain		206
Component and assembly	Any component part or operation omitted (unless otherwise classified herein)	106	
	Any component not as specified	107	
	Any component part twisted, distorted, pleated, misshaped, tight or full (unless otherwise classified herein)		207
	Fullness creating unwanted permanent, fold, pleat, crease, in fabric or garment	108	
	Edge of any component part required to be forced out, having folds of more than 1/8-inch (unless otherwise classified herein)	109	
Cutting	Any component part not cut in accordance with specified pattern or directional line on patterns, or not in accordance with this document	110	

TABLE X. End item visual defects – Continued

Examination	Defect	Classification	
		Major	Minor
Stitching and seams	Seam irregular, twisted, pleated, or wavy	111	
	Seam puckered (score only when on major portion of seam)	112	
	Any part of shirt caught in an unrelated stitching (unless otherwise specified)		208
	End of stitching not back stitched or caught in other seams as required.	113	
	Thread break secured by stitching back of the break less than 1/2-inch		209
	End of continuous line of stitching overlapped less than 1/2-inch		210
	Gage of stitching and seam allowance irregular or not within range specified or varies more than 1/16-inch when no range is specified	114	
	Edge or raised stitching sewn too close to edge, resulting in damage to cloth	115	
	Seam allowance not as specified or varies more than 1/8-inch (score only when on major portion of seam)		211
	Open seam: (On all seams)		
	up to 1/2-inch inclusive		212
	more than 1/2-inch	116	
	NOTE: One or more broken stitches or two or more continuous skipped or run-off stitches on joining seam		
	On double-stitched seams, a seam is considered open when one or both sides of seam are open.		213
	Runoff on joining seam, (score as an open seam)		
	Raw edges:		
	On outside:		
	1/8 to 1/4-inch inclusive		214
	More than 1/4-inch	117	
	On inside:		
	More than 1/4-inch	118	
	On over-edged edge:		
	1-inch to 2-inches inclusive		215
	More than 2-inches	119	
	Stitch and seam type:		
	Not specified stitch and seam type	120	
	Any line of stitching omitted	121	
	Any line of stitching not beginning or ending where specified		216

TABLE X. End item visual defects – Continued

Examination	Defect	Classification	
		Major	Minor
Stitching and seams-Continued	Broken, missing, or skipped stitches on edge or raised stitching		
	1/2-inch inclusive		217
	More than 1/2-inch	122	
	Stitch tension:		
	Loose tension resulting in a loose seam:		
	up to 1/2-inch		218
	More than 1/2-inch	123	
	Loose tension on raised or edged stitching resulting in exposed loose thread		219
	Tight tension (stitches break when normal strain is applied in the direction of the seam or stitching)	124	
	All other seams		
	Stitches per inch (to be scored only when the condition exists on the major portion of seam or stitching) **(**exclusive of overedge stitching):		
	Less than the minimum		220
	More than the maximum	125	
	Overedge stitching, two or more stitches less than specified		221
Bartacks or tacks	Missing, insecure, misplaced, not specified size or type, not serving intended purpose	126	
	Loose stitch tension		222
Neck	Tight at joining to neck, causing puckers or pleats on front or back	127	
Pockets	Construction and position		
	Pocket construction or position not as specified	128	
	Edges of pocket pleated or twisted in stitching		223
	Raw edge of pocket hems not turned in		224
	Pocket flap tight, causing fullness, twisting or curling of pocket flap		225
	Pocket flap not completely covering slide fastener		226
	Pockets set on crookedly, or poorly shaped		227
	Pockets out of alignment by more than 1/4 inch		228
	Pencil pocket channels vary more than 1/8 inch in width		229

TABLE X. End item visual defects – Continued

Examination	Defect	Classification	
		Major	Major
Sleeves	Sleeves reversed (i.e., right sleeve in left armhole, left sleeve in right armhole)	129	
	Sleeve puckered or pleated at joining to armhole		230
	Sleeve tight at armhole, causing puckers, or pleats on fronts or back at armhole seam		231
	Sleeve back arm seams unequal distance from shoulder seams by more than 3/4 inch	130	
	Bottom edges of top and under sleeve not aligned at bottom by more than 1/8 inch if alternate hemming is used		232
	Sleeve lengths vary by more than 3/4 inch	131	
	Cuff and cuff tab out of alignment with bottom folded edge of sleeve hem by more than 1/8 inch		233
Slide fastener	Any part of side fastener bent, broken, distorted, damaged, or other wise defected	132	
	Not closing as specified	133	
	Length not as specified, wrong style or type	134	
	Color not as specified		234
	Thong omitted or not as specified		235
	Not located correctly on shirt		236
Labels	Missing , incorrect, or illegible	135	
	Not positioned as specified		
	More than 1-inch off center		237
	Bar code label tag(if applicable):		
	Bar code omitted or not readable by scanner	136	
	Human readable interpretation (HRI) omitted or illegible	137	
	Not visible on packaged item		238
	Causes damage to item	138	
IFF material	Not specified material or missing	139	
	Cover:		
	Not able to cover IFF tab	140	
Loop for name tape patch, rank patch and American flag patch	Not specified size		239
	Not specified location		240
Elbow patches	Not attached as specified	141	
	Abrasion dots missing	142	
	Missing elbow foam	143	

TABLE X. End item visual defects – Continued

Examination	Defect	Classification	
		Major	Major
Bottom hem	Stitching across ends of hem omitted or insecure	144	
	Twisted, puckered, pleated, wavy or distorted	145	
	Width less than 3/8-inch or more than 3/4-inch		241
	Irregular in width by 1/4-inch or more		242
Tape, hook and loop fastener	Not material specified (color and type)	146	
	Misplaced or not located as specified on patterns	147	
	Not serving intended purpose	148	
	Missing	149	
	Cut length/width not within tolerance	150	
	Damaged, twisted or distorted when closed.	151	
	Out of alignment causing a bulge or more than 1/4 inch	152	
Packaging	Any shirt not packaged in accordance with contract or purchase order		243

4.6 Component and end item testing. Components and end items shall be tested for the characteristics listed in Table XI. The methods of testing as specified wherever applicable and as listed in Table XI shall be followed. All test reports shall contain the individual values utilized in expressing the final results. Unless otherwise noted, each lot of component material must be tested, and the lot shall be unacceptable of one or more sample units fail to meet any requirements specified. The number of samples tested per lot shall be in accordance with Table XII, unless otherwise noted.

TABLE XI. Component and end item testing (as specified)

Characteristic	Requirement reference	Item tested	Test method
Component testing			
Cloth:			
Elbow pad abrasion dots	3.4.2	Component	ASTM D 3884 (H-18 wheel 500 gram load)
Visual shade matching	3.5.2	Component	AATCC Evaluation Procedure 9, Option A or C, 4.5.2.1
Colorfastness: (all cloths for neck and torso, side and sleeve panel, and modesty panel)	3.5.3		
• Light (after 40 hours or 170 KJ)	Table I	Component	AATCC 16 Opt 1 or 3
• Laundering (after 4 cycles)	Table I	Component	AATCC 61 Test 2A
• Crocking (Wet and Dry)	Table I	Component	AATCC 8

TABLE XI. Component and end item testing (as specified) - Continued

Characteristic	Requirement reference	Item tested	Test method
Component testing continued			
Colorfastness (continued): • Perspiration (acid & alkaline)	Table I	Component	AATCC 15
Spectral reflectance: 1/ • Sleeve and side panel • Neck/torso and modesty panel	3.7 Table II, Table III	 Component Component	 4.6.1 and 4.6.1.1 4.6.1
Weight	3.8,Table IV	Component	ASTM D 3776
Bursting strength	3.8,Table IV	Component	ASTM D 3787
Air permeability	3.8,Table IV	Component	ASTM D 737
Wicking	3.8,Table IV	Component	4.6.2
Stretch & Recovery	3.8,Table IV	Component	ASTM D 2594, 4.6.5
Pilling	3.8,Table IV	Component	ASTM D 3512
Dimensional stability (after 5 cycles)	3.8,Table IV	Component	AATCC 135: 1, V, Ai
Flame resistance (All basic fabrics) Afterflame Afterglow Char Length	3.9 Table V Table V Table V	 Component Component Component	 ASTM D 6413 ASTM D 6413 ASTM D 6413
Flame resistance (see 3.4.2) (Abrasion dot fabric) Afterflame Afterglow Char length	 Table V Table V Table V	 Component Component Component	 ASTM D 6413, 4.6.4 ASTM D 6413, 4.6.4 ASTM D 6413, 4.6.4
pH 2/	3.10	Component	AATCC 81
Toxicity 3/	3.11	Component	4.6.3
Antimicrobial properties 2/	3.12	Component	AATCC 100
Foam: 2/	(see 3.13.2.4)		
Density	Table VI	Component	ASTM D 3575
Tensile strength	Table VI	Component	ASTM D 412 (DIE A)
Compression deflection (@25%)	Table VI	Component	ASTM D 1056
Water absorption	Table VI	Component	ASTM D 1056
Elongation	Table VI	Component	ASTM D 412 (DIE A)

TABLE XI. Component and end item testing (as specified) - Continued

Characteristic	Requirement reference	Item tested	Test method
Component testing continued			
Thread			
Colorfastness to laundering, accelerated	3.13.2.6	Component	AATCC 61, 2A (4 cycles)
End item testing			
Garments			
Flame resistance (entire garment) 2/	3.9.2	End item	ASTM F 1930 (4 second exposure), 4.6.6
Design and construction			
Seaming	Table VIII 3.13.6	End item	ASTM D 6193
Stitch count	3.13.6.1	End item	ASTM D 6193

1/ For Operation Enduring Freedom Camouflage Pattern- all spectral reflectance evaluations shall be performed on the solid color area and not the tonal area.
2/ Tested during first article inspection only.
3/ If the toxicity requirement (see 3.11) can be demonstrated with historical data testing may not be required (see 6.2).

TABLE XII. Lot Sampling Requirements

Lot Size (yards)	Sample Size (sample units)
800 or below	2
801 – 10,000	3
10,001 – 20,000	4
20,001 and above	5

4.6.1 Spectral reflectance (camouflage patterns and solids). Spectral reflectance data shall be obtained from 600 to 860 nanometers (nm) at 20 nm intervals on a spectrophotometer relative to the 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 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 layers of the same 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 different areas. Specimens shall be oriented in different directions during testing. When possible, the specimens tested shall not contain the same wales or courses when presented to the sample port. Photometric accuracy of the

spectrophotometer shall be within 1 percent and wavelength accuracy within 2 nm. The diameter for standard aperture size used in the color measurement device shall be 1.0 to 1.25 inches for solid color Foliage Green 504 for Class 1 and Tan 499 for Class 2, unless other solid color is stated in contract or procuring documents and 0.3725 inches or larger for the Universal Camouflage Pattern, Class 1, Operation Enduring Freedom Camouflage Pattern Class 2 or other camouflage patterns as specified in the contract or procuring documents (see 6.2). Any color having spectral reflectance values falling outside the limits at four or more of the wavelengths specified shall be considered a test failure.

4.6.1.1 Spectral reflectance (Camouflage patterns). The spectral reflectance of other camouflage patterns shall be a specified in the contract or procuring activity.

4.6.2 Wicking. Wicking data will be collected using the following procedure. A sample size of 6 inch by 1 inch will be cut with the 6 inch cut measured in the wale direction. A 500 ml Erlenmeyer flask shall be filled with 200 ml of colored water (food coloring used shall be a contrasting color to the cloth material to make the water level visible on the sample). The top edge of the sample will be pierced with a long straight pin and the sample then suspended from the top of the flask. After 1 minute remove the sample from the flask and measure water level on sample in inches and record. Return sample to the flask. Repeat the following measurement at 3 minutes, 5 minutes and each 5 minute interval until the water level reaches 6 inch or 1 hour has elapsed. Values are reported as inches per hour. A minimum of 3 samples shall be tested with the average value reported along with each individual measurement.

4.6.3 Toxicity test. When required (see 6.2), an acute dermal irritation study and a skin sensitization study shall be conducted on laboratory animals. When the results of these studies indicate the shirt 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 3.11) can be demonstrated with historical use data, toxicity testing may not be required (see 6.2).

4.6.4 Abrasion dot flame resistance testing. The material shall be tested in accordance with ASTM D 6413. Any form of melt drip during the ASTM D 6413 test constitutes a failure.

4.6.5 Stretch and recovery testing. Stretch data shall be collected using the test method outlined in ASTM D2594, Section 10.4, for loose fitting apparel fabrics (0-5 lbf cycling). Fabric stretch, percent, shall be calculated as outlined in Section 11.1.1, Equation 3. Recovery, percent, shall be calculated as follows:

$$\text{Fabric recovery, \%} = 100 \times (A - (C - A)) / A$$

Where:

A = original distance between bench marks prior to tension force application

C = distance between bench marks following one (1) hour recovery after tension is released from the specimen.

4.6.6 Garment flame resistance testing. Finished shirts shall be tested as specified in ASTM F 1930 using a 4 second flame exposure. For testing, the instrumented manikin shall be dressed in 100 percent cotton tee shirt and briefs and flame resistant trousers provided by U.S. Army Natick Research, Development and Engineering Center as well as the shirts to be tested. Predicted percent body burn results shall be calculated with the assumption that sensors covered by the plate carrier armor show zero burn readings, and head/neck sensors shall not be considered. Average predicted body burn for six samples shall not exceed 35 percent.

5. PACKAGING.

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

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 shirt is for wear by military personnel in the United States Army as a modular combat uniform shirt to be worn with the Outer Tactical Vest during combat operations.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this document.
b. Class and sizes required (see 1.2)
c. The specific issue of individual documents referenced (see 2.1 - 2.3)
d. When first article sample is required (see 3.1, 4.2, 6.3)
e. Color required (3.4.1.1, 3.4.1.2, 3.4.1.3)
f. Camouflage pattern drawing (as applicable) (see 3.6)
g. When barcoding (if applicable) is required (see 3.13.2.7)
h. Conformance inspection acceptance quality limits (see 4.3)
i. Inspection Conditions (see 4.4 & 4.5)
j. When toxicity testing is required (see 4.6.3)
k. Packaging requirements (see 5.1)

6.3 First article. When a first article inspection is required (see 3.1), it will be inspected and approved under the appropriate provisions of FAR 52.209-4. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

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

6.5 Known material sources.

6.5.1 IFF material. (As listed below or equal)
- a. Night Vision Systems, a DRS Technologies Company, P.O. Box 219, Fogelsville, PA 18104
- b. Omniglow Corporation, 96 Windsor Street, West Springfield, MA 01089,
- c. TVI Corporation, 7100 Holladay Tyler Road, Glenn Dale, MD 20769, (301) 352-8800 ext. 245

6.5.2 Tape, hook and loop. (As listed below or equal)
- a. Velcro USA, Inc. 406 Brown Avenue, Manchester, NH 03103
- b. YKK USA, Inc. c/o Diversified Marketing Group, Inc. 109 Forrest Avenue, Narberth, PA 19072, (610)-667-5589

6.5.3 Fabrics. (As listed below or equal)
- a. Massif Mountain Gear Company, LLC, 498 Oak Street, Ashland, OR 97520, (541) 488-0801

6.5.4 Foam. (As listed below or equal)
- a. Rubberlite Inc., 2501 Guyan Avenue, Huntington, WV 25703 (304)-525-3116
- b. Rogers Foam Corp., 120 Clarence Drive, Mt. Sterling, KY 40353, (859)-497-0702

6.5.5 Abrasion dots. (As listed below or equal)
- a. HDM Inc., 570 Hale Avenue, Oakdale, MN 55128 (651) 730-6203 or (866) 730-6200.

6.5.6 Slide fastener (zipper). (As listed below or equal)
- a. YKK USA, Inc. c/o Diversified Marketing Group, Inc. 109 Forrest Avenue, Narberth, PA 19072 , (610)-667-5589

6.6 Operation Enduring Freedom Camouflage Pattern (OCP). Operation Enduring Freedom Camouflage Pattern (OCP) has previously been referred to as MultiCam® Camouflage pattern.

6.7 Subject term keyword listing:

Camouflage clothing
Fire retardant
Operation Enduring Freedom Camouflage Pattern (OCP)
Universal Camouflage Pattern (UCP)

FIGURE 3. Shirt, combat flame resistant- front view

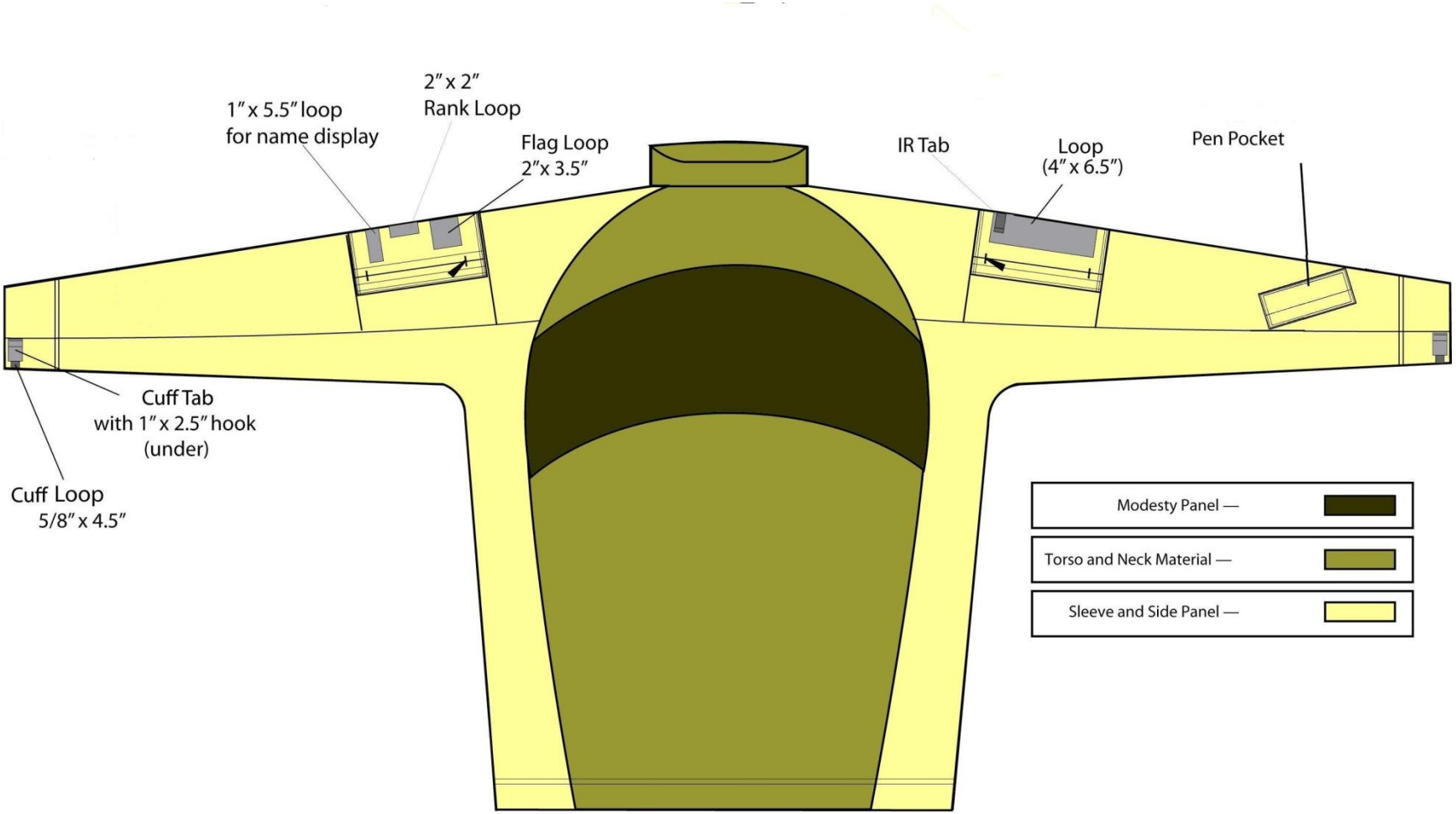
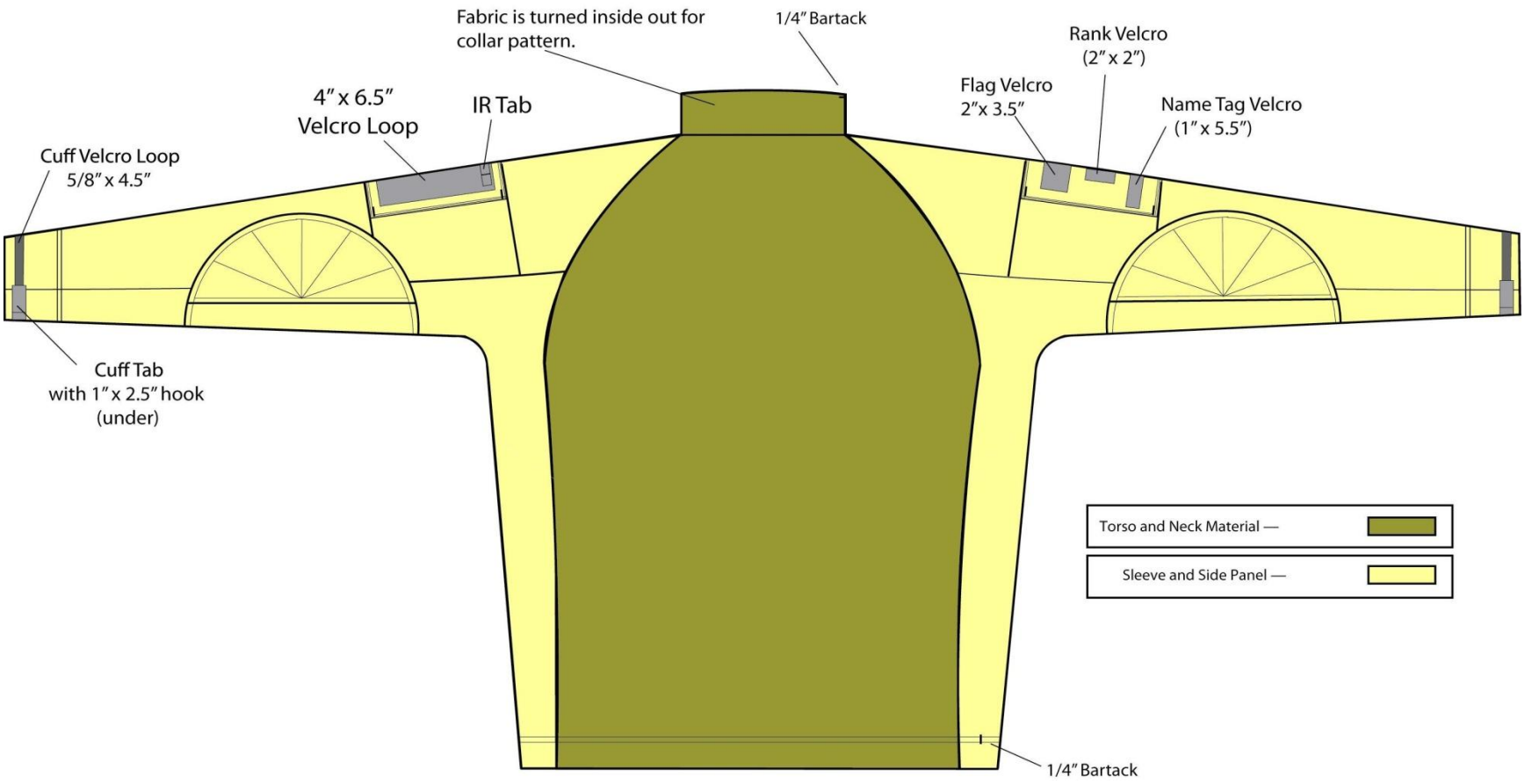


FIGURE 4. Shirt, combat flame resistant- back view



Custodian:
Army-GL

Preparing Activity:
Army - GL