

INCH - POUND
GL-PD-07-12, Rev. 2
15 August 2007
SUPERSEDING
GL-PD-07-12
6 April 2007

PURCHASE DESCRIPTION

CLOTH, FLAME RESISTANT

1. SCOPE

1.1 Scope. This purchase description covers one type of flame resistant, Universal Camouflage pattern, ripstop woven cloth for use in the flame resistant clothing.

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 of 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 cited in the solicitation or contract (see 6.2).

FEDERAL STANDARDS

FED-STD-4 - Glossary of Fabric Imperfections

COMMERCIAL ITEM DESCRIPTIONS

A-A-55217 - Thread, Aramid, Spun Staple

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings and publications. The following other Government documents, drawings and publications form a part of this document to the extent

specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract.

U.S. ARMY NATICK SOLDIER CENTER

DRAWINGS

2-1-2519 – Universal Camouflage Pattern

(Copies of drawings are available through <http://warfighter.dla.mil> under tab “Vendor Info” then “Specifications/Pattern Request”)

CODE OF FEDERAL REGULATIONS

16 CFR Part 1500 – Federal Hazardous Substances Act Regulations
29 CFR Part 1910 – Occupational Safety and Health Standards

(Copies are available online at www.access.gpo.gov or from U.S. Government Printing Office 732 North Capitol Street NW, Washington, DC 20401.)

FEDERAL TRADE COMMISSION

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies are available online at www.ftc.gov or from the Federal Trade Commission, 600 Pennsylvania Avenue, N.W., Washington, DC 20580-0001.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.X).

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 20 - Fiber Analysis: Qualitative
- AATCC Test Method 20A - Fiber Analysis: Quantitative
- AATCC Test Method 61 - Colorfastness to Laundering, Home and Commercial, Accelerated
- AATCC Test Method 81 - pH of the Water-Extract from Bleached Textiles
- AATCC Test Method 135 - Dimensional Changes of Fabrics after Home Laundering
- AATCC Test Method 143 - Fabric Appearance/Smoothness
- AATCC Evaluation Procedure 1 - Gray Scale for Color Change
- AATCC Evaluation Procedure 2 - Gray Scale for Staining
- AATCC Evaluation Procedure 8 - AATCC 9-Step Chromatic Transference Scale

AATCC Evaluation Procedure 9 - Visual Assessment of Color Difference of Textiles
AATCC Smoothness and Appearance Replicas

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

ASTM INTERNATIONAL

- ASTM D-737 - Standard Test Methods for Air Permeability of Textile Fabrics
- ASTM D-1424 - Standard Test Methods for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
- ASTM D-1683 - Standard Test Methods for Failure in Sewn Seams of Woven Apparel Fabrics
- ASTM D-3775 - Standard Test Methods for Warp End Count and Filling Pick Count of Woven Fabric
- ASTM D-3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
- ASTM D-5034 - Standard Test Methods for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
- ASTM D-6413 - Standard Test Methods for Flame Resistance of Textiles (Vertical Test)

(Copies of documents are available online at www.astm.org or from the ASTM INTERNATIONAL, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

NATIONAL FIRE PROTECTION ASSOCIATION

- NFPA 1971 - Standard Protective Ensemble for Structural Fire Fighting

(Copies of this document are available online at <http://www.nfpa.org> or National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.)

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 .)

(Copies of documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.4 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 in accordance with 4.2.

3.2 Standard sample. The finished cloth 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 Fiber Content. The warp and filling yarns shall be made using a fiber blend of flame resistant rayon, para-aramid, and nylon in a blend ratio of 65/25/10 percent by weight. The fibers shall be made of virgin material and the use of recycled or recovered materials is prohibited.

3.4 Weave. The weave shall be plain weave with reinforcement ribs in both the warp and filling directions. The ribs should be formed by having every twentieth warp end contain two ends weaving as one and every fifteenth filling pick contain two picks weaving as one. Testing shall be as specified in 4.6.

3.5 Finish. The cloth shall be given a wrinkle free finish to match the “hand” crispness, fabric appearance and smoothness of the guide sample provided.

3.6 Color

3.6.1 Universal Camouflage Pattern. The cloth shall be dyed to a ground shade either matching or approximating Desert Sand 500 and then overprinting with the camouflage pattern. When the ground shade is dyed to match Desert Sand 500, the remaining colors shall be obtained by overprinting 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 overprinting of all three colors of the pattern. Resin bonded pigments are not permitted.

3.6.2 Visual shade matching. The color and appearance of the cloth shall match the standard sample when viewed using the AATCC Evaluation Procedure 9, Option A, with sources simulating artificial daylight D75 illuminant with a color temperature of 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.

3.6.3 Colorfastness. The finished cloth shall conform to the colorfastness requirements listed below in Table I, when tested as specified in 4.6.

TABLE I. Colorfastness requirements.

	Laundering (4 cycles) 1/ (min.)	Light (40 hrs or 170 KJ) 2/ (min.)	Perspiration (acid & alkaline) 1/ (min.)	Crocking 3/ (min.)
All colors	3-4	3	3	3.0

1/ Rated using the AATCC Evaluation Procedure 1, Gray Scale for Color Change and AATCC Evaluation Procedure 2, Gray Scale for Staining.

2/ Rated using the AATCC Evaluation Procedure 1, Gray Scale for Color Change

3/ Rated using the AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale

3.7 Pattern execution, Universal Camouflage. The Universal Camouflage pattern shall reproduce the standard sample in respect to design, colors and registration of the respective areas. The pattern repeat of the dyed, printed, and finished cloth shall be 36.00 inches (+1.25 inches, -2.50 inches) in the warp direction. The various areas of the pattern shall be properly registered in relation to each other and shall present definite sharp demarcations with a minimum of feathering or spew. Each pattern area shall show solid coverage; skitteriness exceeding that shown by the standard sample in any of the printed areas shall not be acceptable. When the standard sample is not referenced for pattern execution or design, a pattern drawing shall be provided, and the pattern on the finished cloth shall match that of Drawing 2-1-2519.

3.8 Spectral reflectance, Universal Camouflage. The spectral reflectance of the colors in the Universal Camouflage cloth shall conform to the requirements specified in Table II when tested as specified in 4.7.1.

TABLE II. Spectral Reflectance Requirements: Reflectance (percent).

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

3.9 Physical requirements. The finished cloth shall conform to the requirements, listed below, in Table III, when tested as specified in 4.6.

TABLE III. Physical requirements

Characteristic	Requirement
Weight, oz./sq.yd.	
Minimum	5.5
Maximum	8.5
Yarns per inch, (minimum)	
Warp	70
Filling	60
Breaking strength, pounds (minimum)	
Warp	100
Filling	80
Tearing strength, pounds (minimum)	
Warp	4.0
Filling	4.0
Air permeability, cu.ft./min./sq.ft. (minimum)	10.0
Flame Resistance:	
Initial -	
After Flame, seconds (maximum)	2.0
After Glow, seconds (maximum)	25.0
Char Length, inches (maximum)	4.5
After laundering -	
After Flame, seconds (maximum)	2.0
After Glow, seconds (maximum)	25.0
Char Length, inches (maximum)	4.5
Thermal Shrinkage Resistance, percent (maximum):	
Initial	10
After laundering (25 cycles)	10
Fabric Appearance/Smoothness, rating (minimum)	
Initial	5
After laundering (20 cycles)	4
Seam Efficiency, percent (minimum)	80

3.10 Fabric break open. The flame from a Meker burner shall not pass from the flame contact side to the other side of the fabric due to the fabric breaking open, when tested as specified in 4.7.2.

3.11 pH. The pH of the water extract of the finished cloth shall be no less than 5.0 nor more than 8.5, when tested as specified in 4.6

3.12 Dimensional stability. The shrinkage or elongation both in the warp and filling of the finished cloth shall not be greater than 5.5 percent for the individual sample unit and not greater than 5.0 for the lot average, when tested as specified in 4.6.

3.13 Toxicity. The finished cloth shall not present a health hazard and shall show compatibility with prolonged, direct skin contact when tested as specified in 4.7.3. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.14 Width. For Government procurements only, the width of the finished cloth shall be as specified (see 6.2) and shall be the minimum acceptable width inclusive of the selva.

3.15 Length and put-up. For Government procurements only, unless otherwise specified (see 6.2), the cloth shall be furnished in continuous lengths, each not less than 40 yards. Each length shall be put-up full width on a roll as specified in 5. 1.

3.16 Fiber identification. Each roll of finished cloth shall be labeled or ticketed for fiber content in accordance with the Rules and Regulations under the Textile Fiber Products Identification Act.

3.17 Workmanship. The finished cloth shall conform to the quality of product established by this specification. The demerit points per 100 square yards when calculated as specified in Section 4 shall not exceed the applicable established maximum point values.

4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. A first article, submitted in accordance with 3.1, shall be inspected, examined for appearance, color and finished defects and tested for the characteristics as specified in Table IV.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.5 and the tests of 4.6 through 4.7.3, as applicable. Sampling for inspection shall be performed in accordance with ANSI/ASQ Z1.4 and with quality acceptance 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. Each roll in the sample shall be examined yard-by-yard on the printed side only. When the total yardage in the roll does not exceed 100 yards the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects, as defined in section I of FED-STD-4, that are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.5.1 except that only those slubs and knots which exceed the limits shown on the Sears Fabric Defect Scale (See 6.5), "D" or "3-1/2" as applicable for slubs and "C" for knots, shall be scored and coarse yarn shall only be scored as a defect when the coarse yarn is twice the diameter of the normal yarn used in the fabric. No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll shall be penalized more than four points. The sample size shall be 20 rolls selected from 20 containers. The lot shall be unacceptable if the points per 100 square yards examined exceeds 30.0 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 45.0 points. If one roll in the sample exceeds 45.0 per 100 square yards, a second sample of 20 rolls shall be examined for individual roll quality only. The lot shall be unacceptable if one or more rolls in the second sample exceeds 45.0 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

$$\text{Points per 100 square yards} = \frac{\text{Total points scored in sample} \times 3600}{\text{Total yards inspected} \times \text{Contracted width of cloth (inches)}}$$

4.5.1 Demerit points. Demerit points shall be assigned as follows:

For defects up to 3 inches in any dimension	- one point
For defects exceeding 3 inches, but not exceeding 6 inches in any dimension	- two points
For defects exceeding 6 inches, but not exceeding 9 inches in any dimension	- three points
For defects exceeding 9 inches in any dimension	- four points

The following defects, when present, shall be scored four points for each yard in which they occur:

- Objectionable odor
- Baggy, ridgy, or wavy cloth
- Overall uncleanness
- Uneven weaving throughout
- Pattern design not equal to the standard sample
- Incorrect color in any part of the pattern
- Pattern repeat not equal to the standard sample
- Pattern repeat less than 33.50 inches or more than 37.25 inches
- Skitteriness (mottled, uneven color) of pattern exceeds that shown by the standard sample
- Excessive feathering or spew (fuzziness at color boundaries) of pattern as compared to the standard sample
- Excessive grinning (off register, gap where ground shade shows through) of pattern as compared to the standard sample

Excessive haloing or trapping (overlapping of colors) of pattern as compared to standard sample

* 4.6 End item testing. The cloth shall be tested for the characteristics listed in Table IV. The methods of testing as specified wherever applicable and as listed in Table IV shall be followed. All test reports shall contain the individual values utilized in expressing the final results. The sample unit shall be 5 continuous yards full width of the finished cloth for all physical and chemical tests. The lot shall be unacceptable if one or more sample units or the lot average for dimensional stability fail to meet any requirement specified. The sample size shall be in accordance with the following:

<u>Lot size (yards)</u>	<u>Sample size (sample units)</u>
800 or less	2
801 up to and including 22,000	3
22,001 and over	5

TABLE IV. End item tests

Characteristic	Requirement Reference	Test Method
Fiber Identification	3.3	AATCC-20
Fiber Content	3.3	AATCC-20A
Weave	3.4	Visual
Visual shade matching	3.6	AATCC Evaluation Procedure 9, Option A
Colorfastness to: Laundering (after 4 cycles) Light (after 40 hrs or 170 kilojoules) Perspiration (acid & alkaline) Crocking	Table I Table I Table I Table I	AATCC-61, Test 2A <u>1/</u> <u>2/</u> AATCC-16, Options 1 or 3 <u>2/</u> AATCC-15 <u>2/</u> AATCC-8 <u>2/</u>
Spectral reflectance	Table II	4.7.1
Weight	Table III	ASTM D-3776 (Method C)
Yarns per Inch	Table III	ASTM D-3775
Breaking Strength	Table III	ASTM D-5034 (G-E or G-T)
Tearing Strength	Table III	ASTM D-1424
Air Permeability	Table III	ASTM D-737
Flame Resistance		
Initial	Table III	ASTM D-6413
After laundering (25 cycles)	Table III	AATCC-135, 3, V, Aiii and ASTM D-6413
Fabric Break Open	3.10	4.7.2
Thermal Shrinkage Resistance: Initial After laundering (25 cycles)	Table III Table III	NFPA 1971 AATCC-135, 3, V, Aiii and NFPA 1971

TABLE IV. End item tests (Continued)

Characteristic	Requirement Reference	Test Method
Fabric Appearance/Smoothness: Initial	Table III	AATCC-143
After laundering (20 cycles)	Table III	AATCC-135, 3, V, Aiii and AATCC-143
Seam efficiency	Table III	ASTM D-1683 <u>3/</u>
pH	3.11	AATCC-81
Dimensional stability (after 5 cycles)	3.12	AATCC-135, 3, V, Aiii
Toxicity	3.13	4.7.3

1/ Only the stain on the nylon and cotton fibers of the color transfer cloth shall be evaluated.

2/ When testing for colorfastness properties, each color shall be evaluated, whenever possible, separately and reported as such. In cases where the print pattern does not allow for the evaluation of each color separately, the test results should indicated which colors were evaluated together.

3/ The needle shall measure 0.040 ± 0.001 inch across the blade at the eye. Reference ASTM D-1683, except use seam type LSc-2 with Flame Resistant threads A-A-55217, Thread, Aramid, Spun Staple, Tex 50-60, 3-ply for needles and Tex 35-40 for loopers.

4.7 Methods of inspection.

4.7.1 Spectral reflectance test. Spectral reflectance data shall be obtained from 600 to 860 nanometers (nm) at 20 nm intervals on a spectrophotometer relative to the 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 fabric and shade. The specimen shall be viewed at an angle no greater than 10° from normal, with the specular component included. Measurements shall be taken on a minimum of two different areas. Specimens shall be oriented in different directions during testing. When possible, the specimens tested shall not contain the same warp or filling yarns 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 0.3725 inches. Any color having spectral reflectance values falling outside the limits at four or more of the wavelengths specified shall be considered a test failure.

4.7.2 Fabric Break Open. The specimen shall be rigidly held in a horizontal position between two metal plates with a 6-inch diameter fabric exposure. One side of the fabric shall be exposed to a Meker burner in the center at a 90 degree angle using natural gas for 30 seconds with a 2-

inch distance between fabric and burner top. Proper flame adjustment shall be accomplished by setting the needle valve at the midpoint between the open and closed positions and adjusting the gas by means of flow meter to 2 liters per minute.

4.7.3 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 cloth 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 3.13) can be demonstrated with historical use data, toxicity testing may not be required (see 6.2).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When 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 cloth is intended for use in flame resistant, camouflage clothing.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. The specific issue of individual documents referenced (see 2.2).
- c. When first article is required (see 3.1, 4.2, 6.3).
- d. Universal Camouflage pattern drawing, if required (see 3.7).
- e. Width of cloth required (see 3.14).
- f. Length required if other than specified (see 3.15).
- g. Conformance inspection quality acceptance limits (see 4.3)
- i. Inspection conditions (see 4.4)
- j. Toxicity Requirements (see 4.13)
- k. Packaging (see 5.1).

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

instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

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

6.5 Fabric defect scales. Fabric Defect Replica Kits are available from Sears Roebuck and Company, 3333 Beverly Road, Dept 871HG,FC568B, Hoffman Estates, Il 60179. For information call (847) 286-8952.

6.6 Changes from previous issue. Asterisks (*) are used as marginal notations in this revision to identify changes with respect to the previous issue.

6.7 Subject term (key word) listing.

Cloth, Flame Retardant
Cloth, Printed
Camouflage
Universal Camouflage
Clothing, Flame Retardant

Custodian:
Army – GL

Preparing activity:
Army - GL

Review activities:

Project 8305-XXXX