

INCH-POUND

MIL-DTL- 32231
15 NOVEMBER 2006DETAIL SPECIFICATION FOR
CLOTH, POLYESTER/COTTON

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

1. SCOPE.

1.1 Scope. This specification covers the requirements for a polyester/cotton herringbone cloth treated with durable press and soil release finishes.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in Sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in Sections 3 and 4 of this specification whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

FEDERAL STANDARDS

FED-STD-4 - Glossary of Fabric Imperfections

COMMERCIAL ITEMS DESCRIPTIONS

A-A-50199 - Thread, Polyester Core, Cotton or Polyester Covered

(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.)

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center Philadelphia, Clothing and Textiles Directorate, ATTN: DSCP Standardization Team, 700 Robbins Avenue, Philadelphia, PA 19111-5092. Since contact information can change, you may want to verify the currency of the address information using Acquisition Streamlining and Standardization Information Systems (ASSIST) online database <http://assist.daps.dla.mil/>.

MIL-DTL-32231

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.

FEDERAL TRADE COMMISSION

16CFR Part 303 - 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.)

(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.)

2.3 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 6.2).

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC-8	-	Colorfastness to Crocking: AATCC Crockmeter Method
AATCC-15	-	Colorfastness to Perspiration
AATCC-16	-	Colorfastness to Light
AATCC-20	-	Fiber Analysis: Qualitative
AATCC-20A	-	Fiber Analysis: Quantative
AATCC-61	-	Colorfastness to Laundering, Home and Commercial: Accelerated
AATCC-81	-	pH of the Water-Extract from Bleached Textiles
AATCC-117	-	Colorfastness to Dry Heat (Excluding Pressing)
AATCC-124	-	Appearance of Fabrics after Repeated Home Launderings
AATCC-130	-	Soil Release; Oily Stain Release Method
AATCC-135	-	Dimensional Change 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, AATCC 9-Step Chromatic Transference Scale Rating		
AATCC Evaluation Procedure 9, Visual Assessment of Color Difference of Textiles		
AATCC Stain Release Replicas		

(Copies of documents are available for purchase 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.)

AMERICAN SOCIETY FOR QUALITY

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

(Copies are available for purchase 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	-	Identification of Fibers in Textiles
------------	---	--------------------------------------

MIL-DTL-32231

ASTM-D-629	-	Quantitative Analysis of Textiles
ASTM-D-1424	-	Tear Resistance of Woven Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
ASTM D 1683	-	Failure in Seams of Woven Fabrics
ASTM-D-3511	-	Pilling Resistance and Other Related Surfaces Changes of Textile Fabrics – Brush Pilling Tester Method
ASTM-D-3775	-	Fabric Count of Woven Fabric
ASTM-D-3776	-	Mass Per Unit Area (Weight) of Fabric, Option C
ASTM-D-5034	-	Breaking Force and Elongation of Textile Fabrics (Grab Test) G-E or GT
ASTM Photographic Rating Standard		

(Copies of documents are available for purchase on line at www.astm.org or from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19426-2959.)

OTHER PUBLICATIONS

Repeat Insult Patch Test – Modified Draize Procedure - Principles and Methods of Toxicology (4th Edition), A. Wallace Hayes (editor) pp 1057-1060, 2001

(Copies are available from Taylor and Francis, Philadelphia, PA or <http://www.taylorandfrancis.co.uk/>.)

(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 (see 4.2 and 6.3).

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 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 Fiber content.

3.3.1.1 Polyester. The fiber shall be an environmentally acceptable polyethylene terephthalate.

3.3.1.2 Cotton. The cotton shall be carded and combed.

3.3.2 Yarns. All yarns shall be a blend of polyester and cotton, drawn and spun into single

MIL-DTL-32231

yarns for both the warp and filling. The finished cloth shall contain 65 ± 5 percent polyester with the remaining percentage cotton, based on the dry weight of the desized specimen, when tested as specified in 4.4.5.

3.4 Color. The color of the dyed and finished cloth shall be Army Gray 510 and shall match the standard sample.

3.4.1 Labile sulfur. Dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid shall not be used. The dyestuff shall be chosen and applied so that they dyed and finished cloth shall contain no more labile sulfur than shown by the standard sample. When a standard sample is not available, the dyed and finished cloth shall show no more than a slight trace of labile sulfur when tested as specified in 4.4.5.

3.4.2 Visual shade matching. The color and appearance of the finished cloth shall match the standard sample when viewed using AATCC Evaluation Procedure 9, with source simulating artificial daylight D75 illuminant with a color temperature of $7500 \pm 200^{\circ}\text{K}$ illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at $2856 \pm 200^{\circ}\text{K}$, when tested as specified in 4.4.5.

3.4.3 Colorfastness. The finished cloth shall conform to the colorfastness requirements specified in Table I, when tested as specified in 4.4.5.

Table I. Colorfastness requirements.

Color Evaluation	Laundering (3 cycles) (min) <u>1/</u>	Light (40 hours or 170 KJ (min) <u>2/</u>	Perspiration (acid and alkaline) (min) <u>1/</u>	Crocking (min) <u>3/</u>
Gray 510	3.0	3.0	3.0	3.5

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.

3.5 Physical requirements. The finished cloth shall conform to the requirements specified in Table II, when tested as specified in 4.4.5.

Table II. Physical requirements

Characteristic	Requirement
Weight, oz/sq yd	5.0 ± 0.25
Yarns per inch, min.	
Warp	135
Filling	65
Breaking strength (pounds), min.	
Warp	100
Filling	50
Tearing strength (pounds), min.	
Warp	4.0
Filling	4.0

MIL-DTL-32231

3.5.1 Weave. The weave shall be a 2 x 2 twill drawn on 4 harnesses with a 4 pick repeat (see figure 1).

3.5.2 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 selvage.

3.6. Finish. The cloth shall be scoured, singed, stabilized, and bleached when required to result in a smooth and lustrous finish equal in character to that of the standard sample. In addition, the cloth shall be given an approved durable press (see 6.6) and soil release finish.

3.6.1 Durable press finish. The cloth shall be given an approved durable press treatment (see 6.6) and shall be processed and cured to meet the requirements of this document when tested as specified in 4.4.5.

3.6.2 Soil release finish. The soil release finish of the finished cloth shall show a rating of not less than 5 using the AATCC stain release replica when tested as specified in 4.4.5.

3.7 Nonfibrous material. The starch and protein content, including chloroform-soluble and water-soluble material, prior to application of the durable press treatment shall not exceed 2.0 percent when tested as specified in 4.4.5.

3.8 Fabric appearance rating. The finished cloth shall have an appearance rating of not less than SA-3.5 when tested as specified in 4.4.5.

3.9 Dimensional stability. The finished and cured cloth shall have dimensional changes of not more than 2.0 percent in either the warp or filling direction when tested as specified in 4.4.5. The preshrinking process used shall not be identified by name or trademark either on the cloth, ticket or package.

3.10 pH. The pH value of the water extract of the finished cloth shall be no less than 5.0 or more than 8.5 when tested as specified in 4.4.5.

3.11 Pilling. The pilling of the finished cloth shall show a rating of not more than 3.5 when tested as specified in 4.4.5.

3.12 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 85 percent when tested as specified in 4.4.5.

3.13 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 on full width rolls as specified in 5.1.

3.14 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.

3.14.1 Marking. The face side of the cloth shall be identified by applying a stamping on that side of the cloth with the word "FACE" at each end of the piece.

3.15 Toxicity. The finished fabric shall not present a health hazard and shall show compatibility with prolonged direct skin contact when tested as specified in 4.4.5. Chemicals

MIL-DTL-32231

recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.16 Workmanship. The finished cloth shall conform to the quality of product established by this purchase description. 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 III.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.4 and the tests of 4.5, 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).

4.3.1 Component and material inspection. 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.

4.4 End item examination.

4.4.1 Yard by yard examination. Each roll in the sample shall be examined yard-by-yard. 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 4.4.1.1, 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 points 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:

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

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

MIL-DTL-32231

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
 Holes, cuts, or tears
 Overall uncleanness
 Baggy, ridgy, or wavy cloth
 Width less than minimum specified
 Excessive neppiness
 Poor dye penetration, mottled, streaky or cloudy

4.4.2 Length examination. During the yard-by-yard examination, each roll in the sample shall be examined for length. Any length found to be less than the minimum specified or more than 2 yards less than the length marked on the ticket shall be considered a length defect. The lot shall be rejected if two or more rolls in the sample are defective with respect to length or if the total of the actual lengths of rolls in the sample is less than the total of the lengths marked on the roll tickets.

4.4.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade and appearance. Any roll in the sample off shade; shaded side to side, side to center, or end to end; or not having the same appearance as the standard sample shall be cause for rejection of the entire lot represented by the sample.

4.4.4 Roll identification examination. During the yard-by-yard examination, each roll in the sample shall be examined for defects listed below. The lot shall be unacceptable if two or more of the following defects are present in the sample.

Preshrinkage process identified by name or trademark on cloth or ticket
 Face stamping missing from either or both ends
 Not labeled or ticketed in accordance with the Rules and Regulations under the Textile Fiber Products Identification Act

4.4.5 End item testing. The cloth shall be tested for the characteristics listed in table III. The methods of testing specified in table III 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

MIL-DTL-32231

TABLE III. End item tests.

Characteristic	Requirement paragraph	Test Method
Polyester Identification	3.3.1.1	AATCC 20 or ASTM D 276 <u>1/</u>
Cotton Identification	3.3.1.2	AATCC 20 or ASTM D 276 <u>1/</u>
Cotton, combed	3.3.1.2	AATCC 20A or ASTM D 276 <u>1/ 2/</u>
Fiber Content	3.3.2	ASTM D 629
Yarn ply (Single)	3.3.2	Visual <u>3/</u>
Labile Sulfur	3.4.1	4.5.1
Visual Shade Matching	3.4.2	AATCC Evaluation Procedure 9, Option A
Colorfastness:		
Laundering (after 3 cycles)	3.4.3	AATCC-61, Opt. 2A <u>4/</u>
Perspiration (acid and alkaline)	3.4.3	AATCC-15
Light (after 40 hrs or 170 kilojoules)	3.4.3	AATCC-16, Opt 1 or 3 <u>5/</u>
Dry Heat <u>4/</u>	3.4.3	AATCC 117 <u>6/</u>
Crocking	3.4.3	AATCC-8
Weight	3.5	ASTM D 3776
Yarns per Inch	3.5	ASTM D 3775
Breaking strength	3.5	ASTM-D-5034
Tearing strength	3.5	ASTM-D-1424
Weave	3.5.1	Visual <u>3/</u>
Durable press treatment	3.6.1	AATCC 124
Soil release treatment	3.6.2	AATCC-130, Opt. IV
Nonfibrous materials	3.7	ASTM-D-629
Fabric appearance rating	3.8	AATCC-124 <u>7/</u>
Dimensional stability	3.9	AATCC-135 <u>8/</u>
pH	3.10	AATCC-81
Pilling	3.11	ASTM-D-3511
Seam efficiency	3.12	ASTM-D-1683 <u>9/</u>
Toxicity	3.15	4.5

1/ In case of dispute, the ASTM Method prevails.

2/ The cotton content shall be calculated as follows:

Cotton content, percent = $R/S \times 100$

R = Weight of residual fiber

S = Weight of desized specimen

3/ One determination shall be made from each sample unit and the result reported as "pass" or "fail".

4/ The specimen shall be dried after each of 3 laundering cycles.

5/ The exposure time shall be 40 hours.

6/ A temperature of $376 \pm 6^{\circ}\text{F}$ shall be used to perform the test.

7/ Permanent press machine cycle, $120 \pm 5^{\circ}\text{F}$ wash temperature. Tumble dry, permanent press cycle. Evaluate specimens after 5 washings and drying cycles.

8/ Permanent press machine cycle, $120 \pm 5^{\circ}\text{F}$ wash temperature. Tumble dry, permanent press cycle.

9/ The needle shall measure 0.36 ± 0.001 inch across the blade at the eye. The polyester/cotton wrapped thread shall conform to A-A-50199. The thread shall be Tex 31-35, 2-ply for the needle and Tex 31-35 for the looper.

4.5 Methods of inspection.

4.5.1 Presence of labile sulfur. In the determination of labile sulfur in textile materials with

MIL-DTL-32231

lead acetate, two 1.50 gm \pm 0.01 gram samples from each material submitted for evaluation shall be tested. Each of the two samples shall be cut into very small pieces and placed into separate test tubes. The samples shall be submersed in a stannous chloride solution that contains 100 grams of stannous chloride crystals ACS in 100 millimeters of hydrochloric acid ACS (35 percent concentration) and 50 milliliters of distilled water. Filter paper wet out with a 5.0 percent lead acetate solution contains 5.0 grams of lead acetate CP reagent grade and enough distilled water to make up a 100-milliliter solution; if the solution is not clear, add a few drops (one at a time) of glacial acetic acid until the solution is clear. Then test over a low flame until the solution is boiling. The solution should not be heated for more than 15 seconds. A brown to black stain on the filter paper should be evaluated as follows.

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

4.5.2 Toxicity test. If the toxicity requirement (see 3.15) can be demonstrated with historical use data, toxicity testing may not be required (see 6.2). 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 the studies indicate the fabric is not a sensitizer or irritant, a Repeat Insult Patch Test shall be performed in accordance with the Modified Draize Procedure (see 2.3).

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 cloth 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 of Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Departments or Agencies 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 the manufacture of shirts worn by Army personnel as part of the Army Service Uniform (ASU).

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. ASSIST will be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).
- c. When first article is required (see 3.1 and 4.2).
- d. Width of cloth required (see 3.5.2).
- e. Minimum length required if other than specified (see 3.13).
- f. Conformance inspection quality acceptance limits (see 4.3).
- g. Toxicity requirements (see 3.15 and 4.5.2).
- h. Packaging (see 5.1).

MIL-DTL-32231

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. Standard samples are also available at DSCP through <http://warfighter.dla.mil> under tab "Vendor Info" then "Specifications/Pattern Request" under "Special Instructions" provide color shade, roll number and solicitation/contract number.

6.5 Fabric defect scales. Fabric Defect Replica Kits are available from Sears Roebuck and Company, 3333 Beverly Road, Hoffman Estates, IL 60179.

6.6 Durable press resin treatment. Approval of the durable press resin for utilization under this document is the responsibility of the US Army Natick Soldier Center, Natick, MA 01760 and is based on extensive tests. Because of the time necessary to conduct a full evaluation (approximately 6 months), only those treatments approved and listed in the invitation for bids or request for proposals should be considered acceptable for the related procurement.

6.7 Subject term (key word) listing.

Fabric
Material
Durable Press
Shirts

MIL-DTL-32231

Weave Chain 2x2 Twill			X	X
		X	X	
	X	X		
	X			X

Pattern Draw Harness #	4				X				X			X		
	3			X				X					X	
	2		X				X			X				X
	1	X				X					X			

FIGURE 1. Herringbone pattern.

MIL-DTL-32231

CONCLUDING MATERIAL

Custodian:

Army – GL

Preparing activity:

DLA – CT

Project No. 8305-2006-019

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 ASSIST Online database at <http://assist.daps.dla.mil>.