

INCH-POUND
MIL-PRF-44423A
2 September 1997
SUPERSEDING
MIL-C-44423(GL)
30 July 1991

PERFORMANCE SPECIFICATION

CLOTH, FLAME RESISTANT, LIGHT WEIGHT, REVERSIBLE

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

1. SCOPE

1.1 Scope. This specification covers a flame resistant, light weight, reversible cloth.

1.2 Classification. The cloth shall be of the following classes as specified (see 6.2).

Class I: Camouflage Green 483 face with Camouflage Green 483 back

Class II: Desert Tan 459 face with Camouflage Green 483 back

Class III - White face with Camouflage Green 483 back

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 4 and 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 4 and 5 of this standard, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions, clarifications) and any pertinent data which may be of use in improving this document should be addressed to: Defense Personnel Support Center, Clothing and Textiles Directorate, Attn: DPSC-FNS, 2800 South 20th Street, Philadelphia, PA 19145-5099 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter..

AMSC N/A

FSC 8305

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

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 issue of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

STANDARDS

FEDERAL

FED-STD-191 - Textile Test Methods

MILITARY

MIL-STD-1487 - Glossary of Cloth Coating Imperfections

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, 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.

FEDERAL TRADE COMMISSION

Rules and Regulations Under-the Textile Fiber Products Identification Act

(Copies are available from the Federal Trade Commission, Pennsylvania Avenue at Sixth Street, 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 the documents which are DOD adopted are those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

(Applications for copies of referenced documents should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19426-2959.)

TECHNICAL MANUAL OF THE AMERICAN ASSOCIATION OF
TEXTILE CHEMISTS AND COLORISTS (AATCC)

(Applications for copies of referenced documents should be addressed to the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

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

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 cloth shall match the standard sample for shade and appearance and shall be equal to or better than the sample for colorfastness (see 6.4).

3.3 Performance requirements. The cloth shall conform to the requirements specified in Table I and 3.4 through 3.8.

TABLE I. Requirements

Characteristic	Requirements
Weight Oz/yd ² (max)	7.0
Breaking Strength, lbs./inch width (min):	
Warp	175
Filling	150
Tearing Strength, lbs (min):	
Warp	5.5
Filling	5.5
Adhesion of coating, lbs/2-inch width (min):	
Face side	8.0 <u>1</u> /
Back side	8.0 <u>1</u> /
Water permeability (min):	
Initial	No leakage
After cold crack	No leakage
After flexing	No leakage
After weathering	No leakage
Flame resistance:	
Initial and after weathering:	
After-flame time, seconds (max):	
Warp	2.0
Char length, inches (max):	
Warp	6.0
Melt drip (min):	
Warp	<u>2</u> /
Stiffness, cm: (max):	
Initial	10.0
At -20°F:	15.0
Blocking, scale rating (max)	No. 1

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TABLE I. Requirements (cont'd)

Characteristic	Requirements
Abrasion resistance, (class) (face and back) (min.)	2.5
Gloss, percent (face and back) (max.)	
At 60°F:	4.0
At 85°F:	4.0

1/ Requirement applies if a film or coating is applied to the surface of the cloth.

2/ No specimen shall drop flaming, melted or molten pieces at any time during the test.

3.4 Resistance to accelerated weathering. The cloth shall not show a color change worse than "fair", cracking, crazing, blooming, or tackiness.

3.5 Resistance to cold crack. The cloth shall not crack.

3.6. Color. The color of the cloth shall be as follows: Class 1 - Camouflage Green 483 face side and Camouflage Green 483 back side; Class 2 - Desert Tan 459 face side and Camouflage Green 483 back side; Class 3 - White face side and Camouflage Green 483 back side.

3.7 Spectral reflectance. Both sides of the cloth shall conform to the spectral reflectance requirements specified in Table II.

TABLE II. Spectral reflectance requirements

Wavelengths Nanometers	Reflectance (%)					
	Camouflage Green 483		Desert Tan 459		White	
	Min	Max	Min	Max	Min	Max
600	5	12	--	--	60	87
620	5	12	--	--	60	87
640	5	12	--	--	60	87
660	5	13	--	--	60	87
680	6	15	--	--	60	87
700	9	21	25	58	61	87
720	15	30	25	59	64	87
740	24	42	25	61	67	87
760	32	50	26	62	70	87
780	38	56	27	63	71	87
800	41	60	28	64	71	87
820	43	63	30	66	71	87
840	45	65	33	68	71	87
860	46	66	36	69	71	87

3.8 Toxicity. The cloth shall not be toxic to the skin, eyes or epidermis when used as intended (see 4.4.11).

3.9 Fiber identification. Each roll shall be labeled and ticketed for fiber content in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act.

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3.10 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.

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. When a first article is required (see 6.2) it shall be examined for the defects listed in 4.3.1 and shall be tested for the characteristics specified in Table III.

4.3 Conformance inspection. Sampling for inspection shall be as specified in the contract or purchase order.

4.3.1 End item examination.

4.3.1.1 Yard by yard examination. During the yard by yard examination, each roll in the sample shall be examined on one side only for the defects listed below. However, the side of the cloth examined shall be alternated on every other roll. The same yardage shall be given a through-lighting inspection for pinholes and for thin areas in accordance with MIL-STD-1487. All defects found shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition of the cloth, in which case only the more serious defect shall be counted. The sample unit shall be one linear yard. An approximate equal number of yards shall be examined from each roll in the sample.

Defect	Classification	
	Major	Minor
Any hole, cut, tear, scratch or abrasion mark	101	
Any pinhole	102	
Any thin areas	103	
Any blister, tunnel or separation of finish (if finished)	104	
Any lump or thick area		201
Crease or wrinkle resulting in doubling or adhesion of surfaces that cannot be corrected by manual pressure	105	
Any spot, stain or streak more than 1 inch in its longest dimension	106	
Any embedded foreign matter		202
Any scorch or burn	107	
Any color off shade, shaded side to side, side to center, end to end, mottled, spotted or streaked	108	
Any tackiness, cloth adheres to itself and will not readily unroll	109	
Edges folded, rolled, or not cut straight		203
Any objectionable odor 1/		204

1/ Odors of chemicals or commonly used finishes (i.e., films and coating compounds) shall not be regarded as objectionable.

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4.3.1.2 Roll identification examination. During the yard-by-yard examination, each roll in the sample shall be examined for proper identification. Any roll in the sample that is not labeled or ticketed in accordance with the Textile Fiber Products Identification Act shall be considered a roll identification defect.

4.3.1.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined for shade and appearance. If any roll in the sample is off shade or shaded side to side, side to center, or end to end, or if any roll does not have the same appearance as the standard sample, it shall be considered a shade and appearance defect.

4.3.2 End item testing. The cloth shall be tested for the characteristics listed in Table III. The methods of testing specified wherever applicable and as listed in Table IV shall be followed. For tests reported as pass or fail, the requirement shall apply to each determination separately and there shall be no evidence of failure of any test specimen to meet the requirement. The sample unit for testing shall be 5 yards full width of the finished cloth. All test reports shall contain the individual values utilized in expressing the final results. The sample size shall be as follows:

<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 III. End item tests

Characteristic	Test method
Weight	ASTM D 3776 Method C (small swatch of fabric method)
Breaking strength	ASTM D 5034 (G-E or G-T)
Tearing strength	ASTM D 1424
Adhesion of coating	4.4.1
Water repellency	
Initial	4.4.2
After cold crack	5874 1/ and 4.4.2
After flexing	4.4.3 and 4.4.2
After accelerated weathering	4.4.4 and 4.4.2
Resistance:	
To accelerated weathering	4.4.4
To cold cracking	5874 1/
Flame resistance:	
Initial	4.4.5
After accelerated weathering	4.4.4 and 4.4.5
Stiffness, warp only:	
Initial:	4.4.6.1
At -20 °F:	4.4.6.2
Blocking	4.4.7
Abrasion resistance	4.4.8
Color	4.4.9
Spectral reflectance:	4.4.10
Toxicity	4.4.11
Gloss (face and back)	ASTM-D-523

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1/ Except that exposure temperature shall be $-40 \pm 5^{\circ}\text{F}$ and exposure time shall be a minimum of 2 hours. The face side of the cloth shall be to the outside of the folds.

4.4 Methods of inspection.

4.4.1 Adhesion of coating. ASTM-D-751, Adhesion of Coating with 2 inch wide reinforced coating adhesion specimens, cyanoacrylate (solventless) adhesive, and pulling clamp speed of 5 mm/s. Three specimens shall be tested by adhering face-to-face and three specimens shall be tested by adhering back-to-back.

4.4.2 Hydrostatic resistance. ASTM D-751, Hydrostatic Resistance, Procedure B (Pressure Application by a Rising Column of Water) Procedure 2 with the hydrostatic head fixed at 50 centimeters and applied to the test specimen for 3 minutes. The face side of the cloth shall contact the water. The report shall only include the "measurement of the appearance of water drops". Leakage of any specimen shall be considered a test failure. Leakage is defined as the appearance of water at three or more different places within the 4-1/2 inch diameter test area.

4.4.3 Flexing. Two 8-inch by 12-inch specimens shall be cut with the 12-inch dimension parallel to the warp direction. Each specimen shall be flexed as specified in ASTM F-392, Condition D for 100 cycles with the face side of the cloth mounted to the inside of the cylinder except that the determination of pinhole count shall not be performed, the specimen shall not be aged, and the short edges shall not be heat sealed or otherwise joined. After flexing, the specimen shall be cut in half to form two, 6-inch by 8-inch pieces. Three of the four pieces shall be tested for water permeability in accordance with 4.4.2.

4.4.4 Accelerated weathering. AATCC Method 169 except that the deviations shown below shall apply. At the end of the accelerated weathering exposure period, each specimen shall be visually examined for colorfastness and for resistance to accelerated weathering and then tested for hydrostatic resistance.

Deviations to AATCC Method 169:

a. The test apparatus shall be either test chamber Type 1A or 1B. Type 1B shall be equipped with a three-tiered inclined specimen rack. The apparatus shall be equipped with an automatic light monitor and shall be capable of automatically controlling irradiance, temperature, and humidity. The apparatus shall be maintained in accordance with the manufacturer's recommendations.

b. The weathering test cycle shall be 40 minutes of light, 20 minutes of light with water spray on the fabric face, 60 minutes of light, 60 minutes of darkness. The test cycle shall be repeated until the total energy exposure is equal to 100 kilojoules per square meter.

c. The irradiance level shall be 0.55 ± 0.01 watt/square meter/nanometer ($\text{w}/\text{m}^2/\text{nm}$) bandpass at 340 nanometers.

d. The glass filter combination shall be a quartz inner filter and a borosilicate Type "S" outer filter.

e. The relative humidity shall be 50 ± 5 percent during the light cycle and not lower than 95 percent during the dark cycle.

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f. The control set points shall be as follows:

	<u>Dark cycle</u>	<u>Light cycle</u>
Black panel	38°C	77°C
Conditioning water	40°C	53°C
Wet bulb depression <u>1/</u>	0°C	10°C

1/ As a guide only; adjust to achieve required relative humidity (see e. above).

g. The test specimens shall fit smoothly on the specimen rack of the apparatus with no wrinkles or gaps. The test specimen shall be mounted to the outside of the rack with the use of appropriate stainless steel spring clips. After the required exposure period, the specimens shall be removed from the apparatus and allowed to dry and condition at Standard Conditions. Then test specimens for each required test shall be cut and tested appropriately.

NOTE: Monitoring of dry bulb temperature, wet bulb depression, irradiance, and black panel temperature is recommended through the use of chart recorders.

4.4.5 Flame resistance. Method 5903 of FED-STD-191 except that five specimens shall be tested in the warp direction only. In addition to after flame time and char length, any evidence of flaming, melted or molten pieces dropping from the specimen at any time during the test shall be reported.

4.4.6 Stiffness.

4.4.6.1 TAPPI Method T-451, Preferred Procedure (1), except that five test specimens with the long dimension parallel to the warp direction of the finished cloth shall be tested and the standard textile test conditions as specified in ASTM D-1776 shall be used.

4.4.6.2 The stiffness test shall be conducted as specified in 4.4.6.1 except that the apparatus and test specimens shall be subjected to a temperature of $-20^{\circ}\text{F} \pm 2^{\circ}\text{F}$ for a period of 2 hours and the test shall be performed in a still atmosphere at that temperature.

4.4.7 Blocking. ASTM D-751, Determination of Blocking Resistance of Fabrics Coated with Rubber or Plastics at Elevated Temperatures, except that the test specimens shall be exposed at an oven temperature of $180^{\circ}\text{F} \pm 2^{\circ}\text{F}$ for 30 minutes.

4.4.8 Abrasion resistance. ASTM-D-3886 except that three specimens shall be tested on the face side and three specimens shall be tested on the back side. The abradant shall be the respective face side or back side of the cloth. Each specimen shall be abraded for 1,000 multidirectional cycles. After abrading, the specimens shall be evaluated for color change in accordance with AATCC Method 119, using the Gray Scale for Color Change. The class rating shall be averaged and then rounded to the nearest 0.5.

4.4.9 Color matching. The color of both sides of the cloth shall match the standard sample when viewed under filtered tungsten lamps that approximate artificial daylight and that have a correlated color temperature of $7500 \pm 200^{\circ}\text{K}$, with illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at $2300 \pm 200^{\circ}\text{K}$.

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4.4.10 Spectral reflectance tests. Spectral reflectance data for Camouflage Green 483 and White shall be obtained from 600 to 860 nm while data for Desert Tan 459 shall be obtained from 700 to 860 nm. Data shall be obtained, at 20 nm intervals on a spectrophotometer relative to a barium sulfate standard, the preferred white standard. Other white reference materials may be used, provided they are calibrated to absolute white; e.g., magnesium oxide, or vitrolite tiles. The spectral band width at 860 nm shall be less than 26 nm. Reflectance measurements shall be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a continuous source that simulates either CIE Source A or CIE Source D65. The specimen shall be measured as a single layer backed with two layers of the same fabric and shade. Measurements shall be taken on a minimum of two different areas, and the data averaged. The measurement areas should be at least 6 inches away from the edges of the finished cloth. The specimen shall be viewed at an angle no greater than 10° from normal, with the specular component included. Photometric accuracy of the spectrophotometer shall be within 1 percent and wavelength accuracy within 2 nm. The standard aperture size used in the color measurement device shall be 1.0 to 1.25 inches in diameter. Any color having spectral reflectance values falling outside the limits at four or more of the wavelengths specified in 3.7 shall be considered a test failure.

4.4.11 Toxicity assessment. The cloth shall be tested for toxicity as follows:

- a) Title 40, Code of Federal Regulations, 1994 Edition;
Section 798.4100- Dermal Sensitization
Section 798.4470- Primary Dermal Irritation
Section 798.4500- Primary Eye Irritation
Marzulli, F. & H. Maibach, "Contact Allergy: Predictive Testing in Humans",
Advances in Modern Toxicology, Volume 4, pp 353-372, 1977.

b) As an alternative to animal and human testing, the contractor may provide information which certifies that the finished product was composed of chemicals or materials which have been safely used commercially where prolonged skin contact has occurred.

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 materiel is to be performed by DoD 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 activity within the Military Department System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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 tent body and fly of the Five Soldier Crew Tent.

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- 6.2 Acquisition requirements. Acquisition documents must specify the following:
- a. Title, number, and date of this specification.
 - b. Class required (see 1.2).
 - c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
 - d. When first article is required (see 3.1, 4.2, and 6.3).
 - e. Width required.
 - f. Length required.
 - g. Levels of preservation and packaging (see 5.1).

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of FAR 52.209. The first article should be a preproduction sample. The contracting officer should specify the appropriate Class of first article and the number of units to be furnished. The contracting officer should include specific instructions in all acquisition instruments regarding arrangements for selection, inspection, and approval of the first article.

6.4 Standard sample. For access to the standard sample (see 3.2), address the contracting activity issuing the invitation for bids.

6.5 Subject term (key word) listing.

Five Soldier Crew Tent
Tentage

Custodians:
Army - GL

Preparing activity
DLA-CT
(Project 8305-0616)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-44423A	2. DOCUMENT DATE (YYMMDD) 2 September 1997
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3. DOCUMENT TITLE
CLOTH, FLAME RESISTANT, LIGHT WEIGHT, REVERSIBLE

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER		
a. NAME <i>(Last, First, Middle Initial)</i>	b. ORGANIZATION	
c. ADDRESS <i>(Include Zip Code)</i>	d. TELEPHONE <i>(Include Area Code)</i> (1) Commercial (2) AUTOVON <i>(If applicable)</i>	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY	
a. NAME DEFENSE PERSONNEL SUPPORT CENTER DPSC-FNS	b. TELEPHONE <i>(Include Area Code)</i> (1) Commercial (2) AUTOVON (215) 737-8079 444-8079
c. ADDRESS <i>(Include Zip Code)</i> 2800 South 20th STREET PHILADELPHIA, PA 19145-5099	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340