INCH-POUND

MIL-PRF-20696F
2 September 1997
SUPERSEDING
MIL-C-20696E
1 June 1987

PERFORMANCE SPECIFICATION

CLOTH, WATERPROOF, WEATHER RESISTANT

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

1.1 Scope. This specification covers the requirements for four types and four classes of weather resistant, waterproof cloth.

1.2 Classification. (see 6.2):

Type I - Cloth, Moderate strength, dimensionally stable
Type II - Cloth, High strength, dimensionally stable
Type III - Cloth, Ultra High strength, dimensionally stable
Type IV - Cloth, High strength

Class 1 - Extreme cold temperature flexibility
Class 2 - Cold temperature flexibility, flame retardant
Class 3 - Extreme cold temperature flexibility, flame resistant
Class 5 - Extreme temperature resistance

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 sent 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
FED-STD-595 - Colors Used In Government Procurement

DEPARTMENT OF DEFENSE

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.)

CODE OF FEDERAL REGULATIONS

(Applications for copies of referenced documents should be addressed to U. S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.)

Contact Allergy: Predictive Testing in Humans", Advances in Modern Toxicology

(Applications for copies of referenced documents should be addressed to U. S. Army Center for Health Promotion and Preventative Medicine, ATTN: MCHB-DC-TTE, Bldg. E-2100, Aberdeen Proving Grounds, MD 21010-5442.)

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.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 1966 - Lubricating Oil, Aircraft Piston Engine (Nondispersant Mineral Oil), Standard

(Applications for copies of referenced documents should be addressed to the Society of Automotive Engineers, Publications Division, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

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 4.3.

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 6.3).

3.3 Materials.

3.3.1 Dusting powder. If dusting powder is used on the cloth, it shall be whiting, talc, or other finely divided mineralmaterial that does not support mildew growth. Talc shall not contain asbestos and whiting shall contain less than 1% quartz. Only the minimum amount of dusting powder necessary to prevent blocking should be applied.

3.4 Performance requirements. The cloth shall conform to the requirements specified in Table I and 3.4 through 3.7. The cloth shall be compatible with state of the art seam sealing materials and technology. The cloth may be dusted on both sides with the dusting powder specified in 3.3.1 to prevent blocking. If dusting powder is used, the side(s) of the cloth containing the dusting powder shall show not less than "good" resistance to dry crocking.

3.4.1 Color. The color of the cloth shall match the applicable color number of FED-STD-595 or shall match the approved color standard for the color specified where such a standard is applicable (see 6.2 and 6.3).

3.4.2 Toxicity. The cloth shall not be toxic to the skin, eyes or epidermis when used as intended (see 4.4.13).

3.4.3 Mildew resistance. The Class 2 cloth shall be mildew resistant. If plastizers are used they should be restricted to phospate or pthalate esters for the purpose of providing mildew resistance (see 4.4.14).

3.5 Back side identification. The back side of the cloth shall be identified by applying a stamping on that side of the cloth with the word "Back" at the beginning and end of each roll. The marking shall not show through onto the face side of the cloth.

3.6 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.

3.7 Physical requirements. The finished cloth shall conform to the requirements listed in Table I.

Table I. Requirements

Characteristic	Type I			Type II & IV			Type III
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 5
Weight Oz/yd^2 (max)	8.0	9.0	10.5	16.0	18.0	18.0	12.0
Breaking Strength, lbs (min) Initial:							
Warp	115	115	115	225	225	225	325
Filling	115	115	115	225	225	225	275
After accelerated weathering:							
Warp	92	92	92	180	180	180	260
Filling	92	92	92	180	180	180	220
Tearing Strength, lbs (min)							
Warp	12	12	12	45	45	45	20
Filling	10	10	10	38	38	38	20
Stiffness cm (max)(warp only)							
At 70^{o}F	10.0	10.0	10.0	14.5	16.5	14.5	--
At 10^{o}F	--	13.0	--	--	22.0	--	--
At -40^{o}F	12.0	--	12.0	20.0	--	20.0	--
Adhesion of coating, lbs/2 inch width (min)1/	10.0	10.0	10.0	15.0	15.0	15.0	12.0
Blocking, rating (max)	(2)	(2)	(2)	(2)	(2)	(2)	(1)
Resistance to accelerated aging	2/	--	2/	2/	--	2/	2/
Flame Resistance:(max)							
After flame (sec)	--	--	--	10	--	--	10
Char length (in)	--	--	--	3.5	--	--	3.5
Flame retardancy	--	3/	--	--	3/	--	3/
Hydrostatic resistance (min) Initial & after abrasion	4/	4/	4/	4/	4/	4/	4/
Resistance to:							
Oil	5/	5/	5/	5/	5/	5/	--
Aromatic hydrocarbons	6/	6/	6/	6/	6/	6/	--
Accelerated weathering	7/	7/	7/	7/	7/	7/	--
Low temperature	--	--	--	--	--	--	6/
High temperature	--	--	--	--	--	--	8/

1/ Requirement applies if a film or coating is applied to the surface of the cloth.
2/ The cloth shall show no softness, stiffness, tackiness or brittleness when compared with an unexposed specimen.
3/ The tip of the flame shall not pass beyond the top edge of the test specimen before 42 seconds after the start of the burner flame.
4/ No leakage in any portion of the test specimen.
5/ No evidence of seepage of oil through the cloth.
6/ The cloth shall not crack or flake.
7/ The cloth shall show no evidence of cracking, crazing, blooming, chalking or appreciable color change.
8/ The cloth shall show no softness, tackiness or blistering.
9/ Applicable only when required by the contract or purchase order.

3.8 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 4.3.2.1 and shall be tested for the characteristics specified in Table II.

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

4.3.1 Certificates of component. If dusting powder is used, it shall be accepted on the basis of a contractor's certificate of compliance with the requirements.

4.3.2 End item examination.

4.3.2.1 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 examined (except for Type III, Class 5 cloth). The same yardage shall be given a through-lighting inspection for pinholes and 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. A continuous defect shall be counted as one defect for each warpwise yard or fraction thereof in which it occurs. 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 or tear, scratch or abrasion (bearing the base cloth)	101	
Any pinhole	102	
Any surface scratch or abrasion mark (not bearing the base cloth)		201
Any unfinished area (if finished)	103	
Any pit, blister, tunnel, or separation of finish (if finished)	104	
Any lump or heavy area		202
Any crease or wrinkle resulting in doubling or adhesion of surfaces that cannot be corrected by manual pressure	105	
Any uneven or thin area of finish (if finished)	106	
Any window or light or translucent area		203
Cloth edges rolled, curled, folded, doubled, scalloped, or wavy precluding a flat lay of the cloth	107	
Any spot, stain, or streak more than 1 inch in combined directions 1/	108	
Any objectionable odor 2/		204
Color not as specified, off shade, uneven or mottled 3/		205
Any tackiness, cloth adheres to itself and will not readily unroll	109	

1/ Clearly visible at normal inspection distance (approx. 3 feet).
2/ Odors of chemicals or commonly used finishes (i.e., films and coating compounds) shall not be regarded as objectionable.
3/ Cloth which has been dusted with dusting powder shall be wiped with a wet cloth and allowed to dry before color matching.

4.3.2.2 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.

4.3.2.3 Shade and appearance examination. During the yard-by-yard examination, each roll in the sample shall be examined on the face side 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, the lot represented by the sample shall be rejected.

4.3.3 End item. The cloth shall be tested for the characteristics listed in Table II. The methods of testing specified wherever applicable and as listed in Table II shall be followed. The lot shall be unacceptable if any sample unit fails to meet any requirement specified. 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 cloth. The lot shall be unacceptable if any sample unit fails to meet any requirement specified. The lot size shall be expressed in units of 1 yard. The sample size shall be as follows:

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

TABLE II. End item tests

Characteristic	Test method
Weight	ASTM D 3776 Method C
Breaking strength:	
Initial	4.4.1.1
After accelerated weathering	4.4.1.2
Tearing strength	ASTM D- 2261 1/
Stiffness:	
At 70°F ± 2°F	4.4.3.1
At 10°F ± 2°F and at - 40°F	4.4.3.2
Adhesion of coating	4.4.4
Blocking	4.4.5
Accelerated aging	5852 2/
Flame resistance	5903
Flame retardancy	5903 3/
Hydrostatic Resistance	
Initial	4.4.6.1
After abrasion	4.4.6.2
Oil resistance	4.4.7
Resistance to:	
Aromatic hydrocarbon	4.4.8
Accelerated weathering	4.4.9
Low temperature	4.4.10
High temperature	4.4.11
Color	4.4.12
Toxicity	4.4.13
Mildew resistance	4.4.14

1/ Specimens of type IV cloth shall be 8 inches by 10 inches.
2/ Only one specimen shall be tested.
3/ Except that the specimen shall be observed for an additional 30 seconds after burner flame turn off. If the tip of the flame passes beyond the top edge of the specimen at any time during the 42 seconds after the burner is turned on, the specimen shall be reported as a test failure. Five specimens shall be tested in the warp direction and the results reported individually as "pass" or "fail".

4.4 Methods of inspection.

4.4.1 Breaking strength.

4.4.1.1 ASTM-D-5035 (1C-E or 1C-T).

4.4.1.2 The specimens shall be cut from each test sample unit at the same time as the specimens for initial test and shall be marked to insure proper identification. The specimens shall be subjected to the accelerated weathering procedure specified in 4.4.2. After completion of the procedure, the two specimens shall be subjected to the following conditions:

a. Two (2) hours at 180° ± 5°F
b. 40 (± 8) hours at 70 ° ± 2°F at a relative humidity of 65 ±2%.

Each specimen shall then be tested for breaking strength as specified in 4.4.1.1.

4.4.2 Accelerated weathering procedure. One specimen, 8 by 6 inches minimum, with the short dimension warpwise and one specimen, 8 by 6 inches, minimum, with the short dimension filling wise shall be subjected to the procedure specified in Method 5804 of FED-STD-191. The procedure shall be performed with the face side exposed. The exposure times shall be as follows:

Types I, II and IV; class 2 - 150 hours for all colors.
Types I, II and IV; classes 1 and 3 - 150 hours for olive green and black only, all other colors - 50 hours.
Type III, class 5 - 150 hours for all colors.

After exposure, the specimens shall be removed and allowed to condition for at least 24 hours.

NOTE: Equipment which operates at one revolution in two hours. may be used. However, the one revolution per minute shall be the standard procedure in the event of dispute. Laboratory reports shall state the procedure used.

4.4.3 Stiffness

4.4.3.1. TAPPI Method T-451, Preferred Procedure (1).

4.4.3.2 The stiffness test shall be conducted as specified in 4.4.3.1 except that the apparatus and test specimens shall be conditioned at the specified temperature for a minimum of 4 hours before testing and the test shall be performed in a still atmosphere at that temperature.

4.4.4 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. The test shall be performed on the coated side (if one side coated) or face to back (if two sides coated) of the cloth. Testing shall be performed in the warp direction.

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

4.4.6 Hydrostatic resistance.

4.4.6.1 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 10 minutes. The back side of the cloth shall contact the water. The report shall only include "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.

4.4.6.2 A new specimen, 10 by 10 inches, shall be abraded by means of a 2-inch square piece of grade 1/0 garnet paper which shall be uniformly loaded with an 8.0 $\pm$ 0.1 ounce weight. The specimen shall be abraded on the face by moving the weighted garnet paper filling-wise five times in each direction. The specimen shall then be turned over and abraded on the back by moving the weighted garnet paper warp-wise five times in each direction. The abraded 2-inch square area shall then be placed face up across the center line of the clamping head so that the center of the abraded area will coincide with the center of the exposed part of the specimen. Hydrostatic resistance shall then be determined as specified in 4.4.6.1.

4.4.7 Oil resistance. One 8 by 8 inch specimen shall be placed on a wood frame. The inside dimensions of the frame shall be 6 inches by 6 inches by 1 inch. The specimen shall be forced into the frame by a wood block 5-3/4 by 5-3/4 inches (with round corner) to form a basin of uniform depth. The edges of the cloth shall be tacked to the frame and the block removed. Lubricating oil, conforming to Grade 50 of SAE J 1966 shall be rapidly poured into the basin to a 1/2 inch depth. After the oil has been in the basin for 1 hour, the bottom of the fabric specimen forming the basin shall be examined to determine if oil has seeped through or permeated the cloth.

4.4.8 Resistance to aromatic hydrocarbon fluid. One, 1 by 6 inch specimen with the long dimension parallel to the warp shall be immersed for 5 minutes in aromatic hydrocarbon fluid conforming to Reference fuel D of ASTM D 471. The specimen shall be dried at room temperature for 2 hours ($\pm$ 5 minutes) and then be creased sharply on itself, with the face side toward the outside of the fold. A similar specimen, except with the long dimension parallel to the filling shall be tested in the same manner.

4.4.9 Resistance to accelerated weathering. The cloth shall be subjected to the accelerated weathering procedure specified in 4.4.2. After completion of the procedure, each specimen shall be folded by hand, face out, sharply upon itself and visually examined along the fold for cracking and crazing. Each specimen shall then be opened flat and examined for blooming, chalking or appreciable color change (An appreciable color change is one that is noticeable on first glance when comparing the tested specimen with the original unexposed cloth).

4.4.10 Resistance to low temperature. A 1 by 4 inch specimen of the cloth with the long dimension warpwise and a 1 by 4 inch specimen of the cloth with the long dimension fillingwise shall be exposed for 4 hours at a temperature of minus 70 $\pm$ 5^{o}F with the temperature recorded at the lowest point in the chamber. The sample, still in the test atmosphere, shall then be bent sharply, face side of the cloth to the outside of the fold, 180 degrees over a 1/8 inch steel rod that has been exposed in the test chamber with the test specimen.

4.4.11 Resistance to high temperature. A 2 by 6 inch specimen of the cloth shall be exposed for a period of 6 hours in an electrically heated oven maintained at a temperature of 170^{o} $\pm$ 2^{o}F. At the end of the exposure period, the specimen shall, while still maintained at the test temperature, be bent 180 degrees over a 1/8 inch steel rod with the face side of the cloth to the outside of the fold.

4.4.12 Matching. The color and shade 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^{o}K, with illumination of 100 $\pm$ 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2300 $\pm$ 200^{o}K.

4.4.13 Toxicity assessment. The waterproof 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.

4.4.14 Mildew resistance. A certificate of compliance shall be submitted for this requirement.

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 or Defense Agency, or within the Military Department's 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. Type I, type II and type IV cloths are for use in the fabrication of covers and shelters. The type III cloth is intended for use in the manufacture of survival containers.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this document.
b. Type and class required (see 1.2).
c. Color and standard sample required.
d. 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).
e. When first article is required (see 3.1, and 4.2).
e. Width required.
f. Length required.
g. Levels of preservation and packing (see 5.1).

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

6.4 Subject term (key word) listing.

Fabric, Weather proof
Fabric, Fowl Weather
Fabric, Shelter
Fabric, Tarpaulin

Custodian:
Army - GL
Navy - NU
Air Force - 99

Review Activities:
Army - ME, MI, AT
Navy - MC
Air Force - 45, 82

Preparing Activity
DLA-CT

Project No. 8305-0622

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	2. DOCUMENT DATE *(YYMMDD)*
	MIL-PRF-20696f	97 September 02

3. DOCUMENT TITLE

CLOTH, WATERPROOF, WEATHER RESISTANT

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 *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME DEFENSE PERSONNEL SUPPORT CENTER DPSC-FNS	b. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON (215) 737-8079 444-8079
c. ADDRESS *(Include Zip Code)* 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