MILITARY SPECIFICATION

CLOTH, PLAIN WEAVE, ARAMID, WATER REPELLENT

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 plain weave aramid cloth that is water repellent treated.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

PPP-P-1133 - Packaging of Synthetic Fiber Fabrics

MILITARY

MIL-T-43548 - Thread, Polyester Core: Cotton-, Rayon-, or Polyester Covered

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Officer in Charge, Navy Clothing and Textile Research Facility, 21 Strathmore Road, Natick, MA 01760-2490 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8305

STANDARDS

FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections
FED-STD-191 - Textile Test Methods

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

LAWS AND REGULATIONS

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies may be obtained from the Federal Trade Commission, Washington, DC 20580.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

TECHNICAL MANUAL OF THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

Method No. 8 Colorfastness to Crocking: AATCC Crockmeter Method

(Copies may obtained from AATCC National Headquarters, P.O. Box 12215, Research Triangle Park.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Standard sample. The finished cloth shall match the standard and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.3). The standard sample is identified under piece number 87177.

3.2 First article. When specified, the contractor shall furnish sample unit(s) for first article inspection and approval (see 4.3 and 6.2).

3.3 Material.

3.3.1 Fiber. The fiber shall be an approved aramid blend (see 6.8), 1.5 denier per filament, cut to a staple length of 1-1/2 to 2 inches (3.80 to 5.10 cm). The fiber shall not char at a temperature less than 675°F (375°C). The use of fiber other than the approved is prohibited. The fiber shall be tested as specified in 4.5.

3.3.2 Yarn. The yarn shall be 2-ply for the warp and filling (see 6.4), when tested as specified in 4.5.

3.4 Color. The color of the cloth shall be blue 3380 and shall match the standard sample, unless otherwise specified (see 6.2). The color shall be obtained by the use of producer colored fiber.

3.4.1 Matching. The color and appearance of the dyed and finished cloth shall match the standard sample when viewed under filtered tungsten lamps which approximate artificial daylight having a correlated color temperature of 7500 ± 200 K, with illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2300 ± 200 K.

3.4.2 Colorfastness. The finished cloth shall show colorfastness to light, laundering, wet dry cleaning, perspiration and crocking equal to or better than the standard sample when tested as specified in 4.5. When no standard sample is available or when the standard sample is not referenced for colorfastness, the finished cloth shall show "Good" fastness to laundering, wet dry cleaning, perspiration, and shall show "Good" fastness to light evaluated after 6 hours of exposure, and a wet and dry crocking rating not lower than 4.

3.5 Physical requirements. The physical requirements of the finished cloth shall be as specified in Table I when tested as specified in 4.5.

TABLE I. Physical requirements

Characteristics	Requirements Minimum	Maximum
Weight, oz/yd^2 (gm/m^2)	6.5 (220.4)	7.5 (254.2)
Yarns per inch (2.54 cm)		
Warp	62	-
Filling	46	-
Break strength, lbs (N)		
Warp	260 (1157)	-
Filling	200 (890)	-
Tear strength, lbs (N)		
Warp	10 (44.5)	-
Filling	7 (31.2)	-
Flame resistance:		
After flame time, seconds	-	2.0
After glow time, seconds	-	25.0
Char length, inches (2.54 cm)	-	3.5
Air permeability, ft^3/min/ft^2 (cm^3/sec/cm^2)		
Initial	-	7 (3.56)
After 15 launderings	-	12 (6.10)
Hydrostatic pressure, inches (2.54 cm)		
Initial, and after 3 launderings	8	-

3.6. Weave. The weave shall be plain, when tested as specified in 4.5.

3.7 Width. The width of the cloth shall be as specified (see 6.2) and shall be the minimum acceptable width, inclusive of selvages when fly shuttle looms or shuttleless with tuck-in selvage looms are used. For all other shuttleless looms the width measurement shall be made between the last warp yarn on each side excluding the protruding fringe.

3.8 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 4.5.

3.9 Finishing. The cloth shall be desized, scoured, heat set (see 6.6) and given an approved water repellent treatment.

3.9.1 Water repellent treatment. The cloth shall be given an approved fluorocarbon water repellent treatment (see 6.5).

3.9.2 Nontibrous material. Prior to application of the water repellent treatment, the cloth shall contain no more than 1.0 percent starch and protein including chloroform-soluble and water-soluble material when tested as specified in 4.5.

3.10 Spray rating. The results of three individual determinations on the sample unit for spray rating shall be equal to or better than 80, 80, 80 when tested as specified in 4.5.

3.11 Curling. The finished cloth shall lie flat, without distortion, and show no evidence of curling when tested as specified in 4.5.

3.12 pH. The pH value of the water extract of the finished cloth shall be not less than 5.0 nor more than 8.0 when tested as specified in 4.5.

3.13 Dimensional stability. The finished cloth shall not shrink or elongate more than 4.0 percent in the direction of the warp nor more than 2.0 in the direction of the filling, after 15 launderings when tested as specified in 4.5.

3.14 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 80 percent when tested as specified in 4.5.

3.15 Length and put-up. Unless otherwise specified (see 6.2), the finished cloth shall be furnished in continuous lengths each not less than 40 yards (36.58m). Each length shall be put-up in full width rolls as specified in 5.1.

3.16 Face identification. 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 roll.

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

3.18 Workmanship. The finished cloth shall conform to the quality established by this document. The occurrence of defects shall not exceed the point level specified.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Certificate of compliance. Where certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification.

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

1. First article inspection (see 4.3).
2. Quality conformance inspection (see 4.4).

4.3 First article inspection. When required (see 3.2 and 6.2), the first article shall be visually examined for appearance, color, and finish, and shall be tested for physical and chemical properties in accordance with the methods specified in 4.5. The presence of any defect or failure of any test shall be cause of rejection of the first article.

4.4 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated.

4.4.1 Component and material inspection. In accordance with 4.1 above, components and materials shall be tested and inspected in accordance with all the requirements of referenced specifications, drawings, and standards unless otherwise excluded, amended, modified, or qualified in this specification or applicable procurement documents.

4.4.2 Examination of the end item. Examination of the end item shall be in accordance with 4.4.2.1 through 4.4.2.4.

4.4.2.1 Yard-by-yard examination. The required yardage of each roll in the sample shall be examined on the face side only. When the total yardage in the roll does not exceed 100 yards (91.4m), the entire yardage in the roll shall be examined. When total yardage in the roll exceeds 100 yards (91.4m), only 100 yards (91.4m) shall be examined. All defects as defined in Section III of FED-STD-4 which are clearly noticeable at normal inspection distance (3 feet) (0.91m) shall be scored and assigned demerit points as listed in 4.4.2.1.1 except as follows:

a. Only coarse yarns that exceed twice the normal yarn diameter shall be scored.

b. Mixed filling (shade bar) shall be scored only when resulting from wrong ply, variation of twist in the yarn, or off shade yarn.

c. Only knots and slubs which exceed limits shown on Sears Fabric Defect Scales (see 6.7) F or 2 as applicable for slubs and D for knots shall be scored.

No linear yard (increment of 1 yard (0.9m) on the measuring device of the inspection machine) from any one roll within the sample shall be penalized more than four points. The sample size shall be 20 rolls selected for 20 containers. The lot shall be unacceptable if the points per 100 square yards ($83.6m^2$) of the total yardage examined exceed 50 points. The lot shall be unacceptable if the points per 100 square yards ($83.6m^2$) of two or more individual rolls exceeds 75 points. If one roll exceeds 75 points per 100 square yards ($83.6m^2$), a second sample of 20 rolls shall be examined only for individual roll quality. The lot shall be unacceptable if one or more rolls in the second sample exceeds 75 points per 100 square yards ($83.6m^2$). Point computation for lot quality and individual roll quality shall be as follows:

$$\frac{\text{Total points scored in sample X 3600}}{\text{Contracted width of cloth (inches) X Total yards inspected}} = \text{Points per 100 square yards } (83.6m^2)$$

4.4.2.1.1 Demerit points. Demerit points shall be assigned as follows

For defects 3 inches (7.6 cm) or less - one point

For defects exceeding 3 inches (7.6 cm) but not exceeding 6 inches (15.2 cm) in any dimension - two points

For defects exceeding 6 inches (15.2 cm) but not exceeding 9 inches (22.9 cm) in any dimension - three points

For defects exceeding 9 inches (22.9 cm) in any dimension - four points

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

Baggy, ridgy, or wavy cloth
Width less than specified
Uneven weaving

4.4.2.2 Examination for length.

4.4.2.2.1 Individual rolls. 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 (1.8m) less than the length marked on the ticket shall be considered a defect with respect to length. The lot shall be unacceptable if two or more rolls in the sample are defective in respect to length.

4.4.2.2.2 Total yardage in sample. The lot shall be unacceptable if the total of the actual lengths of rolls in the sample is less than the total of the lengths marked on the tickets. The rolls examined shall be those selected for the examination of individual rolls.

4.4.2.3 Examination for shade variation. During the yard-by-yard examination, each roll in the sample shall be examined for shade variation. Any two rolls in the sample exhibiting uneven shade, shade variation side to side, side to center, or end to end, shall be cause for rejection of the entire lot represented by the sample.

4.4.2.4 Examination for face identification and compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for the defects listed below. The lot shall be unacceptable if two or more rolls in the sample contain one or more of the following defects:

Face identification missing from either or both ends
Face identification on wrong side
Not labeled or ticketed in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act

4.4.3 Examination of packaging requirements. An examination shall be made in accordance with the provisions of PPP-P-1133 to determine whether packaging, packing, and marking comply with section 5 requirements.

4.5 Tests. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in Table II shall be followed. The physical and chemical values specified in section 3, except where otherwise specified, apply to the results of the determinations made on the sample unit for test purposes as specified in the applicable test method. The sample unit shall be five continuous yards (4.55m) full width of the finished cloth, plus 1/4 yard (.23m) full width of the cloth prior to the application of the finish for determination of nonfibrous materials and 1/2 yard (.46m) of the finished cloth carefully wrapped on a tube for the air permeability test. The lot size shall be expressed in units of one yard (0.91m) each. The lot shall be unacceptable if one or more sample units fail to meet any test requirements specified. All test reports shall contain the individual values utilized in expressing the final result. The sample size shall be in accordance with the following:

Lot size (yards)(0.91m)	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	Requirement paragraph	Test method
Fiber		
Identification	3.3.1	1/
No charring	3.3.1	1/
Denier	3.3.1	1/
Staple length	3.3.1	Visual 1/
Yarn ply	3.3.2	Visual 1/
Colorfastness to:		
Light	3.4.2	5660 2/
Laundering	3.4.2	5610
Wet dry cleaning	3.4.2	5622
Perspiration	3.4.2	5680
Crocking	3.4.2	AATCC-8
Weight	3.5	5041
Yarns per inch	3.5	5050
Break strength	3.5	5100
Tear strength	3.5	5132
Flame resistance	3.5	5903
Air permeability:		
Initial	3.5	5450
After 15 launderings	3.5	5556, 5450 3/
Hydrostatic pressure		
Initial	3.5	5514
After 3 launderings	3.5	5556, 5514
Weave	3.6	Visual 4/
Fabric break open	3.8	4.5.1 4/
Finish		
Desized	3.9	1/
Scoured	3.9	1/
Nonfibrous material	3.9.2	2611
Spray rating	3.10	5526
Curling	3.11	4.5.2
pH	3.12	2811
Dimensional stability		
After 15 launderings	3.13	5556 5/
Seam efficiency	3.14	5110 6/

1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirements.

2/ The specimen shall be compared with the standard sample after 6 hours and evaluated.

3/ The sample used for the dimensional stability determination may be used for testing air permeability after 15 launderings.

4/ One determination per sample unit and the result reported as "pass" or "fail".

5/ Cotton laundering procedures.

6/ The thread shall be polyester core, cotton or rayon covered, size 50, 2 or 3 ply for the needle thread, and size 70, 2 or 3 ply for the looper thread of MIL-T-43548. The needle size shall be 0.040 (± 0.001) inch.

4.5.1 Fabric break open test. One specimen of cloth, 7 by 7-inch (17.8 by 17.8cm) piece shall be cut. The specimen shall be rigidly held in a horizontal position between two metal plates with a 6-inch (15.2cm) diameter fabric exposure. The specimen shall be positioned 2-inches (5.1cm) above the top of a meker burner. The center of one side of the specimen shall be exposed for 30 seconds at a 90 degree angle to a flame from the burner. Natural gas at a flow rate of 2 liters per minute shall be used.

4.5.2 Curling. Two specimens of cloth, 1-1/2 inches (3.81cm) wide by 6-inches (15.2cm) long shall be cut, one having the long dimension parallel to the warp and the other with the long dimension parallel to the filling. Both specimens shall be placed on a flat surface for at least 5 minutes and then visually examined for evidence of curling.

5. PACKAGING

5.1 Put-up and preservation. Put-up and preservation packaging shall be level A or Commercial as specified (see 6.2).

5.1.1 Level A and Commercial. The cloth shall be put-up and preserved in accordance with the applicable requirements of PPP-P-1133.

5.2 Packing. Packing shall be level A, B, or Commercial as specified (see 6.2).

5.2.1 Levels A, B, and Commercial. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1133.

5.3 Marking. In addition to any special marking required by the contract or purchase order, shipments shall be marked in accordance with the applicable requirements of PPP-P-1133.

6. NOTES

6.1 Intended use. The cloth covered by this specification is intended for use in cold weather clothing.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this document.
b. When a first article is required (see 3.2 and 4.3). The item will be tested and should be a first article sample. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, quantity, and testing and approval of the first article.
c. Color, if other than specified (see 3.4).
d. Width required (see 3.6).
e. Length required if other than specified (see 3.15)
f. Levels of packaging and packing (see 5.1 and 5.2)

6.3 Standard sample. For access to standard sample, address the procuring activity issuing the invitation for bids.

6.4 Yarn. Cloth woven with 22/2 yarn for the warp, and 22/2 for the filling has been found to meet the requirements of this document (see 3.3.2).

6.5 Water repellent treatment. Only those approved fluorocarbon water repellent treatments listed in the invitation to bids or request for proposal shall be considered acceptable for related procurement. Information on currently approved material may be obtained from Defense Personnel Support Center, Philadelphia, PA 19101 (see 3.9).

6.6 Heat set. A heat setting procedure that has given satisfactory results is as follows:

Autoclave with steam at 30 pounds per square inch (p.s.i.) minimum for at least 40 minutes. The steam shall be drawn through the cloth by the application of a vacuum for a period of 5 minutes in order to adequately saturate the cloth with steam. The steam pressure shall be held at 30 p.s.i. minimum for approximately 20 minutes after which the steam is cut off and a vacuum placed on the material for 5 minutes. The steam shall then be reapplied for the remaining time of the autoclaving period followed by a vacuum for 5 minutes to remove all moisture from the cloth. Care must be taken to avoid the presence of creases in the cloth and any roll deformation since autoclaving will permanently set the cloth.

6.7 Sears defect scales. Sears Fabric Defect Scales are available from Sears, Roebuck, and Company, Department 817 (Attn: BSC 23-29), Sears Tower, Chicago, IL 60684 (see 4.4.2.1).

6.8 Fiber identification. The fiber requirements can be met with "Type 458" 95% Nomex/5% Kevlar aramid fiber blend manufactured by E.I. DuPont de Nemours Co., Wilmington, DE (see 3.3.1). Approval of other fibers is the responsibility of the US Navy Clothing and Textile Research Facility, Natick, MA 01760-2490, and is based on extensive tests, including those for toxicity, which are not set forth in this document.

6.9 Subject term (key word) listing:

a. Cloth, plain weave
b. Fiber, aramid blend
c. Finish, water repellent
d. Flame resistant, cloth

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

Review Activity:
DLA - CT
Army - GL
Air Force - 82

User:
Navy - MC

Preparing activity:
Navy - NU

Project Number: 8305-0155

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-C-24931	CLOTH, PLAIN WEAVE, ARAMID, WATER REPELLENT

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
	☐ USER
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)* _____

5 PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6 REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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