

INCH-POUND

MIL-C-87262(USAF)

11 February 1992

MILITARY SPECIFICATION

CLOTH, PLAIN WEAVE, POLYBENZIMIDAZOLE/ARAMID BLEND

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

1. SCOPE. This specification covers the requirements for intimately blended polybenzimidazole, aramid and, if specified, stainless steel piece dyed woven cloth used in the manufacture of special clothing.

1.2 Classification. The cloth shall be one of the following classes specified (see 6.2, 6.6, 6.7, and 6.8).

Class 1 – Antistatic treated

Class 2 – Quarpel treated

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications and standards. Unless otherwise specified (see 6.2), the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB OH 45433-6503 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

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SPECIFICATIONS

FEDERAL

PPP-P-1133 - Packaging of Synthetic Fiber Fabrics

MILITARY

MIL-T-44100 - Thread, Para-Aramid, Spun, Intermediate Modulus

STANDARDS

FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections

FED-STD-191 - Textile Test Methods

FED-STD-595 - Colors Used in Government Procurement

MILITARY

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

(Copies of specifications, standards, drawings and publications required by suppliers 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 form a part of this specification to the extent specified herein.

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies may be obtained without charge from the Federal Trade Commission, Washington, D C. 20580)

Technical Manual of the American Association of Textile Chemists and Colorists

Method Number 76-1978 - Electrical Resistivity of Fabrics

Method Number 135-1987 - Dimensional Changes in Automatic Home Laundering of Durable Press Woven or Knit Fabric

(Applications for copies of the AATCC Manual should be addressed to the AATCC National Headquarters, P.O. Box 12215, Research Triangle Park, North Carolina 27709)

2.1.3 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.

3. REQUIREMENTS

3.1 Standard sample. The dyed and finished cloth shall match the standard sample for shade 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)

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3.2 First article. This specification contains provisions for first article inspection and approval (see 4.4 and 6.2).

3.3 Material

3.3.1 Fiber. The fibers shall be (1) non-melting aramid, 1.5 denier per filament, cut to a staple length of 2 inches, (2) polybenzimidazole (PBI), 1.4 denier per filament cut to staple length of 2.0 inches and, if specified, (3) stainless steel, 8 micron diameter cut to a staple length of 2.0 inches. The aramid fiber shall not char at temperature less than 675° F (358° C) and the PBI fiber shall not char at temperature less than 675° F (358° C) when tested as specified in 4.7.

3.3.2 Yarn. The yarn shall be an intimate blend with 20 percent by weight being PBI fiber and 80 percent by weight being aramid fiber. If specified, 1% stainless steel fiber by weight shall be intimately blended with 20% PBI fiber by weight and 79% aramid fiber by weight (see 6.7). The yarn shall be spun into 2 ply for both the warp and filling (see 6.4).

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

3.4 Color. Unless otherwise specified, the color of the cloth shall be sage green, USAF color shade No. 1590 in accordance with FED-STD-595. The color of the cloth shall be obtained by piece dyeing.

3.4.1 Matching. The color of the finished cloth shall match the standard sample under artificial daylight having a correlated color temperature of 7000 ± 500 kelvin and shall be a good approximation to the standard sample under incandescent lamplight at 2850 ± 100 kelvin.

3.4.2 Colorfastness. The dyed and finished cloth shall show colorfastness to light and to laundering equal to or better than the standard sample when tested as specified in 4.7.

3.5 Physical requirements. The physical requirements of the finished cloth shall be as specified in table I when tested as specified in 4.7.

3.5.1 Width. Unless otherwise specified (see 6.2), the width shall be 60 inches inclusive of selvages. When cloth has shuttleless loom selvages, the width of the cloth should be as specified (see 6.2) and shall be the minimum width of the woven cloth, excluding the selvages.

3.6 Finishing. The cloth shall be desized, scoured, dyed, and heat set. The class 1 cloth shall be given a durable antistatic finish (see 6.6), unless otherwise specified (see 3.6.1). The class 2 cloth shall be given a durable water repellent treatment (see 3.6.2). The cloth shall be heat set to meet the requirements of 3.5 and 3.7.

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TABLE I Physical requirements.

Characteristics	Requirements
Weave	Plain
Weight (ounces/yard ²) (minimum)	4.8
Yarns per inch (minimum)	
Warp	66
Filling	54
Breaking Strength (pounds) (minimum)	
Warp	140
Filling	100
Tearing strength (pounds) (minimum)	
Warp	8
Filling	6
Air permeability (feet ³ /minute/feet ² at 1/2-inch water pressure)	
(minimum)	60
(maximum)	100
Flame resistance	
(FSTM-191-5903)	
Flaming time (seconds) (maximum)	1
Glow time (seconds) (maximum)	10
Char length (inches) (maximum) (average)	3.00
(FSTM-191-5905)	
First burn flaming time (seconds) (maximum)	2
Second burn flaming time (seconds) (maximum)	2
Percent consumed (maximum) (average)	25
Non-fibrous material (percent) (maximum)	2.0 ^{1/}
Flammability	
Break open time (seconds) (minimum)	80
Moisture content (percent) (minimum)	6.0
pH	4.0 - 9.0 ^{2/}
Curling	Shall be flat without distortion and show no evidence of curling

^{1/} Including starch and protein matter as well as chloroform and water soluble material.

^{2/} Determined on water extract of finished cloth.

3.6.1 Antistatic properties (class 1). Unless otherwise specified, the class 1 cloth shall be given a durable antistatic finish (see 6.6) so that the maximum resistivity of any one sample before laundering shall be 3.0×10^{11} ohms per square and the maximum resistivity of any one sample after five launderings

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shall be 8.0×10^{11} ohms per square when tested as specified in 4.7. Only those chemical treatments already approved by the appropriate medical service and so listed herein (see 6.6) shall be considered acceptable for the related procurement. If specified, the cloth shall contain 1.0% stainless steel fiber by weight (see 3.3.2 and 6.7). Cloth with stainless steel fiber shall not be treated with antistatic finish. Cloth with stainless steel fiber shall meet the post-laundrying resistivity requirements when tested as specified in 4.7.

3.6.2 Water repellency (class 2). The class 2 cloth shall be given an approved "Quarapel type" (see 6.8) water repellent treatment and shall conform to the water repellency requirements of 3.6.2.1 when tested as specified in 4.7. The use of materials other than approved water repellents are prohibited. The cured fabric shall be scoured to remove all unreacted reagents.

3.6.2.1 Spray rating. The results of three individual determinations on the sample unit for spray rating shall be equal to or better than ratings of 100, 100, 90 when tested as specified in 4.7.

3.7 Dimensional stability. The cloth shall not shrink more than 4.5 percent in the direction of the warp nor more than 3.0 percent in the direction of the filling, after fifteen launderings when tested as specified in 4.7. The preshrinkage process shall not be identified by name or trademark, either on the cloth or on the ticket or package.

3.8 Seam efficiency. The finished cloth shall have a seam efficiency of not less than 80 percent when tested as specified in 4.7.

3.9 Length and put-up. Unless otherwise specified (see 6.2), the finished cloth shall be furnished in continuous lengths each not less than 50 yards. Each length shall be put-up in full width rolls as specified in PPP-P-1133.

3.10 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.

3.11 Workmanship. The finished cloth shall conform to the quality and grade of product established by this specification. The occurrence of defects shall not exceed the applicable acceptable quality levels.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the 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 shall 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

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or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations is an acceptable practice to ascertain compliance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept 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 inspections. The inspection requirements specified herein are classified as follows:

- a First article inspection (see 4.4)
- b. Quality conformance inspection (see 4.5)

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.7.

4.4 First article inspection. The first article inspection shall consist of specified examinations and tests performed on samples of PBI/aramid plain weave cloth to determine that the production item conforms to the requirements of this specification.

4.4.1 First article samples. Unless otherwise specified, as soon as practical after the award of the contract or order, the manufacturer shall submit three linear yards of the woven cloth for subjection to the examinations and tests specified in 4.4.2. The sample shall be representative of the construction, workmanship, components, and materials to be used during production.

4.4.2 First article tests. The first article sample shall be subjected to tests specified in 4.7.

4.5 Quality conformance inspection. The quality conformance inspection shall consist of the examinations in 4.5.1 through 4.5.2.4 and all the tests required for the cloth for each lot. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

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

4.5.2 Examination of the end item. Examination of the end item shall be in accordance with the provisions of 4.5.2.1 through 4.5.2.5.

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4.5.2.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only and visual defects as defined herein shall be classified as listed in table II. All defects found shall be counted regardless of their proximity one to another 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 sample unit for each lengthwise yard or fraction thereof in which it occurs. The sample unit for this examination shall be one linear yard. The sample size shall be in accordance with Inspection Level II of MIL-STD-105. The Acceptable Quality Level (AQL) shall be 2.5 major defects and 6.5 total defects per 100 units (yards). The total size shall be expressed in units of one linear yard. An approximate equal number of yards shall be examined from each roll selected for yard-by-yard examination.

TABLE II. Classification of defects.

Classification		
Defect	Major	Minor
Any hole, cut, or tear	X	
End out	X	
Mend	X	
Abrasion <u>1/</u>	X	
Thin place <u>1/</u>	X	
Seams	X	
Tight yarn <u>1/</u>	X	
Smash	X	
Any slub or slug, more than twice the size of normal yarn		X
Foreign matter <u>1/</u>		X
Float		X
Knots extending above the surface of the cloth <u>1/</u>		X
Kinks or untrimmed ends		X
Crease or wrinkle (embedded)		X
Barre, stop mark or shade bar <u>1/</u>		X
Spot or stain	X	
Bowing		X

1/ Clearly visible at normal inspection distance (3 feet)

NOTE. Reference FED-STD-4.

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4.5.2.2 Overall examination. The sample unit shall be examined for overall defects specified in table III. The sample unit shall be one roll. The sample size and the acceptance number shall be specified in table IV. Each defect listed in table IV shall be counted not more than once in each roll examined.

TABLE III. Overall defects.

Classification		
Defect	Major	Minor
Objectionable odor	X	
Overall uncleanness		X
Baggy, ridgy, or wavy cloth	X	
Off shade, shaded end to end, side to side, side to center, or throughout roll . . .	X	
Poor dye penetration, mottled, streaky, or cloudy	X	
Overall width less than specified	X	

4.5.2.3 Examination for length

4.5.2.3.1 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 two yards less than the length marked on the ticket shall be considered a defect with respect to length. The maximum number of defects acceptable in the sample shall be in accordance with table IV.

TABLE IV Sample size

Lot size in yards	Sample size in rolls	Maximum number of defects acceptable in sample
Up to 1200 ^{1/}	3	0
1201 up to and including 3200	5	0
3201 up to and including 10,000	8	0
10,001 up to and including 35,000	13	0
35,001 up to and including 150,000	20	1
150,000 and over	32	2

^{1/} If lot is fewer than three rolls, each roll in the lot shall be examined.

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4.5.2.3.2 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 ticket. The rolls examined shall be those selected for the examination of individual rolls

4.5.2.4 Examination for shade. During the yard-by-yard examination, each roll in the sample shall be examined for shade. Any roll in the sample off shade, shaded side to side, side to center, or end to end shall be rejected, and shall be cause for inspection of the entire lot represented by the sample

4.5.2.5 Examination for compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for conformance to the Textile Fiber Products Identification Act. Each roll not labeled or ticketed in accordance with this act shall be a defect. The lot shall be unacceptable if two or more of these defects occur

4.6 Examination of preparation for delivery requirements. An examination shall be made in accordance with the provisions of PPP-P-1133, to determine that packaging, packing, and marking complies with the section 5 requirements.

4.7 Testing of the end item. The methods of testing specified in FED-STD-191, wherever applicable as listed in table V 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 a sample unit for test purposes as specified in the applicable test method. The sample unit shall be 5 continuous yards, full width, of the finished cloth. The sample unit for determining non-fibrous material (see 3.5) shall be 1/4 yard full width of cloth prior to the application of the antistatic or water repellent finish. All test reports shall contain the individual values utilized in expressing the final result. The lot size shall be expressed in units of a linear yard. The lot shall be unacceptable if one or more units fail to meet any requirement specified. The sample size (number of sample units) shall be as follows:

Lot size (yards)	Sample size
800 or less	2
801 thru 22,000	3
22,001 and over	5

4.7.1 Curling. Two specimens of cloth, 1-1/2 inches wide by 6 inches 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.

4.7.2 Flammability. A circular fabric sample shall be rigidly held with its edges completely restrained in a horizontal position between two metal plates with a six (6) inch diameter fabric exposure. One side of the fabric shall be exposed to a Meker burner in the center at a ninety (90) degree angle using natural gas (2 liters per minute flow rate) for 80 seconds with 2 inches distance between fabric and burner top.

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TABLE V. Test methods.

Characteristic	Requirement paragraph	FED-STD-191 Test method
Fiber Identification		
(non-melting aramid, PBI)	3.3 1	1/
No charring	3.3.1	<u>1/ 8/</u>
Staple		
Denier	3.3.1	Visual <u>1/</u>
Length	3 3.1	Visual <u>1/</u>
Yarn		
Blend	3 3.2	<u>1/</u>
Ply	3 3.2	Visual <u>2/</u>
Colorfastness to:		
Light	3.4.2	5660 <u>6/</u>
Laundering	3.4.2	5610
Weave	3 5	Visual <u>2/</u>
Weight	3 5	5041 <u>11/</u>
Yarns per inch:		
Warp	3.5	5050
Filling	3.5	5050
Breaking Strength:		
Warp	3.5	5100
Filling	3.5	5100
Tearing Strength		
Warp	3 5	5132
Filling	3.5	5132
Air permeability	3 5	5450
Flame resistance	3.5	5903 & 59053 <u>3/ 10/</u>
Nonfibrous material	3.5	2611 <u>11/ 13/</u>
Flammability	3 5	4.7.2
Moisture content	3.5	2600 <u>9/ 11/</u>
pH	3.5	2811 <u>12/</u>
Curling	3.5	4.7.1
Antistatic Properties (class 1)		
Before laundering	3.6.1	5930 <u>4/ 7/</u>
After five launderings	3 6.1	5930 <u>3/ 4/ 7/</u>
Spray rating (class 2)	3.6.2 1	5526
Dimensional stability		
After fifteen launderings	3.8	<u>3/</u>
Seam efficiency	3 9	5110 <u>5/</u>

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- 1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirements.
- 2/ One determination shall be made from each sample unit and the results reported as "pass" or "fail."
- 3/ AATCC 135-1987 version, Permanent press machine cycle, 60° C (140° F), tumble dry permanent press cycle.
- 4/ Average of three determinations to nearest 1.0×10^{11} ohms per square.
- 5/ The needle shall be ball point, size 20, classified 125 at the blade. The thread for the needle shall be T35, 30/2 para aramid, conforming to MIL-T-44100.
- 6/ Except that the suppliers submission shall be compared with the standard sample after 6 hours and evaluated.
- 7/ AATCC Test Number 76-1978, Electrical Resistivity of Fabrics.
- 8/ Fiber puffs shall be suspended in oven such that the entire specimen is no less than 2 inches from any oven surface. Oven shall not be vented, nor shall air within the oven be circulated artificially during the test. Fiber shall be exposed for a minimum of five (5) minutes to the temperature specified. Oven recovery time shall not be more than 3 minutes and shall not be counted as exposure time.
- 9/ Five specimen samples shall be tested from each sample unit.
- 10/ Fabric samples shall be laundered 5 times prior to testing.
- 11/ Fabric samples shall be tested prior to the application of antistatic or water repellent finish.
- 12/ Determined on water extract of finished cloth.
- 13/ Including starch and protein matter as well as chloroform and water soluble material

5. PACKAGING

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

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

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

5.2.1 Levels A, B and C. 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 order, shipments shall be marked in accordance with PPP-P-1133.

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6. NOTES

6.1 Intended use. The cloth covered by this specification is intended for use in the fabrication of special flight, shipboard, and ground combat clothing.

6.2 Ordering data. Procurement documents should specify the following:

- a Title, number and date of this specification
- b First article (see 3.2 and 4.2)
- c Width of cloth required when other than specified (see 3.5.1)
- d Length required if other than specified (see 3.9)
- e Selection of applicable levels of packaging and packing (see 5.1 and 5.2)
- f Class of cloth required (see 1.2)
- g Blend of cloth required (see 3.3.2)

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

6.4 The cloth requirements were based on a construction using 38/2 warp and filling yarn. The 1.4 denier, 2.0 inch PBI fiber used to manufacture this yarn was obtained from Hoechst Celanese Corporation, PBI Products Division, and the 1.5 denier, 2.0 inch cut length, T-455 aramid fiber from E. I. DuPont de Nemours Company.

6.5 An in-loom construction of 64 ends X 54 picks reeded 2 per dent has been successful in the production of this fabric.

6.6 Suitable antistatic treatment for this cloth is an aqueous solution including 4.0 percent Aston 123, 0.4 percent Eponite 100 and 0.05 percent Neutronyx 600 at pH 6.0.

6.7 Suitable stainless steel fiber for this cloth is Bekinox VS. Bekinox fiber is available from Bekeart Steel Wire Corporation, 1395 Marietta Parkway, Building 500, Suite 100, Marietta, Georgia 30067.

6.8 The "Quarapel type" water repellent treatment consists of the co-application of an emulsified fluorocarbon and a fluorocarbon extender. List of approved components and combinations is available from U. S. Army Natick Research and Development Center, Natick, MA.

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6.9 Subject term (key word) listing

Antistatic finish
Aramid
Cloth
Colorfast
Curling
Defects
Dye
Fabric
Fiber
Flame resistance
Flight clothing
Ground combat clothing
Material
Polybenzimidazole
Shipboard clothing
Shrink
Stainless steel fiber
Water repellent
Weave
Yarn

Custodian:
Air Force - 11

Preparing Activity:
Air Force - 11

Review Activity:
DLA - CT
Navy - NU

Project No 8305-F453

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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I RECOMMEND A CHANGE
1 DOCUMENT NUMBER
 MIL-C-87262 (USAF)

2 DOCUMENT DATE (YYMMDD)
 92C211
3. DOCUMENT TITLE

Cloth, Plain Weave, Polybenzimidazole/Aramid Blend

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**7 DATE SUBMITTED**
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