

MIL-C-4294A(USAF)

24 September 1979

SUPERSEDING

MIL-C-4294(USAF)

3 April 1952

MILITARY SPECIFICATION

CLOTH, TWILL, NYLON

This specification is approved for use by the Air Force Materials Laboratory, Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense

1. SCOPE

1.1 Scope. This specification covers continuous filament nylon fabric of several weights for use in aviation ground clothing.

1.2 Classification. The cloth covered by this specification shall be of the following types and classes as specified (see 6.2):

Type I - 3.30 ounces per square yard, nominal weight.

Class A - Finished natural.

Class B - Water resistant treatment.

Type II - 5.40 ounces per square yard, nominal weight.

Class A - Finished natural.

Class B - Water resistant treatment.

Class C - Finished natural - heavily calendered.

Class D - Water resistant treatment - heavily calendered.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Air Force Materials Laboratory, WPAFB, OH 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8305

MIL-C-4294A(USAF)

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-P-1133 -Packing and Packing of Synthetic Fiber Fabrics

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.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply.

Textile Fiber Products Act

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

3. REQUIREMENTS

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

MIL-C-4294A(USAF)*

3.2 First article. When specified (see 6.2), the supplier shall furnish a sample for first article inspection and approval.

3.3 Material.

3.3.1 Nylon yarn. The nylon yarn shall be a bright luster polyamide prepared from hexamethylene diamine and adipic acid, or its derivatives. It shall have a minimum melting point of 244°C (471°F). The warp yarn for both types shall be 70 denier. The filling yarn shall be 100 denier for Type I and 200 denier for Type II.

3.4 Physical requirements. The finished cloth shall conform to the physical requirements of Table I when tested as specified in 4.5.

3.5 Finish.

3.5.1 Type I. Type I cloth shall be finished to meet the requirements as stated:

Class A - Finished smooth and free from wrinkles.

Class B - Finished smooth and free from wrinkles and given a durable water repellent treatment to give an original Spray Rating of 100 and a Spray Rating of at least 70 after three launderings or three dry cleanings, when tested in accordance with 4.5.

3.5.2 Type II. Type II cloth shall be finished to meet the requirements as stated:

Class A - Finished smooth and free from wrinkles.

Class B - Finished smooth and free from wrinkles and given a durable water repellent treatment to give an original Spray Rating of 100 and a Spray Rating of at least 70 after three launderings or three dry cleanings, when tested in accordance with 4.5.

Class C - Finished smooth and free from wrinkles and heavily calendered.

Class D - Finished smooth and free from wrinkles, heavily calendered and given a durable water repellent treatment to give an original Spray Rating of 100 and a Spray Rating of at least 70 after three launderings or three dry cleanings, when tested in accordance with 4.5.

MIL-C-4294A(USAF)

Table I Physical requirements.

	T Y P E. I		T Y P E. I I			
	Class A	Class B	Class A	Class B	Class C	Class D
Weight, (Oz/Yd ²) Maximum	3.30	3.35	5.40	5.50	5.40	5.50
Breaking Strength (Pounds/Inch)						
Ravel Strip, Minimum	120	115	170	160	150	140
Warp						
Filling	100	100	160	155	160	150
Tear Strength (Pounds) Strip Tear, Minimum						
Warp	7	8	10	10	7	9
Filling	7	8	10	10	7	9
Thread Count, Minimum						
Warp	170	170	250	250	250	250
Filling	85	85	72	72	78	78
Filling Yarn Twist (turns per in.)	N.S.	N.S.	6.0 to 8.0	6.0 to 8.0	N.S.	N.S.
Ultimate Elongation(%) Minimum						
Warp	20	20	20	20	20	20
Filling	20	20	20	20	20	20
Air Permeability (ft ³ /Min/Ft ²)	Max.15	Max.15	Min.18	Min.18	Max.10	Max.10

NOTE: N.S. signifies "not specified".

MIL-C-4294A(USAF)

3.6 Residual shrinkage. The residual shrinkage of the cloth, when tested in accordance with 4.5, shall not be more than 2 percent in the warp direction and shall not be more than 1-1/2 percent in the filling direction.

3.7 Nonfibrous materials. The cloth shall not contain more than 3 percent of oils, sizing and non-fibrous matter when extracted with chloroform in accordance with 4.5.

3.7.1 pH. The cloth shall be so that the pH of the water extract shall be not lower than 6.0 nor higher than 8.0 when tested in accordance with 4.5.

3.8 Weave. The cloth shall be woven as a 2 up 2 down right hand twill, except that at the contractor's option, the weave of Type II cloth may be a 2 up 1 down right hand twill.

3.9 Width. The width, unless otherwise specified, shall be a minimum of 40 inches inclusive of selvages.

3.10 Color. Unless otherwise specified by the contract or purchase order (see 6.2), the cloth shall be furnished in Sage Green, Shade No. 1511.

3.10.1 Matching. The color shall match the approved standard shade when viewed under artificial daylight having a color temperature of 7500 degrees Kelvin and shall be a good approximation to the standard shade under incandescent lamplight at 2800 degrees Kelvin.

3.10.2 Colorfastness. The finished cloth shall shown fastness to laundering, light, dry cleaning, and perspiration equal to or better than the standard sample. When a standard is not available, the cloth shall show a minimum of "good" for each characteristic.

3.11 Fiber identification. Each roll of cloth shall be labeled or ticketed for fiber content in accordance with the Textile Fiber Products Identification Act.

3.12 Workmanship. The finished cloth shall conform to the quality established by this specification. The demerit points per 100 square yards, when calculated as specified in Section 4, shall not exceed the established maximum point value.

4. QUALITY ASSURANCE PROVISIONS

MIL-C-4294A(USAF)

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, 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.

4.2 Preacceptance inspection. (When applicable.)

4.3 Inspection for acceptance. Inspection shall be in accordance with the provisions of MIL-STD-105, except where otherwise indicated.

4.3.1 Examination of end item. Defects found during the examination shall be classified in accordance with 4.3.1.1, 4.3.1.2, and 4.3.1.3.

4.3.1.1 Yard-by-yard examination. 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, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects as defined in Section III of FED-STD-4, which are clearly noticeable at normal inspection distance (3 feet), shall be scored and assigned demerit points as listed in 4.3.1.1.1, except that only those slubs and knots which exceed the maximum limit shown in Figure 3 of FED-STD-4 shall be scored. No linear yard (increments of 1 yard on the measuring device on the inspection machine) from any one roll within the sample shall be penalized more than 4 points. The sample size shall be 20 rolls selected from 20 containers. The lot shall be unacceptable if the points per 100 square yards of the total yardage examined exceeds 30.0 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceed 40.0 points. If one roll exceeds 30.0 points per 100 square yards, a second sample of 20 rolls shall be examined only for individual roll quality examination. The lot shall be unacceptable if one or more rolls in the second sample exceeds 30.0 points per 100 yards. Point computation for lot quality and individual roll quality shall be as follows:

Total points scored in sample X 3600	Points per 100
Contracted width of cloth (inches) x total yards inspected	square yards

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

For defects 3 inches or less in any dimension	- one point
For defects exceeding 3 inches, but no exceeding 6 inches in any dimension	- two points
For defects exceeding 6 inches, but no exceeding 9 inches in any dimension	- three points
For defects exceeding 9 inches in any dimension	- four points.

MIL-C-4794A(USAF)

NOTE: 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
 Poor dye penetration, mottled, streaky, or cloudy
 Holes, cuts, tears, open places.

4.3.1.2 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 cause for rejection of the entire lot represented by the sample.

4.3.1.3 Examination for compliance with the rules and regulations under the Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll in the sample shall be examined for conformance to the Rules and Regulations under the Textile Fiber Product 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.

4.4 Examination of preparation for delivery requirements. An examination shall be made in accordance with the provisions of PPP-P-1133 to determine the packaging, packing and marking comply with the Section 5 requirements of this specification.

4.5 Testing of the end item. 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 average of the determinations made on sample unit for test purposes as specified in the applicable test method. The sample unit shall be four continuous yards, full width of the finished cloth. All test reports contain the individual values utilized in expressing the final results. The sample size shall be as shown in the list below. The lot size shall be expressed in units of one yard. The lot shall be unacceptable if one or more sample units fail to meet any requirement specified.

<u>Lot Size (Yards)</u>	<u>Sample Size</u>
800 or less	2
801 up to and including 22,000	3
22,001 and over	5

MIL-C-4294A(USAF)

4.6 Water resistance. The spray rating tests shall be conducted upon cloth of Type I, Class B and Type II, Classes B and D, in accordance with Method No. 5526 of FED-STD-191. After determination of original spray ratings, the same specimens, prepared by cutting 8 by 8 inch squares of the cloth, are tested for spray rating after being subjected to three dry cleanings, conducted in accordance with Method No. 5508, and also tested for spray rating after being subjected to three launderings conducted in accordance with Method No. 5614, except that the color transfer cloth of 4.5 of Method No. 5614 shall be omitted.

4.7 Shrinkage-boil test. After conditioning for not less than four hours, an 18-inch square shall be marked on a 20-inch square specimen by means of a template, using indelible ink. A metal tub of adequate size to accommodate the specimen prepared as described below shall be filled to within three inches of the top with water which shall then be heated to a boil. The sample for the Boil Test shall be prepared by joining the two sides cut filling-wise so as to form a loop which is threaded over a glass rod or tube 1/4 inch in diameter by 21 inches long. A hold down weight formed of a 1/4 inch diameter glass tube or rod approximately 21 inches in length and having a weight of 50 grams plus or minus 5 grams shall be introduced into the cloth loop. A glass rod or tube resting across the tub top shall support the cloth loop entirely below the surface of the water by wires connecting to the ends of the upper 21 inch tube or rod. The sample shall be supported so that the slight tension of the hold-down weight shall apply in the warp direction, and the cloth loop shall hang freely in the bath. The sample shall then be subjected to the action of the boiling water bath for a period of 15 minutes. It shall then be removed from the tub and allowed to drain for a few minutes, opened out and then placed flat on a horizontal screen to dry. After the specimen is thoroughly dry, it shall be exposed for at least four hours to the standard atmosphere and then be measured in three places in the warp direction and three places in the filling direction, and the amount of shrinkage recorded.

5. PACKAGING

5.1 Put-up and packaging. Packaging shall be Level A or C (See 6.2).

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

5.2 Packing Packing shall be Level A, B or C (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.

MIL-C-4429 A (USAF)

Table II. Test methods.

Characteristic	Requirement	Test method FED-STD-191 or paragraph	No. deter. per indiv. unit or product	Results reported as
Weight/oz. per sq. yd. (Max.)	Table I	5041	5	Avg. of the 5 det. to nearest 0.1 oz.
Breaking strength				
Warp (Min.)	Table I	5104	5	Avg. of 5 det. to nearest 1.0 lb.
Filling (Min.)	Table I	5104	5	
Tear strength				
Warp (Min.)	Table I	5134	5	Avg. of 5 det. to Nearest 1.0 lb.
Filling (Min.)	Table I	5134	5	
Thread count				
Warp (Min.)	Table I	5050	5	Avg. of 5 det. to nearest whole number.
Filling (Min.)	Table I	5050		
Twist per inch (Filling)	Table I	4052	10	Avg. of 10 det. to nearest whole number.
Type of Nylon	3.3.1 1/			
Elongation (Ultimate)				
Warp (Min.)	Table I	5104	5	Avg. of 5 det. to nearest 1.0 percent
Filling (Min.)	Table I	5104	5	
Air Permeability (Min. or Max. as specified in Table I)	Table I	5450	5	Avg. of 5 det. to nearest 0.1 cubic foot.

MIL-C-4294A(USAF)

Table II. Test methods - Continued

Characteristic	Requirement	Test method FED-STD-191 or paragraph	No. deter. per indiv. unit or product	Results reported as
Nonfibrous Materials	3.7	2611	2	Avg. of 2 det. to nearest 0.1 percent.
Neutrality (ph)	3.7.1	2810 or 2811 <u>2/</u>	2	Avg. of 2 det. to nearest 0.1 or 0.2 pH as designated by test method.
Residual shrinkage	3.6	4.7	3	Avg. of 3 det. to nearest 0.1
Weave	3.8	Visual	1	Pass or fail
Spray Rating Original	3.5.1 & 3.5.2	4.6	3	No individual value shall fall below the value specified.
After 3 laundering	3.5.1 & 3.5.2	5614 <u>3/</u>	3	
After 3 dry cleanings	3.5.1 & 3.5.2	5508	3	
Color Fastness to: Light	3.10.2	5670	1	Excellent, Good Fair or Poor
Laundering	3.10.2	5614	1	
Dry cleaning	3.10.2	5620	1	Excellent, Good Fair or Poor.
Perspiration	3.10.2	5682	1	

*MIL-C 4294A(USAF)

- 1/ A Contractor's Certification of Compliance is acceptable for this requirement in lieu of test results.
- 2/ In case of dispute Method 2811 shall rule.
- 3/ Except that the color transfer cloth referred to in paragraph 4.5 of Test Method 5614 shall be omitted

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

6 NOTES

6.1 Intended use. The cloth covered by this specification is intended for use in the manufacture of aviation ground clothing.

6.2 Ordering data. Procurement documents should specify the following:

- a Title, number and date of this specification.
- b. Width of cloth required (see 3.9).
- c Requirements for first article approval if applicable (see 3.2).
- d Selection for applicable levels of packaging and packing (see

5.2 and 5.3)

6.3 Standard sample. For access to standard sample, address the procuring activity issuing the invitation for bids (see 3.1).

Custodian:
Air Force - 11

Preparing Activity:
Air Force - 11

User:
Air Force - 99

Project No. 8305-0188

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