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AEROSPACE MATERIAL SPECIFICATION

SAE AMS3820 REV. B

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Superseding AMS3820A

Tape, Nylon Cloth For Ring-Slot Parachutes

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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1. SCOPE:

1.1 Form:

This specification covers a nylon cloth in the form of tape.

1.2 Application:

This tape has been used typically in construction of canopies of ribbon parachutes, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-W-43334 Webbing and Tape, Textile, Packaging and Packing of

FED-STD-191 Textile Test Methods

2.2 American National Standard:

Available from American Society for Quality Control, 611 East Wisconsin Avenue, Milwaukee, WI 53202.

ANSI/ASQZ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.3 Other Publications:

Available from the Federal Trade Commission, Washington, DC 20580.

Textile Fiber Products Identification Act, Rules and Regulations

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 Yarn: The yarn shall be 840/140 denier, bright, high tenacity, light and heat resistant polyamide prepared from hexamethylene diamine and adipic acid, or its derivatives. The yarn shall have a minimum melting point of 244 °C (471 °F).

3.1.1.1 The yarn shall not be bleached in any manner or in any subsequent process; acceptable on basis of supplier's certificate of compliance.

3.1.1.2 Twist: The warp and filling yarn shall have a minimum of 2-3/4 turns of "Z" twist per inch (25.4 mm).

3.1.1.3 Weave: The body and selvage shall be in accordance with Figure 1. The selvage weave shall be two ends of 840/140 denier woven as one, determined by visual inspection. One determination per sample unit and report results as "pass" or "fail." .

3.1.1.3.1 Narrow fabric looms may be used to weave the tape by folding over a 5-1/2 inch (140 mm) width in the loom that will unfold to an 11 inch (279 mm) finished tape off the loom.

3.2 Construction and Properties:

Shall be as specified in Table 1 and the following:

3.2.1 Color: Shall be natural.

3.2.2 Finish: The finished tape shall be smooth and even and shall not contain sizing, lubricating, or weighting materials.

3.2.3 Resistance to Light and Heat: The tape shall lose not more than 25% of its original breaking strength when tested for resistance to light and to heat in accordance with 4.5.2 and 4.5.3. Specimens shall be selected from the same continuous warp yarns as the specimens for the original breaking strength tests.

3.2.4 Fiber Identification: Each roll of tape shall be labeled, ticketed, or invoiced for fiber content in accordance with the Textile Fiber Products Identification Act.

TABLE 1 - Construction, Properties, and Test Methods

Property	Requirement	Test Method FED-STD-191
Weight, max	3.5 ounces per linear yard (109 g/linear m)	5040
Yarns per inch (25.4 mm), min		5050
Warp	48	
Filling	36	
Selvage	41	
Total Tape Width, including selvages	11 inch ± 1/4 (279 mm ± 6.4)	5020
Selvage Width, each	1-1/8 inch ± 1/16 (28.6 mm ± 1.6)	5020
Breaking Strength, min		5104
Body Width		
Warp	625 pounds force per inch (109 kN/m)	
Filling	450 pounds force per inch (79 kN/m)	
Breaking Strength, min		
Selvage Width	900 pounds force per inch (158 kN/m)	5104 (specimen width of 1-1/2 inch (38.1 mm) does not apply)
pH	4.5 to 8.5	2811
Permanence of Finish		
Air Permeability	70 cubic feet/minute per square foot ± 20 ($21.3\ m^3$/minute per m^2 ± 6)	5450 and 4.5.1
Thickness Increase, max	10%	5030 and 4.5.1
Shrinkage, max		4.5.1
Warp	5 %	
Filling	5 %	

3.3 Quality:

Tape, as received by purchaser, shall be clean, evenly woven, and free from foreign materials and from imperfections detrimental to usage of the tape.

3.3.1 Imperfections: Acceptability of each lot of webbing shall be based on defects shown in Table 2. The term "clearly noticeable" as used in Table 2 shall be interpreted to mean visible at normal inspection distance of appxoximately 3 feet (0.9 m).

TABLE 2 - Classification of Visual Defects

Defect	Description	Major	Minor
Abrasion mark	Any abrasion mark showing fuzziness.	X	
Biased filling	Over 2 inches (51 mm) from horizontal at greatest point of bias.	X	
Broken end or missing end	Two or more contiguous regardless of length.	X	
	Single, over 18 inches (457 mm) missing.	X	
	Single, 18 inches (457 mm) or under missing.		X
Broken or missing pick	Two or more contiguous regardless of length.	X	
	Single, regardless of length.		X
Coarse filling bar	Clearly noticeable and extending for more than 1 inch (25 mm) in the length direction of the tape.	X	
	Clearly noticeable and extending for 1 inch (25 mm) or under in the length direction of the tape.		X
Crease	Hard, embedded crease.	X	
Cut, hole, or tear	Three or more warp or filling threads ruptured at adjoining points.	X	
Distortion or slippage of threads	Any distortion or slippage of warp or filling threads that cannot readily be reset by hand.	X	
Filling bow	Over 2 inches (51 mm) in height, measured from a straight line chord to highest point of arc.	X	
Fine filling bar	Any clearly noticeable fine filling bar.	X	

TABLE 2 - (Continued)

Defect	Description	Major	Minor
Floats or skips	Any multiple float over 3/16 inch (4.8 mm) in either warp or filling direction. Single floats over 1/4 inch (6.4 mm) in length.	X	
	Pin floats, sequence of more than 1 inch (25 mm) continuous in length.	X	
	Two or more multiple floats (in any linear yard (0.9 m) over 1/8inch (3.2 mm) in either warp or filling direction.		X
	Single floats over 1/8 inch (3.2 mm) but less than 1/4inch (6.4 mm) in length.		X
	Single floats 1/8 inch (3.2 mm) and under in length shall not be considered as defects.		
Heavy filling bar or heavy place	Clearly noticeable and extending over 1 inch (25 mm) in length direction of the tape.	X	
	Clearly noticeable and extending for 1 inch (25 mm) or under in the length direction of tape.		X
Hitchback crack (warp crack)	Resulting in a thin place 3/8 inch (9.5 mm) or over in combined warp and filling directions	X	
Jerked-in filling or slough-off	Two or more additional yarns in the shed.	X	
	One additional yard in the shed.		X
	One-half inch (12.7 mm) and under shall not be considered a defect.		
Loops, kinks, or snarls, (except selvage)	Any over 1/8 inch (3.2 mm) in length.	X	
	Three or more in any linear yard (m) 1/8 inch (3.2 mm) or under in length.	X	
	One or two in any linear yard (m) 1/8 inch (3.2 mm) or under In length.		X

TABLE 2 - (Continued)

Defect	Description	Major	Minor
Mispick or double pick	Two or more additional picks in the shed.	X	
	One additional pick in the shed		X
Pick out mark	Resulting in a clearly noticeable thin or light place.	X	
Selvage cut, broken, torn, or scalloped	Any cut, broken, torn, or scalloped selvage	X	
Selvage slack or wavy	Clearly noticeable waviness along selvage edge when viewed without tension.	X	
Selvage stringy or loopy	Any stringy or loopy selvage projecting over 1/8 inch (3.2 mm).	X	
	Over 3 inches (76 mm) of continuous stringy or loopy selvage projecting 1/8 inch (3.2 mm) or under.	X	
	Three inches (76 mm) or under of continuous stringy or loopy selvage projecting 1/8 inch (3.2 mm) or under.		X
Selvage tight	Any clearly noticeable roll of edge or edges when tension is released.	X	
Smash	Any smash.	X	
Spot, stain, or streak	Clearly noticeable and over 1/2 square inch (323 mm^2) in area.	X	
	Clearly noticeable but 1/2 square inch (323 mm^2) or under in area.		X
Strip back	More than 5 per linear yard (0.9 linear m) over 1/4 inch (6.4 mm) in length.	X	
	5 or less per linear yard (0.9 linear m) over 1/4 inch (6.4 mm) in length.		X
Thin or light place, light set mark	Any clearly noticeable reduction in filling texture.	X	

TABLE 2 - (Continued)

Defect	Description	Major	Minor
Undrawn filling yarn (caused by uneven filling shrinkage)	Resulting in clearly noticeable pucker.	X	
Weak places	Any weak place.	X	
Wrong draw	Resulting in a clearly noticeable warpwise streak over 18 inches (457 mm) in length.	X	

3.3.2 Yard-by-Yard (Meter-by-Meter) Examination: The required continuous length of each piece shall be inspected on both sides and visual defects classified as shown Table 2. The defects shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition of the tape, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each warp-wise yard (0.9 m), or fraction thereof, in which the defect occurs. The lot shall be unacceptable when more than 1.0 major or 6.5 total (major and minor defects combined) defects are found per 100 yards (91.4 m) of the sample.

3.3.3 Overall Examination: Rolls with any of the following defects shall be unacceptable.

Objectionable odor
Uncleanliness throughout
Uneven weaving throughout
Not labeled in accordance with Textile Fiber Products Identification Act

3.3.4 Length Examinations:

3.3.4.1 Individual Rolls: Each roll shall be examined for the following defects; any roll with any of the listed will be unacceptable.

Number of pieces in roll not indicated on piece ticket
Gross length less than specified minimum length
Total gross length is more than 2 yards (1.8 m) less than the sum of the gross lengths marked on individual piece tickets
Any roll containing more than three pieces
Any piece under 10 yards (9 m) in length

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The manufacturer of tape shall supply all samples and shall be responsible for all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tape conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Weight and breaking strength (Table 1) and quality (3.3) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of tape to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Each lot of tape shall be visually examined as required for quality (3.3) and sampled at random for all other tests; the number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 Yarn Tests: Prior to weaving the webbing, the yarn shall be sampled as shown in Table 3, using 500 yards (457 m) as the sample unit. The lot shall be unacceptable if one or more units fail to meet any specified requirement.

TABLE 3 - Yarn Sampling

Lot Size Yards	Lot Size Meters	Number of Sample Units
Up to 800, incl	Up to 732, incl	2
Over 800 to 2000, incl	Over 732 to 1829, incl	3
Over 2000	Over 1829	5

4.3.1.2 Yard-by-Yard (Meter-by-Meter) Examination: The sample unit shall be 1 linear yard (0.9 linear m). Sample size shall be in accordance with ANS1/ASQZ Z1.4. The number of rolls from which the sample is selected shall be in accordance with Table 4.

4.3.1.3 Overall Examination: The sample unit shall be one roll. The sample size and acceptance number shall be as specified in Table 4.

4.3.1.4 Length Examination: The sample unit shall be one roll. The sample size and acceptance number shall be as specified in Table 4.

TABLE 4 - Sampling Plan

Lot Size Yards	Lot Size Meters	Sample Size Rolls	Number of Defects Accepted in Sample max
Up to 1200, incl	Up to 1097, incl	3	0
Over 1200 to 3000, incl	Over 1097 to 2743, incl	5	0
Over 3200 to 10,000, incl	Over 2743 to 9144, incl	8	0
Over 10,000 to 35,000, incl	Over 9144 to 32,004, incl	13	0
Over 35,000 to 150,000, incl	Over 32,004 to 137,160, incl	20	1
Over 150,000	Over 137,160	32	2

4.3.1.5 Property Examination: The lot shall be unacceptable if one or more units fail to meet any specified requirement. The lot size shall be expressed in units of yards (meters). The sample unit shall be 15 yards (13.7 m) long. The number of sample units required per lot is shown in Table 5. All tests shall be performed under standard conditions in accordance with FED-STD-191, Section 4.

TABLE 5 - Tape Sampling

Lot Size Yards	Lot Size Meters	Number of Sample Units
Up to 800, incl	Up to 732, incl	2
Over 800 to 10,000, incl	Over 732 to 9144, incl	3
Over 10,000	Over 9144	5

4.3.1.6 A lot shall be all tape of a single size and configuration, produced in a single production run under the same fixed conditions, and presented for manufacturer's inspection at one time (See 5.1.1). For mechanical property testing, an inspection lot shall not exceed 5000 yards (4572 m).

4.3.1.7 A statistical sampling plan, acceptable to purchaser, may be used in lieu of sampling as in 4.3.1.

4.3.2 Preproduction Tests: Acceptable to purchaser.

4.4 Approval:

4.4.1 Sample tape shall be approved by purchaser before tape for production use is supplied, unless such approval be waived by purchaser. Results of tests on production tape shall be essentially equivalent to those on the approved sample tape.

4.4.2 The production tape shall be made using the same materials and processing procedures as were used for preproduction cord. If any changes are required, the manufacturer shall submit a statement of the proposed changes and, when requested, a sample of revised tape. Production tape shall not be shipped before changes are approved.

4.5 Test Methods: Shall be as specified in Table 1 and 4.5.1, 4.5.2, and 4.5.3.

4.5.1 Permanence of Finish:

4.5.1.1 The tape shall be conditioned for at least 3.5 hours under standard conditions specified in FED-STD-191, Section 4.

4.5.1.2 A 8-inch (204-mm) square, excluding the selvages, shall be marked on the conditioned specimen by means of a template, using indelible ink. Divide the square into 2-inch (50.8-mm) squares with three equally spaced lines in the warp direction, and three equally spaced lines in the fill direction. Extend the fill lines into the selvage. Measure the thickness of the body of the tape at the intersections of the warp and fill lines (nine places); and the thickness of the selvage in the center of the selvage on the extended fill lines (six places). Measure the width of the square on the lines (5 places in the warp and fill).

4.5.1.3 A metal tub of adequate size to accommodate the specimen prepared as specified in 4.5.1.4, shall be filled to within 3 inches (76 mm) of the top with water which shall then be heated to a boil.

4.5.1.4 The specimen shall be placed in boiling water in a "skein" form prepared by stapling two opposite sides of the specimen together to form a loop or skein. The specimen shall be placed over a glass rod 1/4 inch (6.35 mm) in diameter and 21 inches (533 mm) long. A glass tube 1/4 inch (6.35 mm) in diameter and 21 inches (533 mm) long weighing approximately 45 grams shall be placed inside the loop at the bottom.

4.5.1.5 The loop shall then be suspended in the boiling water bath by attaching it to another glass rod 1/4 inch (6.35 mm) in diameter and 24 inches (610 mm) long by means of twine or wire. The 24 inch (610 mm) glass rod shall rest on top of the tub, allowing the specimen to hang freely in the bath.

4.5.1.6 The specimen shall be subjected to the action of the boiling water bath for not less than 15 minutes, after which the specimen shall be removed from the tub and allowed to drain for a few minutes; the staples shall be removed and the specimen placed flat on a horizontal screen to dry. After the specimen is thoroughly dry, it shall be exposed for not less than four hours to a standard atmosphere of 65% ± 5 relative humidity and temperature of 70 °F ± 2 (21 °C ± 1).

4.5.1.7 The 8-inch (203-mm) square shall be measured in three places in the warp direction and three places in the filling direction, and the amount of shrinkage recorded.

4.5.1.8 Air permeability and thickness tests shall again be conducted on the specimen to determine the air permeability and increase in thickness after exposure to boiling water.

4.5.2 Resistance to Light:

4.5.2.1 Five tests from the same continuous warp yarn as the specimens for the original breaking strength tests, shall be conducted from a 5 yard (4.6 m) sample unit of the tape. The test specimens shall be exposed in the accelerated weathering unit as specified in FED-STD-191, Method 5804. The specimens shall be placed side by side on the rack in such a manner that only the center portion of each specimen is exposed.

4.5.2.2 Corex D filters and sunshine carbons shall be used. The exposure time shall be 50 hours ± 0.5. The spray heads shall be cut off during the entire exposure period. At the end of the exposure period, the specimens shall be brought to equilibrium under standard conditions as defined in FED-STD-191, Section 4.

4.5.2.3 The specimens shall be tested for breaking strength in accordance with FED-STD-191, Method 5104, and the percent of breaking strength loss calculated using Equation 1.

$$\frac{\text{Original Breaking Strength - Breaking Strength After Aging}}{\text{Original Breaking Strength}} \times 100 = \text{\% Breaking Strength Loss} \qquad \text{(Eq.1)}$$

4.5.3 Resistance to Heat:

4.5.3.1 Five tests from the same continuous warp yarn as the specimens for the original breaking strength tests shall be conducted from a 5 yard (4.6 m) sample unit of the tape. The test specimens shall be suspended in a circulating-air oven at 180 °C ± 3 (356 °F ± 5) for not less than one hour. After removal from the oven, the specimens shall be brought to equilibrium under standard atmospheric conditions as specified in FED-STD-191, Section 4.

4.5.3.2 Specimens shall be tested for breaking strength in accordance with FED-STD-191, Method 5104, and the percent of breaking strength loss calculated using Equation 1.

4.6 Reports:

4.6.1 The supplier of tape shall furnish with each shipment a report from the manufacturer showing the results of tests to determine conformance to the acceptance test requirements and stating that the tape conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3820B, manufacturer's identification, width, specified tape breaking strength, and quantity.

4.6.2 The supplier of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 3820B, contractor or other direct supplier of tape, manufacturer's tape identification, part number, and quantity. When tape for making parts is produced or purchased by the parts supplier, that supplier shall inspect each lot of tape to determine conformance to the technical requirements and shall include copies of laboratory reports showing the results of tests to determine conformance.