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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3798A

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Superseding AMS 3798

WEBBING, LOW MODULUS ARAMID

1. SCOPE:

1.1 Form: This specification covers low-modulus aramid in the form of webbing.

1.2 Application: Primarily for use in construction of parachutes.

1.3 Classification: Low-modulus aramid webbing shall be as specified in the applicable detail specification, classified by width and strength. An example is shown in 8.2. The webbing covered by each detail specification appears as part of the title.

1.4 Safety - Hazardous Materials: While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D123 - Terminology Relating to Textile Materials
ASTM D1777 - Measuring Thickness of Textile Materials
ASTM D3774 - Width of Woven Fabric
ASTM D3776 - Mass Per Unit Area (Weight) of Woven Fabric

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Street, Philadelphia, PA 19120 except as specified in 2.3.4.

2.3.1 Federal Standards:

FED-STD-4 - Glossary of Fabric Imperfections
FED-STD-191 - Textile Test Methods
FED-STD-595 - Color

2.3.2 Military Specifications:

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

2.3.3 Military Standards:

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

2.3.4 Other Publications: Available from Federal Trade Commission, Washington, DC 20580.

Rules and Regulations Under the Textile Fiber Products Identification Act

3. TECHNICAL REQUIREMENTS:

3.1 Detail Specifications: The requirement for a specific webbing shall consist of all the requirements specified herein in addition to the requirements specified in the applicable detail specification. In case of conflict between the requirements of this basic specification and an applicable detail specification, requirements of the detail specification shall govern.

3.2 Material: The webbing shall be woven from low-modulus aramid fibers; yarn shall not begin to char at a temperature lower than 355°C (671°F), determined in accordance with 4.5.1. The yarn shall be of the filament count, denier, twist, color, and weave as specified in the applicable detail specification.

3.3 Properties of Yarn: Shall be as specified in the applicable detail specification, determined in accordance with the following test methods:

Carbonization (See 3.3.1)	4.5.1
Denier	4.5.2
Twist	Visual

3.3.1 Carbonization: The yarn manufacturer's statement of conformance may be used in lieu of actual test; however, if testing is performed after weaving, the sample for test shall be obtained by unraveling the woven webbing.

3.4 Properties of Webbing: Shall be as specified in the applicable detail specification, determined in accordance with 4.5.

3.5 Quality: The finished webbing, as received by purchaser, shall be evenly woven and free from foreign materials and from imperfections detrimental to usage of the webbing.

3.5.1 Imperfections: Acceptability of each lot of webbing shall be based on defects defined in FED-STD-4 and as specified in Table I herein.

3.5.2 Yard-by-Yard Examination: The required length of each piece shall be inspected on both sides and visual defects classified as listed in Table I. 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 webbing, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each warpwise yard (0.9 m) or fraction thereof in which it occurs. The acceptance quality level (AQL) shall be 0.4 major and 2.5 total (major and minor defects combined) defects per 100 units. The lot size shall be expressed in units of 1 linear yard (0.9 m) each. An approximately equal number of yards (metres) shall be examined from each roll selected. Definition of terms used herein are covered in ASTM D123.

TABLE I

CLASSIFICATION OF DEFECTS

Defect	Description (See 3.5.2.1)	Classification
Abrasion marks	Resulting in rupture of yarns or in nap sufficient to obscure the identity of any yarn, over 10% of width or 1 inch (25.4 mm) in length.	Major
Broken or missing end	2 or more regardless of length or a single end over 6 inches (152 mm) in length.	Major
	Single end from 0.25 to 6.0 inches (6.4 to 152 mm), inclusive.	Minor
Broken or missing pick	2 or more regardless of extent. (The filling tie-in or joining shall not be construed as a defect of any nature.)	Major

TABLE I (Continued)

CLASSIFICATION OF DEFECTS

Defect	Description (See 3.5.2.1)	Classification
Coarse or light filling bar	Resulting in noticeable difference in stiffness of webbing and extending over 0.25 inch (6.4 mm) in the length direction.	Major
	Resulting in noticeable difference in stiffness or thickness of webbing and extending 0.25 inch (6.4 mm) or under in length direction.	Minor
Crease, wrinkle, or twist	Webbing will not lay flat upon application of manual pressure due to twist or distortion.	Minor
Cut, hole, or tear	Any cut, hole, or tear.	Major
Drop ply	Clearly noticeable on more than 2 ends within same length and extending over 9 linear inches (229 linear mm) or more.	Major
	Clearly noticeable on 1 or 2 ends within same length and extending over 9 linear inches (229 linear mm) or more.	Minor
Edge beaded or corded	Noticeable increase in edge thickness or misformed edge.	Minor
Edge folded or rolled	(See crease or wrinkle defect)	Minor
Edge loopy	Forming clearly noticeable filling loops, or edge tied loosely to body of webbing for 2 linear inches (51 linear mm) or over.	Major
Edge loose (slack)	Resulting in waviness, distortion in orientation of filling, or looseness along edge.	Major
Edge scalloped	Any indentation of edge above the width tolerance as specified.	Major
Edge cut, torn, or frayed	Any cut, torn, or frayed edge or clearly noticeable rupture of yarn along edge.	Major
Edge tight	Resulting in noticeable tension along edge, or pucker, waviness, bagginess, or slackness that cannot be flattened by manual pressure.	Major

TABLE I (Continued)

CLASSIFICATION OF DEFECTS

Defect	Description (See 3.5.2.1)	Classification
Floats or skips	Multiple 0.5 inch (12.7 mm) or over in combined warp and filling directions or single float or skip over 1 inch (25.4 mm).	Major
	Multiple, under 0.5 inch (12.7 mm) in combined warp or filling directions or single float or skip over 0.5 inch (12.7 mm), but not over 1 inch (25.4 mm) if in warp, or over 0.2 inch (5 mm) of the width but not over 1 inch (25.4 mm), if in filling.	Minor
Hitchback crack	Clearly noticeable opening between adjoining picks, or warpwise tension area over part of the width resulting in noticeable light and heavy places.	Minor
Jerked-in filling, slough-off, and slug	A clearly noticeable loop of filling pulled in at edges.	Minor
Kinks	More than 3 kinks in any 9 linear inches (229 linear mm).	Major
Knots	More than 1 knot in any 9 linear inches (229 linear mm).	Major
	One knot every 2 yards (1.8 m) with untrimmed ends extending from surface of webbing.	Minor
Mispick, double pick	2 or more across the full width. Single across the full width.	Major Minor
Slack end	2 or more in the same length, jerked in between picks, or forming clearly noticeable loops on the surface.	Major
	Single, jerked in between picks, or forming clearly noticeable loops on the surface.	Minor
Slub or slug, gout	More than twice the thickness of the yarn (or ply if plied).	Minor
Smash	Any smash.	Major

TABLE I (Continued)

CLASSIFICATION OF DEFECTS

Defect	Description (See 3.5.2.1)	Classification
Spot, stain, or streak (See 3.5.2.2)	Any clearly noticeable dirt, rust, grease, oil spot, stain, or streak.	Major
Tight end	Clearly noticeable up to 12 inches (305 mm) in length.	Major
Wrong draw	Extending over 9 inches (229 mm).	Major
Identification	Misplaced Missing	Major Major

3.5.2.1 The terms "clearly noticeable" and "noticeable" contained in defect descriptions shall be interpreted to mean clearly visible at normal inspection distance (approximately 1 yard (0.9 m)).

3.5.2.2 For use in special items, any spot, stain, or streak up to 12 inches (305 mm) in length that can be covered with an approved white spotter shall be minor. Any spot, stain, or streak that cannot be covered or is longer than 12 inches (305 mm) shall be a major defect.

3.5.3 Overall Examination: Each defect listed below shall be counted no more than once in each roll examined. The sample unit for this examination shall be one roll. The sample size and acceptance number shall be as shown in Table II:

Defects

Objectionable odor
Unclean throughout
Uneven shading, spottiness, poor penetration
Off shade, i.e., not within established tolerance
Uneven weaving throughout

3.6 Sizes and Tolerances: Shall be as specified in the applicable detail specification.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the webbing shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the webbing conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification and the applicable detail specification are classified as acceptance tests and as preproduction tests and shall be performed prior to or on the initial shipment of webbing to a purchaser, on each lot, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 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: Shall be as follows:

4.3.1 For Acceptance Tests: Each lot of webbing shall be visually examined for Ø quality (3.3) and sampled at random for all other tests except as qualified by 4.3.1.5; the number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than the number shown in Table III, taken from 3 linear yards (2.7 linear m) of webbing.

4.3.1.1 Yarn Tests: Prior to weaving the webbing, the yarn shall be sampled for tests as specified below, using 1 cone, 1 tube, or 1 spool as the sample unit. The lot shall be unacceptable if one or more units fail to meet any requirement specified.

Lot Size		Number of Sample Units
Yards	Metres	
Up to 800, incl	Up to 732, incl	2
Over 800 to 10,000, incl	Over 732 to 9,144, incl	3
Over 10,000	Over 9,144	5

4.3.1.2 Yard-by-Yard Examination of Webbing: The unit of webbing for this examination shall be 1 linear yard (0.9 linear m). The sample size shall be in accordance with Inspection Level III of MIL-STD-105.

4.3.1.3 Webbing - Overall Examination: The sample unit for this examination shall be one roll. The sample size and acceptance number shall be as shown in Table II. If a lot contains fewer than 3 rolls, each roll in the lot shall be examined.

TABLE II

SAMPLING FOR OVERALL EXAMINATION

Lot Size		Sample Size, Rolls	Maximum Number of Defects Accepted in Sample
Yards	Metres		
Up to 1,300, incl	Up to 1,189, incl	1	0
Over 1,300 to 3,200, incl	Over 1,189 to 2,926, incl	3	0
Over 3,200 to 8,000, incl	Over 2,926 to 7,315, incl	5	0
Over 8,000 to 22,000, incl	Over 7,315 to 20,117, incl	7	0
Over 22,000 to 110,000, incl	Over 20,117 to 100,584, incl	10	1
Over 110,000	Over 100,584	15	1

4.3.1.4 A lot shall be all webbing of a single size and configuration produced under the same fixed conditions and presented for vendor's inspection at one time. A lot may be packaged in smaller quantities and delivered under the basic lot approval provided the lot identification is maintained.

4.3.1.5 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6.1 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production webbing which are essentially the same as those used on the approved sample webbing. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and/or processing and, when requested, sample webbing. Production webbing made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods: Shall be as specified in Table III and as follows:

4.5.1 Carbonization:

4.5.1.1 Apparatus: A suitable melting point apparatus shall be used.

4.5.1.2 Procedure: A sufficient number of fibers shall be removed from the yarn sample for observation of carbonization. The temperature at which the yarn begins to stiffen or char shall be considered the end point of the test.

4.5.2 Denier: Shall be determined as follows:

4.5.2.1 Measure a 900 mm length of yarn to the nearest millimetre.

4.5.2.2 Weigh the yarn sample to the nearest 10 milligrams.

4.5.2.3 Calculate the denier (weight per length) as follows:

Denier = weight in grams of 9000 m = weight in grams of 900-mm sample x 10,000.

4.5.3 Breaking Strength: Shall be determined by testing full-width specimens. Tests shall be conducted on a machine of an approved type. Grips for holding the specimens shall be of the split-drum type, approximately 3-3/4 inches (95 mm) in diameter and 4 inches (102 mm) in length. The no-load rate of jaw separation shall be 4 inches (102 mm) per minute. The distance between the centers of the split drums at the start of the test shall be 10.0 inches ± 0.5 (254 mm ± 13). The minimum length of specimens taken for test shall be 40 inches (1016 mm). This length may vary with thickness of the webbing being tested.

TABLE III

TEST METHODS

Characteristics	Test Method	Number of Determinations per Individual Sample Unit	Results Reported as
Width	ASTM D3774	3	Nearest 1/16 inch (1.5 mm)
Thickness	ASTM D1777	3	Nearest 0.001 inch (0.02 mm)
Weight	ASTM D3776	3	Nearest 0.01 ounce (0.28 g)
Yarns per inch (25.4 mm)			
Face and Back	FED-STD-191, Method 5050 1/	3	Nearest whole number
Binder	FED-STD-191, Method 5050 1/	3	Nearest whole number
Picks per inch (25.4 mm)	FED-STD-191, Method 5050	3	Nearest whole number
Breaking Strength			
Original	FED-STD-191, Method 4108, and 4.5.3	5	Nearest 1.0 pound force 4.4N
After Aging	FED-STD-191, Method 4108, and 4.5.4	5	Nearest 1.0%
After Abrasion	FED-STD-191, Method 4108, and 4.5.5	5	Nearest 0.1%
Resin Treatment	2/	5	Nearest 0.1%
Extractable Matter	4.5.6	5	Nearest 0.1%

1/ Determination shall be made on full width of webbing.
2/ A certificate of compliance shall be submitted and will be acceptable for the stated requirement.

4.5.4 Aging: The size of the specimens for oven aging shall be the same as specified in 4.5.3 for the unaged tests. The specimens shall be placed in an oven at 260°C ± 5 (500°F ± 9) for 4 hours ± 0.1. Upon removal, the specimens shall be conditioned for 4 hours ± 0.1 at 20°C ± 1 (68°F ± 2) and 65% ± 2 relative humidity and then tested for breaking strength as specified in 4.5.3. The loss in breaking strength due to aging shall be reported as percent loss from the unaged specimens.

4.5.5 Abrasion: When specified in the detail specification, abrasion testing shall be performed as follows on a device conforming to Figure 1. The size of the specimens shall be the same as specified in 4.5.3 for breaking strength. New abrading edges of hexagonal steel rod (C) shall be used for each specimen tested. The webbing (A) shall have one end attached to weight (B), shall pass over the hexagonal rod (C), and shall be attached to the oscillating drum (D). The drum shall oscillate so that the webbing is given a 12-inch ± 1 (305-mm ± 25) traverse over the rod at a rate of 60 strokes ± 2 per minute. After 5000 strokes, the webbing shall be removed and the breaking strength determined. The breaking strength shall be the average of results obtained from the specimens tested and the loss in breaking strength (B.S.) shall be calculated as follows:

$$\frac{\text{Original B.S. - B.S. after abrasion}}{\text{Original B.S.}} \times 100 = \% \text{ Loss in B.S.}$$

4.5.6 Extractable Matter: When specified in the detail specification, extractable matter, inclusive of the resin deposit, shall be determined on a specimen of approximately 5 g (0.18 ounce) of the webbing. The sample, after separation of the warp and filling yarns, shall be dried to constant weight in a weighing bottle at 105°C ± 5 (221°F ± 9). After a 6-hours extraction with methyl ethyl ketone in a Soxhlet apparatus, the final weight of the extracted sample shall be obtained after constant weight has been obtained under the previous drying conditions.

$$\text{Percent extractable matter} = \frac{\text{loss in weight on extraction}}{\text{original dry weight of sample}} \times 100$$

4.5.7 Examination of Length:

4.5.7.1 Individual Roll: The roll shall be examined for gross length and the number and length of pieces on the roll. Any gross length (roll) found to be more than 2 yards (1.8 m) under the gross length marked on the piece ticket, or any roll found to contain more than the number of pieces allowed in the detail specification or any one piece less than 10 yards (9 m) in length shall be considered as a defect with respect to length. The sample size and acceptance level shall be as specified in Table II.

4.5.7.2 Total Length in Sample: The lot shall be unacceptable if the total actual gross length of rolls in the sample is less than the total of the gross length marked on the ticket.

4.5.8 Examination for Compliance with Textile Fiber Products Identification Act: During the examination of individual rolls for length, each roll in the sample shall be examined for conformance to the Textile Fiber Products Identification Act. Each roll not labeled in accordance with this act shall be a defect. The lot shall be unacceptable if two or more of these defects occur.

4.6 Reports:

4.6.1 The vendor of the webbing shall furnish with each shipment a report showing the results of tests to determine conformance to the technical requirements of this specification and the applicable detail specification. This report shall include the purchase order number, AMS 3798A and its applicable detail specification number and revision letter, if any, vendor's material designation, lot number, quantity, and specified webbing strength.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 3798A and its applicable detail specification number and revision letter, if any, contractor or other direct supplier of webbing, supplier's product identification, part number, and quantity. When webbing for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of webbing to determine conformance to the requirements of this specification and shall include in the report either a statement that the webbing conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the webbing may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the webbing represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Webbing shall be supplied in rolls of the size specified in the applicable detail specification.