

AEROSPACE MATERIAL SPECIFICATION

SAE AMS3798

REV. C

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Superseding AMS3798B

Webbing, Low Modulus Aramid

RATIONALE

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1. SCOPE:

1.1 Form:

This specification covers a low-modulus aramid in the form of webbing.

1.2 Application:

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

1.3 Classification:

Low-modulus aramid webbing shall be as specified in the applicable detail specification, classified by width and breaking 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 applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 123	Terminology Relating to Textile Materials
ASTM D 1777	Measuring Thickness of Textile Materials
ASTM D 3774	Width of Woven Fabric
ASTM D 3776	Mass Per Unit Area (Weight) of Woven Fabric

2.2 U.S. Government Publications:

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

FED-STD-4	Glossary of Fabric Imperfections
FED-STD-191	Textile Test Methods
FED-STD-595	Color
MIL-W-43334	Webbing and Tape, Textile, Packaging and Packing of
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes

2.3 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 requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between 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 4.5.2. The yarn shall be of the filament count, denier, twist, color, and weave 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)	4.5.2
Denier	4.5.3
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 test methods shown in 4.5.

3.5 Quality:

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 imperfections defined in FED-STD-4 and as specified in Table 1 herein.

- 3.5.2 Yard-by-Yard Examination: The required length of each piece shall be inspected on both sides and visual imperfections classified as listed in Table 1. All imperfections found shall be counted, regardless of their proximity to each other, except where two or more imperfections represent a single local condition of the webbing, in which case only the more serious imperfection shall be counted. A continuous imperfection shall be counted as one imperfection for each warpwise yard (0.9 m) or fraction thereof in which it occurs. Acceptable quality level shall be 0.4 major and 2.5 total (major and minor imperfections combined) imperfections 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 (meters) shall be examined from each roll selected. Definition of terms used herein are covered in ASTM D 123. The terms "clearly noticeable" and "noticeable" contained in imperfection descriptions shall be interpreted to mean clearly visible at normal inspection distance (approximately 1 yard (0.9 m)).

TABLE 1 - Classification of Imperfections

Imperfection	Description	Classification
Abrasion marks	Resulting in rupture of yarns or in nap sufficient to obscure the identify of any yarn, over 10% of width or over 1 inch (25 mm) in length.	Major
Broken or missing end	Two 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	Two or more regardless of extent. The filling tie-in or joining shall not be construed as an imperfection of any nature.	Major
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 two ends within same length and extending over 9 linear inches (229 linear mm) or more.	Major
	Clearly noticeable on one or two 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

TABLE 1 - Classification of Imperfections (Continued)

Imperfection	Description	Classification
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
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 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 mm) if in warp, or over 0.2 inch (5 mm) of the width but not over 1 inch (25 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 three kinks in any 9 linear inches (229 linear mm).	Major
Knots	More than one 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	Two or more across the full width.	Major
	Single across the full width.	Minor
Slack end	Two 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 1 - Classification of Imperfections (Continued)

Imperfection	Description	Classification
Spot, stain, or streak (See 3.5.2.1)	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	Major
	Missing	Major

3.5.2.1 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 imperfection, consisting of objectionable odors, unclean throughout, uneven shading, spottiness, poor penetration, off shade, i.e., not within established tolerance, or uneven weaving throughout, 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 2:

TABLE 2 - Sampling for Overall Examination

Lot Size Yards		Lot Size Meters		Sample Size, Rolls	Maximum Number of Imperfections Accepted in Sample
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

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 webbing shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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 for all technical requirements are acceptance tests and 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 ingredients 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 and Testing:

Shall be as follows

4.3.1 For Acceptance Tests: Each lot of webbing shall be visually examined for 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 4, taken from 3 linear yards (2.7 linear m) of webbing.

4.3.1.1 Yarn Tests: Prior to weaving the webbing, yarn shall be sampled for tests as shown in Table 3, using one cone, one tube, or one spool as the sample unit. The lot shall be unacceptable if one or more units fails 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 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 MIL-STD-105, Inspection Level III.
- 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 2. If a lot contains fewer than three rolls, each roll in the lot shall be examined.
- 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.
- 4.3.1.5 When a statistical sampling plan has 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 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. 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 ingredients 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 4 and as follows:

TABLE 4 - Test Methods

Characteristics	Test Method	Number of Determinations per Individual Sample Unit	Results Reported as
Width	ASTM D 3774	3	Nearest 1/16 inch (1.6 mm)
Thickness	ASTM D 1777	3	Nearest 0.001 inch (0.025 mm)
Weight	ASTM D 3776	3	Nearest 0.01 ounce (0.28 g)
Yarns per inch (25.4 mm)		3	
Face and Back	FED-STD-191, Method 5050 (A)		Nearest whole number
Binder	FED-STD-191, Method 5050 (A)	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 4.5.4	5	Nearest 1.0 pound force (4.4N)
After Aging	FED-STD-191, Method 4108, and 4.5.5	5	Nearest 0.1%
After Abrasion	FED-STD-191, Method 4108, and 4.5.6	5	Nearest 0.1%
Resin Treatment	(B)	5	Nearest 0.1%
Extractable Matter	4.5.7	5	Nearest 0.1%

(A) Determination shall be made on full width of webbing.
 (B) A certificate of compliance shall be submitted and will be acceptable for the stated requirement.

- 4.5.1 Except for breaking strength, the physical and chemical values specified apply to the average of the determinations made on a sample unit for test purposes as specified in the applicable test methods. For breaking strength, the lot is not acceptable if the value of any individual determination is lower than the required minimum. The sample unit shall be as specified in the basic specification.

4.5.2 Carbonization:

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

4.5.2.2 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.

4.5.3 Denier: Shall be determined as follows

4.5.3.1 Measure a 900 mm length of yarn to the nearest millimeter.

4.5.3.2 Weigh the yarn sample to the nearest 10 milligrams.

4.5.3.3 Calculate the denier (weight per length) using Equation 1.

$$\text{Denier} = \text{weight in grams of 9000 m} = \text{weight in grams of 900-mm sample} \times 10,000 \quad (\text{Eq. 1})$$

4.5.4 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 (95.2 mm) in diameter and 4 inches (102 mm) in length. The no-load rate of jaw separation shall be 4 inches per minute (1.7 mm/s). The distance between the centers of the split drums at the start of the test shall be 10.0 inches $\pm$ 0.5 (254 mm $\pm$ 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.

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

4.5.6 Abrasion: When specified in the detail specification, abrasion testing shall be performed on a device conforming to Figure 1. The size of the specimens shall be the same as specified in 4.5.4 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 $\pm$ 1 (305-mm $\pm$ 25) traverse over the rod at a rate of 60 strokes per minute $\pm$ 2. 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 using Equation 2.

$$\frac{\text{Original B.S.} - \text{B.S. after abrasion}}{\text{Original B.S.}} \times 100 = \% \text{ Loss in B.S.} \quad (\text{Eq. 2})$$

- 4.5.7 Extractable Matter: When specified in the detail specification, extractable matter, inclusive of the resin deposit, shall be determined on a specimen of approximately 5 grams (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 $105^{\circ}\text{C} \pm 5$ ($221^{\circ}\text{F} \pm 9$). After a six-hour 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. Use Equation 3.

$$\text{Percent extractable matter} = \frac{\text{loss in weight on extraction}}{\text{original dry weight of sample}} \times 100 \quad (\text{Eq. 3})$$

4.5.8 Examination of Length:

- 4.5.8.1 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 an imperfection with respect to length. The sample size and acceptance criteria shall be as specified in Table 2.
- 4.5.8.2 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.
- 4.5.9 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 an imperfection. The lot shall be unacceptable if two or more of these imperfections occur.

4.6 Reports:

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

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. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

- 5.1.1 A lot of webbing may be packaged in small quantities and delivered under the basic lot approval provided lot identification is maintained.