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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3799A

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Superseding AMS 3799

WEBBING, TUBULAR, LOW MODULUS ARAMID-54

1. SCOPE:

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

1.2 Application: Primarily for use in construction of parachutes.

1.3 Classification: Tubular 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 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 Avenue, Philadelphia, PA 19120 except as specified in 2.3.4.

2.3.1 Federal Standards:

FED-STD-4 - Glossary of Fabric Imperfections
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 requirements 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, which shall not begin to char at 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 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 Ø specification, determined in accordance with the following test methods and as specified in 4.5.7:

Width	ASTM D3774
Thickness	ASTM D1777 (See 3.4.1)
Weight	ASTM D3776
Breaking Strength	
As Received	4.5.3
Aged	4.5.4
Elongation	4.5.3
Weave	Visual
Warp Ends	Visual Count
Filling Picks	Visual Count
Color	FED-STD-595, Visual

3.4.1 A 6-ounce (1.7-N) total load shall be applied and the presser foot diameter shall be 3/8 inch (9.5 mm).

3.5 Quality: The webbing, as received by purchaser, shall be clean, 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 3.5.2.

3.5.2 Yard-by-Yard Examination: The required length of each piece shall be Ø inspected and visual defects classified as listed in Table I. The 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 (metre) or fraction thereof in which it occurs. For critical defects, the lot shall be rejected when one or more critical defects are found in the sample. The acceptable quality level shall be 0.15 critical defects, 0.4 major and 1.5 total (major and minor defects combined) defects per 100 units. The lot size shall be expressed in units of 1 linear yard (metre) each. An approximate equal number of yards (metres) shall be examined from each roll selected. Definitions 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.	Critical
Defect	Description (See 3.5.2.1)	Classification
Broken or missing end	2 or more regardless of length or a single end over 6 inches (152 mm) in length.	Critical
	Single end over 0.25 to 6.0 inches (6.4 to 152 mm), inclusive.	Minor
Broken or missing pick	2 or more regardless of extent.	Critical
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 (See 3.5.2.1).	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 or wrinkle	Twisted or distorted. Will not lay flat upon application of manual pressure.	Minor
Cut, hole, or tear	Any cut, hole, or tear	Critical
Drop ply	Clearly noticeable on more than 2 ends within same length and extending 9 linear inches (229 linear mm) or over.	Critical
	Clearly noticeable on 1 or 2 ends within same length and extending 9 linear inches (229 linear mm) or over.	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

TABLE I (Continued)

CLASSIFICATION OF DEFECTS

Defect	Description (See 3.5.2.1)	Classification
Edge loose	Resulting in waviness, distortion in orientation of filling, or looseness along edge.	Major
Edge nicks or bumps	Any nick or bump falling outside the width tolerance as specified or over 0.25 inch (6.4 mm) in length.	Major
Edge cut, torn, or frayed	Any cut, torn, or frayed edge or clearly noticeable rupture of yarn along edge.	Critical
Edge tight	Resulting in noticeable tension along edge, or pucker, waviness, bagginess, or slackness that cannot be flattened by manual pressure.	Critical
Fine or light filling bar, light place	Clearly noticeable.	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 more than 1 inch (25.4 mm).	Critical
	Multiple, under 0.5 inch (12.7 mm) in combined warp or filling directions or single float or skip over more than 0.5 inch (12.7 mm), but not over 1 inch (25.4 mm) if in warp, or more than 0.25 inch (6.4 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	More than twice the thickness of the normal yarn.	Minor
Kinks	More than 3 kinks in any linear inch (25.4 linear mm).	Major
Knots	More than 2 knots in any 9 linear inches (229 linear mm).	Major
Mispick, double pick	2 or more across the full width.	Major
	Single across the full width.	Minor

TABLE I (Continued)

CLASSIFICATION OF DEFECTS

Defect	Description (See 3.5.2.1)	Classification
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	More than twice the thickness of the yarn (or ply if plied).	Minor
Smash	Any smash.	Critical
Spot, stain, or streak	Any clearly noticeable dirt, rust, grease, oil spot, stain, or streak.	Major
Tight end	Clearly noticeable.	Major
Tight pick or tight filling	Resulting in rolling of webbing (also see Edge scalloped defect).	Major
Wrong draw	Extending over 9 inches (229 mm).	Major

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

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
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:

4.3.1 For Acceptance Tests: Each lot of webbing shall be visually examined as Ø required below for quality (3.5) 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 specified in 4.3.1.1 and 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 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 Webbing Tests:

4.3.1.2.1 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.

4.3.1.2.2 Webbing - Overall Examination: The sample unit for this examination shall be in accordance with Inspection Level III of MIL-STD-105.

TABLE II

SAMPLE FOR OVERALL EXAMINATION

Lot Size, Yards	Lot Size, Metres	Sample Size, Rolls	Maximum Number of Defects 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

4.3.1.2.2.1 If a lot contains less than 3 rolls, each roll in the lot shall be examined.

4.3.1.3 A lot shall be all webbing of a single size and configuration produced in a single production run under the same fixed conditions and presented for vendor's inspection at one time. For mechanical property testing, an inspection lot shall not exceed 5000 yards (4,572 m). A lot may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.4 Ø 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 approved 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 procedures shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

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 in grams 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 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 approved type. The test grips for holding the specimen 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 (250 mm ± 13). The minimum length of specimens taken for test shall be 40 inches (1016 mm). This length may vary with thickness of webbing being tested.

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 at 20°C ± 1 (68°F ± 2) and 65% ± 2 relative humidity for 4 hours ± 0.1, and then tested for breaking strength as specified in 4.5.3. The loss in breaking strength due to the aging treatment shall be reported as percent loss from the unaged specimens.

4.5.5 Examination of Length:

4.5.5.1 Individual Roll: The roll shall be examined for gross length and the number and length of pieces in the roll. Any gross length (roll) found to be more than 2 yards (1.8 m) below 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 20 yards (18 m) in length shall be considered as defective with respect to length. The unit of product for this examination shall be one roll. The sample size and acceptance number shall conform to Table II.

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

4.5.6 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.

4.5.7 Examination of Preparation for Delivery: An examination shall be made to determine conformance with the packaging, packing, and marking requirements of this specification. Defects shall be scored as specified in Table III. The sample unit shall be one shipping container fully prepared for delivery, with the exception that it need not be sealed. Defects of closure listed in Table IV shall be examined on shipping containers prepared for delivery. The lot size shall be the number of containers in the inspection lot. The inspection level shall be S-2 and the AQL shall be 4.0 defects per 100 units.

TABLE III

TEST METHODS

Characteristic	Number of Determinations	Results Reported As
Width	3	Pass or fail
Thickness	5	Nearest 0.001 inch (0.025 mm)
Weight	3	Nearest 0.01 pound (4.5 kg)
Breaking Strength		
Unaged	5	Nearest 1.0 pound force (4.4 N)
Aged	5	Nearest 1.0%
Elongation	5	Nearest 0.1%
Ends	3	Nearest whole number
Picks	3	Nearest whole number
Weave	1	Pass or fail

TABLE IV

CLOSURE DEFECTS

Examine	Defects
Marking (exterior and interior)	Omitted, incorrect, illegible, or improper size, location, sequence, or method of application.
Materials	Any component missing. Any component damaged, affecting serviceability.
Workmanship	Inadequate application of components, such as incomplete closure of case liners, container flaps, loose strapping, inadequate stapling. Bulging or distortion of containers.
Weight	Gross or net weight, or both, exceeds requirements.

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 applicable detail specification. This report shall include the purchase order number, AMS 3799A and applicable detail specification number, 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 3799A and applicable detail specification number, 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 the applicable detail 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.