

25 September 1974

SUPERSEDING

MIL-T-43435A

29 December 1969

(See 6.4)

MILITARY SPECIFICATION

TAPE, LACING AND TYING

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers five types of flat braided tapes suitable for lacing and tying (see 6.1).

1.2 Classification. The tape shall be of the following types, sizes, and finishes as specified (see 3.4, 3.6 and 6.2).

- Type I - - Polyamide (nylon) -
 - Finish A - Natural
 - Finish B - - Wax impregnated -
 - Finish C - Synthetic rubber or elastomer coating
 - Finish E - Vinyl chloride or vinyl chloride-acetate copolymer coating
 - Finish G - Liquid nylon coating
- Type II - Polyester
 - Finish A - Natural
 - Finish B - Wax impregnated
 - Finish C - Synthetic rubber or elastomer coating
 - Finish E - Vinyl chloride or vinyl chloride-acetate copolymer
- Type III - Tetrafluorocarbon
 - Finish A - Natural
 - Finish C - Synthetic rubber or elastomer coating
- Type IV - Glass
 - Finish C - Synthetic rubber or elastomer coating
 - Finish D - Tetrafluorocarbon coating (see 6.5)
 - Finish F - Silicone resin impregnated
- Type V - Polyamide (nylon) - heat resistant
 - Finish A - Natural
 - Finish B - Wax impregnated
 - Finish C - Synthetic rubber or elastomer coating
 - Finish F - Silicone resin impregnated
 - Finish G - Liquid nylon coating

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2. APPLICABLE DOCUMENTS

2.1 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:

SPECIFICATION

MILITARY

MIL-C-3131 - Cordage; Preparation for Delivery of.

STANDARDS

FEDERAL

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 suppliers in connection with specific procurement functions, should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Government and supplier purchases. The requirements specified in 3.11 and 3.12 apply only to tape purchased directly by the Government. All other requirements apply to tape purchased as a component for an end item by a supplier, and to tape purchased directly by the Government.

3.2 Materials.

— 3.2.1 Type I. The yarn used in the fabrication of type I tape shall be a high tenacity, continuous filament, nylon yarn.

3.2.2 Type II. The yarn used in the fabrication of the type II tape shall be a high tenacity, continuous filament, polyester yarn.

3.2.3 Type III. The yarn used in the fabrication of the type III tape shall be a continuous filament, tetrafluorocarbon yarn.

3.2.4 Type IV. The yarn used in the fabrication of the type IV tape shall be an electrical grade, continuous filament, glass yarn having high insulation resistance, high dielectric strength, high resistance to aging, and low moisture pickup. The material shall be free from any free alkali metal oxides, such as soda or potash, and from foreign particles, dirt, or other impurities.

3.2.5 Type V. The yarn used in the fabrication of the type V tape shall be an electrical grade, continuous filament, non-melting, aromatic polyamide yarn (see 6.3) having high temperature resistance, high insulation resistance, high dielectric strength, and high resistance to aging. The yarn shall be substantially free from sizing, loading and other adulterants.

3.3 Construction. Type I, II, III, IV and V tapes shall be braided in a flat braid construction.

* 3.4 Physical requirements. The finished tapes shall conform to the requirements specified in tables I through V when tested as specified in 4.2.5.

* TABLE I. Physical requirements - type I tape

Size	Width, inches (+ 10%)	Thickness, inches (+ 0.003)	Breaking strength, pounds (minimum)	Elongation, percent (maximum)
1	.200	.016	135	40
2	.110	.015	80	40
3	.085	.014	50	40
4	.060	.012	25	40
5	.050	.010 ^{1/}	15	40

^{1/} The tolerance for size 5 tapes shall be ± 0.004 inch.

* TABLE II. Physical requirements - type II tape

Size	Width, inches (+ 10%)	Thickness, inches (+ 0.003)	Breaking strength, pounds (minimum)	Elongation, percent (maximum)
1	.200	.016	135	40
2	.110	.015	80	40
3	.085	.014	50	40
4	.060	.012	25	40
5	.050	.010 ^{1/}	15	40

^{1/} The tolerance for size 5 tapes shall be ± 0.004 inch.

TABLE III. Physical requirements - type III tape

Size	Width, inches (+ 10%)	Thickness, inches (+ 0.003)	Breaking strength, pounds (minimum)	Elongation, percent (maximum)
1	-	-	-	-
2	.120	.011	30	30
3	-	-	-	-
4	.065	.011	15	30
5	.025	.011	10	30

TABLE IV. Physical requirements - type IV tape

Size	Width, inches (+ 10%)	Thickness, inches (+ 0.003)	Breaking strength, pounds (minimum)	Elongation, percent (maximum)
1	.225	.016	200	5
2	.110	.016	100	5
3	.085	.016	75	5
4	.060	.016	50	5
5	.050	.016	-	-

TABLE V. Physical requirements - type V tape

Size	Width, inches (+ 10%)	Thickness, inches (+ 0.003)	Breaking strength, pounds (minimum)	Elongation, percent (maximum)
1	.200	.016	85	40
2	.110	.014	30	40
3	.075	.012	35	40
4	.055	.010	25	40

* 3.5 Color. Unless otherwise specified (see 6.2), the color of the tape shall be natural. When other than natural color tape is specified, the color shall be imparted by using spun dyed fiber or by dyeing the fiber or tape prior to application of the finish.

- * 3.5.1 Colorfastness. When other than natural colored tape is specified, the finished tape shall show colorfastness to crocking equal to or better than the standard sample. When no standard sample is available the finished tape shall show no greater crocking than Munsell value of 6.5.

3.6 Finish. All tape finishes shall contain no copper, mercury, or compounds of copper or mercury. All finishes shall be able to be used freely in contact with insulated cable or wire (see 6.2).

3.6.1 Finish A. Natural finish shall denote a tape for which no consistency or luster other than that inherent in the material is required.

3.6.2 Finish B. Finish B tape shall be uniformly treated with micro-crystalline fungicide wax. The treated tape shall contain a minimum of 15 percent to a maximum of 32 percent wax when tested as specified in 4.2.5.

3.6.3 Finish C. Finish C tape shall be uniformly impregnated with a synthetic rubber finish. The treated tape shall contain a minimum of 7 percent to a maximum of 17 percent synthetic rubber impregnating material or elastomer coating when tested as specified in 4.2.5.

3.6.4 Finish D. Finish D tape yarns shall be uniformly impregnated with tetrafluorocarbon coating before braiding. The treated tape yarns shall contain a minimum of 10 percent to a maximum of 20 percent tetrafluorocarbon impregnating material when tested as specified in 4.2.5.

3.6.5 Finish E. Finish E tape shall be uniformly coated with virgin vinyl chloride or vinyl chloride acetate copolymers plasticized with phosphate or phthalate ester plasticizers exclusively. The finished tape shall contain a minimum of 15 percent to a maximum of 30 percent of the vinyl coating material when tested as specified in 4.2.5.

3.6.6 Finish F. Finish F tapes shall be uniformly impregnated with a silicone resin finish. The treated tape shall contain a minimum of 7 percent to a maximum of 17 percent silicone resin material when tested as specified in 4.2.5.

- * 3.6.7 Finish G. Finish G tapes shall be uniformly coated with liquid nylon polymer. The finished tape shall contain a minimum of 4 percent to a maximum of 14 percent of the liquid nylon polymer coating material when tested as specified in 4.2.5.

3.7 Fungus resistance. No tape shall show visible growth (to the naked eye) of fungus on the surface of the test specimens when tested as specified in 4.2.5.

- * 3.8 Knot slip resistance. Stress applied to a specimen made by joining two ends of the braided tape with a square knot shall result in the breakage of the tape specimen rather than the slippage or pulling out of the knot when tested as specified in 4.2.5. Knot slip resistance is not applicable to type III tapes or tapes which have finish A, B, D and E.
- * 3.9 Blocking. There shall be no visible damage or removal of the coatings on finish C, D, E, F, and G tapes when tested as specified in 4.2.5.
- * 3.10 Accelerated aging. When specified (see 6.2) finish C, D, E, F, and G tapes shall evidence no stiffness, brittleness, softness, or tackiness when tested as specified in 4.2.5.

3.11 Put-up. Unless otherwise specified (see 6.2), the tapes shall be furnished on parallel wind spools (reels) or universal wind tubes (hereinafter referred to as holders). Size 1 and 2 tapes shall be put up in 250 yard lengths and size 3, 4 and 5 tapes shall be put up in 500 yard lengths. A plus tolerance of 10 percent and a minus tolerance of 3 percent shall be allowed on the length of tape on any holder specified. The tape shall be free from twists, lumps or projecting ends and shall be evenly wound so that each turn and layer is free from entanglement and twisting. There shall be no more than four pieces per holder and no piece shall be less than 50 yards in length.

3.12 Identification. Each holder of tape shall have a label attached in such a manner as to remain in place and be clearly legible until all tape has been removed. The label shall be legibly printed, stamped, or typed with water insoluble ink. The label shall contain the following information.

Stock number
Nomenclature
Specification number
Type, finish and size
Yardage
Contract number and date
Supplier's name

3.12.1 Type III tape. Type III tape shall be accompanied by a warning label or sheet calling attention to the generation of hazardous vapors at temperatures above 400°F (204°C).

3.13 Workmanship. The finished tape shall conform to the quality and grade of product established by this specification. The occurrence of defects shall not exceed the applicable acceptable quality levels.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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.

4.1.1 Certificate of compliance. Where certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification.

4.2 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter:

4.2.1 Component and material inspection. In accordance with 4.1 above, components and materials shall be tested in accordance with all the requirements of referenced specifications, drawings, and standards unless otherwise excluded, amended, modified or qualified in this specification or applicable purchase document. In addition, inspection shall be performed for the requirements in table VI.

TABLE VI. Component test

Characteristic	Requirement reference	Test method
Material identification	3.2	<u>1/</u>
Finish identification	3.6	<u>1/</u>
Copper and mercury content	3.6	<u>1/</u>

1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirements.

- * 4.2.2 In-process inspection. Inspection shall be conducted to insure that processing is in accordance with the specified requirements. The Government reserves the right to exclude from consideration for acceptance any material or service for which in-process inspection has indicated nonconformance. The percentage of finish C, D, E, F, and G impregnating materials on the respective

type tapes shall be determined during processing in accordance with 4.2.5.1. The sample unit, lot size, sample size and acceptance criteria shall be as specified in 4.2.5. One determination shall be made per sample unit. The sample size shall be 5 regardless of the lot size, and the results shall be averaged.

4.2.3 Examination of the end item for visual defects. The defects listed in table VII shall be counted regardless of their proximity to each other. The sample unit for this examination shall be one holder of tape. The lot size for this examination shall be expressed in units each of holders of tape. The acceptable quality level (AQL) shall be 4.0 defects per 100 units. The inspection level shall be level I.

TABLE VII. Visual examination - defects

<u>Examine</u>	<u>Defect</u>
Appearance and workmanship	- Any cut - Chafed or damaged - Finish, lumpy, unevenly applied, resulting in thin or bare spots, clearly visible <u>1/</u>
Color	- Other than specified
Cleanness	- Overall uncleanness, clearly visible <u>1/</u>
Identification	- Omitted, incorrect, illegible, insecurely attached or not as specified - Handwritten entries - Warning sheet or label not included with type III tape

1/ At normal inspection distance (approximately 3 feet).

4.2.3.1 Examination for length and winding per holder. The sample unit for this examination shall be one holder. The inspection level shall be S-3 and the AQL shall be 4.0 percent defective. The lot size shall be expressed in units of one holder. Defects with regard to length and winding shall be considered to exist if any of the following are determined during inspection.

- (a) The total yardage of any one holder is less than minimum or more than the maximum specified in 3.11.

- (b) Length of tape on spool (reel) more than 2 yards less than length marked on label.
- (c) Improperly or not firmly wound resulting in kinks, entangling or slippage during unwinding or otherwise affecting free unhampered unwinding of tape.
- (d) Tape creased.
- (e) More than four pieces on any holder.
- (f) Any piece less than 50 yards in length.
- (g) Any twists, lumps or projecting ends.

4.2.3.2 Total yardage in sample. No AQL is applicable to the examination for total yardage. The number of holders examined under 4.2.3 shall be utilized in determining the total yardage. A lot shall be unacceptable if the total of the actual yardage of the individual holders in the sample is less than the total yardage marked on the labels.

4.2.4 Examination of preparation for delivery requirements. An examination shall be made to determine that packaging, packing and marking requirements comply with the section 5 requirements of this specification. The examination shall be in accordance with the provisions of MIL-C-3131, except that the inspection level shall be S-2 and the AQL shall be 2.5 defects per 100 units.

- * 4.2.5 Testing of the end item. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in table VIII shall be followed. The physical and chemical values specified in section 3, except as specified herein, apply to the average of the determinations made on a sample unit for test purposes as specified in the applicable test method. For the percentages of finish for finishes B, C, D, E, F, and G the requirements shall apply only to the lot average (average of all sample units within the lot). The sample unit for end item testing shall be one holder of finished tape. The sample unit for in-process inspection for percent add on for finish C, D, E, F, and G shall be as follows:

30 yards of unfinished tape
 30 yards of finished tape
 or
 120 yards of unfinished yarn
 120 yards of finished yarn

The lot size shall be expressed in units of one holder. The lot shall be unacceptable if one or more units fail to meet any test requirement specified or if the lot average of the percentages of finishes B, C, D, E, F, and G

fails to meet the requirement specified in 3.6. All test reports shall contain the individual values utilized in expressing the final result. The sample size (number of sample units) shall be in accordance with the following:

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

Tests to determine compliance with specification requirements including quantity of delivery may be made under prevailing atmospheric conditions, except in settlement of dispute, in which case the tests shall be made upon material which has reached equilibrium under standard conditions as defined in FED-STD-191.

TABLE VIII. Test methods

<u>Characteristic</u>	<u>Requirement paragraph</u>	<u>Test method</u>	<u>Number of determinations per sample unit</u>	<u>Results reported as</u>
<u>Construction</u>				
(Flat braid)	3.3	Visual	1	Pass or fail
Width	3.4	4.2.5.4	3	Avg. of 3 determinations to nearest 0.001 inch
Thickness	3.4	5030 <u>4/</u>	5	Avg. of 5 determinations to nearest 0.001 inch
Breaking strength	3.4	4102	5	Avg. of 5 determinations to nearest 0.5 pound
Elongation	3.4	4102 <u>1/</u>	5	Avg. of 5 determinations to nearest 0.2 percent
Colorfastness to crocking	3.5	5651	1	Pass or fail
Wax content	3.6.2	2611 <u>2/</u>	2	Avg. of 2 determinations to nearest 0.2 percent

TABLE VIII. Test methods (cont'd)

Characteristic	Requirement paragraph	Test method	Number of determinations per sample unit	Results reported as
Finish content	3.6.3 3.6.4 3.6.5 3.6.6 3.6.7	4.2.5.1	1	Pass or fail
Fungus resistance	3.7	5760	1	Pass or fail
Knot slip resistance	3.8	4.2.5.2	1	Pass or fail
Blocking	3.9	4.2.5.3	1	Pass or fail
Accelerated aging	3.10	5852 <u>3/</u>	1	Pass or fail

1/ To be determined simultaneously with breaking strength.

2/ The chloroform soluble procedure shall be used.

3/ Except that the specimen shall be 6 inches in length by the full width of the tape.

4/ A tension load equal to 5 ± 1 percent of the minimum specified breaking strength shall be applied to the specimen and the thickness determination shall be measured while under this load.

4.2.5.1 Determination of percentage of finish. The percentage of finish C, D, E, F, and G impregnating materials on the respective type tapes shall be determined during processing, by the supplier, by weighing an identical sample of tape or yarn (see 3.6.4), before and after the impregnating process. The test specimen shall be a minimum of 30 yards of tape or 120 yards of yarn as applicable. Weight (length per pound) shall be determined in accordance with Method 4010 of FED-STD-191. The percentage of finish shall be calculated as follows:

$$\text{Percent finish } \frac{B - A}{B} \times 100$$

Where: A = Length per pound of untreated tape or yarn, as applicable.

B = Length per pound of treated tape or yarn, as applicable.

4.2.5.2 Determination of knot slip resistance. The knot slip resistance of the tapes shall be determined in accordance with Method 4102, except as modified herein. The test specimens shall be cut in half and then the two halves shall be firmly tied together with a square knot. The two protruding ends at the knot shall be cut so that one-half inch protrudes. The specimen shall be aligned so that the knot is approximately halfway between the clamps. The machine shall be operated until the knot slips or pulls out or the specimen breaks at or in the proximity to the knot. Breaks closer than 1/2 inch of the jaws shall be discarded. Five good readings shall be obtained. If knot slippage is obtained on only one of the five readings, an additional specimen shall be tested and if a good reading is obtained, the reading indicating knot slippage shall be discarded.

4.2.5.3 Determination of blocking. Ten turns of the tape shall be wound on a 1/4-inch diameter clean metal mandrel under a 2-pound tension and the end secured through holes in the mandrel. Eight turns of tape shall then be wound on top of the first layer under the 2-pound tension and the ends secured as before. The wound mandrel shall then be placed in a temperature controlled oven at $70 \pm 1^\circ\text{C}$ for 2 hours, and in such a manner that no part of the specimen comes in contact with the surface of the oven. The specimen shall then be removed and cooled at room temperature. After cooling, the outer layer shall be unwound and examined for evidence of damage to the coatings due to adhesion between layers of turns. The first layer shall be examined while still in place for similar evidence of adherence and damage.

4.2.5.4 Determination of width. The width of the tapes shall be determined by using an optical comparator. The optical comparator used shall include a reticle calibrated to 0.005 inch divisions and shall incorporate a magnifier capable of magnifying the scale, a tension load equal to 5 ± 1 percent of the minimum specified breaking strength for each particular size shall be applied to the specimen and the width of the tape shall be measured while under this load.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C as specified (see 6.2).

5.1.1 Levels A and C. Tape shall be packaged in accordance with the applicable requirements of MIL-C-3131.

5.2 Packing. Packing shall be level A, B or C as specified (see 6.2).

5.2.1 Levels A, B and C. Tape shall be packed in accordance with the applicable requirements of MIL-C-3131.

5.3 Marking. In addition to any special marking required by the contract or order, interior packages and shipping containers shall be marked in accordance with MIL-C-3131.

6. NOTES

6.1 Intended use. The tape covered by this specification is intended for lacing and tying telephone switchboard cable forms, hookup wires, cable ends, aircraft cable bundles, electrical and electronic equipment, and electrical wire-harness assemblies.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Type, size and finish required (see 1.2, 3.4 and 3.6).
- (c) Color, if other than specified (see 3.5).
- (d) Put-up if other than specified (see 3.11).
- (e) When accelerated aging is required (see 3.10).
- (f) Selection of applicable levels of packaging and packing (see 5.1 and 5.2).

6.3 An acceptable material for type V tapes, Nomex (formerly called HI-1), is manufactured by E. I. du Pont de Nemours & Co., Inc. (see 3.2.5).

6.4 Supersession data. This specification includes the requirements of the nylon tape previously covered by specifications MIL-T-713A and MIL-T-00713B. These requirements are cited under type I, finish B tapes of this specification.

6.5 The application of an additional finish to type IV glass tape coated with finish D (tetrafluorocarbon coating) may be used when knot holding characteristics are desired.

6.6 Marginal identification. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and suppliers are cautioned to evaluate

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the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - GL
Navy - EC
Air Force - 82

Preparing activity:

Army - GL
Project No. 4020-0225

Review activities:

Army - EL, MD, MI, MU
Navy - AS
Air Force - 11
DSA - IS

User activities:

Army - ME, WC
Navy - MC, OS, SH

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION <i>(Mark one)</i>
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>	<input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify):</i> _____
5. PROBLEM AREAS	
a. Paragraph Number and Wording:	
b. Recommended Wording:	
c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER <i>(Last, First, MI) - Optional</i>	b. WORK TELEPHONE NUMBER <i>(Include Area Code) - Optional</i>
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code) - Optional</i>	8. DATE OF SUBMISSION <i>(YYMMDD)</i>

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

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PREVIOUS EDITION IS OBSOLETE.