MILITARY SPECIFICATION

THREAD, PARA-ARAMID, INTERMEDIATE MODULUS

This specification is approved for use by Air Force Materials Laboratory, Department of the Air Force, and is available for use by all Departments of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers requirements for para-aramid, intermediate modulus thread used for machine and hand-sewing (see 6.1).

1.2 Classification. The thread shall be furnished as twisted, soft multiple cord (soft finish), or as the same cord with resin finish, designated by a suffix R (see 3.1.2, 6.6 and Table I).

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

L-P-1183	Plastic Molding Material, Acrylonitrile-butadiene-styrene (ABS), Rigid
PPP-P-50	Packaging and Packing of Thread for Domestic and Overseas Shipment

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: AFML/MXA, WPAFB, O. 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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 contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D2146	Polypropylene Plastic Molding and Extrusion Materials

(Application for copies should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa 19103.)

(Technical Society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Materials.

3.1.1 Yarn. The yarn used in the manufacture of the threads shall be a para-aramid, intermediate modulus type of the denier, ply and twist specified in Table I.

TABLE I. Twisted soft multiple cord.

Letter size	Yarn Denier	Ply	Twist (turns per inch)		Length per pound (min) yards	Breaking strength (lb)
			Singles	Ply		
A	100	2	20S	10Z	20,000	8
B	200	2	12S	6Z	10,000	16
E	200	3	12S	6Z	6,700	25
F	200	4	10S	5Z	5,000	35
FF	400	3	8S	4Z	3,350	60
Number size						
3	400	5	10S	5Z	2,100	80
5	1000	4	7S	3.5Z	1,050	150
6	1500	3	6S	3Z	900	175
8	1500	5	5S	2.5Z	550	225

3.1.2 Finish. The thread shall be waxed or finish applied so that it shall have a smooth, dressed surface suitable for high-speed machine sewing. If better structural integrity is desired application of a 1/2 - 1 percent by weight (dry add-on) of a resinous finish such as polyvinyl butyral may be appropriate (see 6.6).

3.2 Construction and physical requirements. The finished thread shall conform to the requirements stated in Table I when tested as specified in 4.2.4 and Table IV.

3.2.1 Knots. Size FF and finer thread shall average not more than one thread-knot per two ounces (57g), and size 3 and heavier thread shall average not more than one thread-knot per four ounces (113g).

3.3 Put-up. Unless otherwise specified (see 6.2), the thread shall be put up on a nominal weight per holder basis on commercial straight paper tubes, single-head plastic tubes (see 3.3.1), single-head wooden spools, or skeins, (hereinafter referred to as holders) as specified in the contract or order in accordance with Table II. When put up on ready-made lockstitch bobbins

is specified, the style of bobbin and the length of thread therein shall be in accordance with the contract or order. The average weight per holder shall be not less than the specified net weight minus 3.0 percent tolerance when tested (on a 10-holder basis), as specified in 4.2.2. The thread shall be put-up in one continuous length per holder and shall be so wound that each turn and layer is free from entanglement when tested as specified in 4.2.1.

TABLE II. Put-up.

Letter size and number size	Type of holder	Net weight (oz) (see 3.3)
All letter sizes	Single wood spools	1
All letter sizes and number sizes 3 and 5; and size 6 when specified.	Single head plastic	4, 8 and 16
Number sizes 6 and 8; sizes 3 and 5 when specified.	Straight paper tubes	8 or 16
All letter sizes.	Skein	1

3.3.1 Plastic tubes. Except as otherwise specified or approved by the contracting officer, single-head plastic tubes shall be made of either acrylonitrile or polypropylene which shall conform to the following requirements.

3.3.1.1 Composition.

3.3.1.1.1 Acrylonitrile. The tubes shall be acrylonitrile-butadiene-styrene (ABS) rigid plastic (see 6.6) meeting the requirements of Type I of L-P-1183 with the following values substituted in the table of property values (see 4.2.4).

Property values	
Impact strength (Izod), min, ft-lb per inch of notch at 23° ± 2°C (1/8 inch sample) (0.32 cm).	1.5 (0.8)
Tensile yield stress, min, psi (KPa).	8,000 (55,120)
Deflection temperature under load, min, (264 psi fiber stress) (KPa).	190°F (88°C)
Modulus of elasticity in tension, min, psi (MPa).	400,000 (2756)
Rockwell hardness (R scale), min.	105
Specific gravity, 23°/23°C, max.	1.2
Chemical resistance, 40 hour immersion in heptane at 23° + 2°C weight change, max, percent.	5.0

3.3.1.1.2 Polypropylene. The tubes shall be molded from a virgin propylene homopolymer EL Rex PP-11S5 meeting the requirements of 1-58208 under ASTM D2146-68 (see 4.2.4).

3.4 Identification marking. Except when commercial identification markings are specified in the invitation to bid, each holder shall have a label attached in such a manner as to remain in place and be clearly legible until all thread has been removed. The label shall be printed with the information as specified below:

a. Stock number
b. Weight (net)
c. Direction of twist
d. Letter or number size and ply
e. Nomenclature
f. Contract or Purchase Order Number
g. Name of contractor
h. Date (month and year).

3.5 Workmanship. The finished thread shall conform to the quality established by this specification. The occurrence of defects shall not exceed the applicable acceptable quality levels (AQL's).

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 that 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 Inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.2.1 End item examination.

4.2.1.1 Thread on the holder. The thread shall be examined on the holder, and the defects listed in Table III shall be counted. The sample unit shall be one holder except the ready made bobbins shall be one gross. The lot size shall be expressed in units of one holder each except the ready made bobbins shall be expressed in units of one gross. The AQL shall be 4.0 defects per 100 units and the inspection level shall be S-3 of MIL-STD-105.

TABLE III. Defects of thread.

Examine	Defect on holders
Identification label	Missing, incorrect, incomplete, illegible or insecurely attached.
Type of holder	Other than specified.
Surface condition	Cut, tear, chafe, slip, affecting strength of thread or interfering with easy location of end and initial unwinding.
Cleanness	Dirt, spot or stain clearly noticeable.
Finish	Other than specified.

TABLE III. Defects of thread. (Continued)

Examine	Defect as unwound
Continuous length	Not in continuous lengths.
Knot	Size FF and finer thread shall average not more than one thread knot per two ounces, and size 3 and heavier thread shall average not more than one thread knot per four ounces.
Winding	Improperly or not firmly wound, resulting in kinks, knots, entangling or slippage during unwinding or otherwise affecting unwinding of thread.
Tackiness or adhesion	Strands adhere to each other or to holder affecting unwinding tension.

4.2.1.2 Thread as unwound. The thread shall be examined by unwinding, and defects listed in Table III shall be counted regardless of their proximity to each other. The sample unit shall be one holder except the ready made bobbins shall be one gross. The lot size shall be expressed in units of one holder each except the ready made bobbins shall be expressed in units of one gross. The AQL shall be 4.0 defects per 100 units and the inspection level shall be S-3 of MIL-STD-105.

4.2.2 Examination for net weight per holder. The sample unit for this examination shall be 10 wound holders, taken at random for the lot under test. The sample size shall be one sample unit regardless of lot size. The holders shall be weighed individually, and the net weight of thread determined. The values obtained shall be averaged, and this average shall represent the net weight per holder in the lot. The lot shall be unacceptable if the net weight per holder is less than the specified weight, minus the 3.0 percent tolerance (see 3.3).

4.2.3 Examination of preparation for delivery requirements. Examination shall be made in accordance with the provisions of PPP-P-50 to determine whether packaging, packing and marking comply with the Section 5 requirements of this specification.

4.2.4 Testing of the end item. The methods of testing specified in FED-STD-191, whenever applicable, and as listed in Table IV, shall be followed. The physical and chemical values specified in Section 3 apply to the results of the determinations made on a sample unit for test purposes. All test reports shall contain the individual values utilized in expressing the final result. The AQL for each characteristic shall be 6.5 test failures per 100 units, and the inspection level shall be level S-1. The sample unit shall be one holder of sufficient holders to provide enough thread for the applicable tests. The lot size shall be expressed in units of one holder, or gross of ready-wound bobbins.

TABLE IV. Test methods.

Characteristic	Requirement paragraph	Test Method FED-STD-191
Construction	3.2	Visual
Direction of twist:		
Initial	Table I	4050
Final	Table I	4050
Twist (tpi):		
Individual	Table I	4050 1/, 2/
Final	Table I	4054 1/, 2/
Number of plies	Table I	Visual 3/
Length per pound	Table I	4010
Breaking strength	Table I	4100 4/
Finish	3.1.2	Visual
Composition of plastic tubes	3.3.1	-- 1/

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

2/ The test for tpi in the individual cords (strands) shall be made in conjunction with that for the final twist. After recording the final twist and while the individual cords (strands)

are straight between the jaws, all cords but one shall be cut out and removed. The clamp shall then be opened, the slack drawn through, and the strand reset under the specified tension. The jaw shall then be rotated until all twist has been removed as determined by free passage of the needle between filaments. The tpi shall be calculated in the general procedure of method 4054.

3/ One determination per sample unit and the result reported as pass or fail.

4/ Except that capstan or drum type clamps shall be used, and five determinations shall be made per sample unit.

5. PACKAGING

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

5.1.1 Levels A, B, and C. The thread, put-up as specified in Table II shall be packaged in accordance with the applicable requirements of PPP-P-50.

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

5.2.1 Levels A, B, and C. The thread shall be packed in accordance with the applicable requirements of PPP-P-50.

5.3 Marking. In addition to any special markings specified in the contract or order, interior packages and shipping containers shall be marked in accordance with applicable provisions of PPP-P-50.

6. NOTES

6.1 Intended use. The threads covered by this specification are intended for use, as applicable, in items of clothing and equipage, and in air delivery and safety equipment.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

a. Title, number and date of this specification.
b. Letter of number size of thread required (see 1.2).
c. Direction of twist, if other than specified (see Table I).
d. Put-up required (see 3.3).
e. Selection of applicable levels of packaging and packing (see 5.1 and 5.2).

6.3 Kevlar 29 manufactured by the E. I. duPont de Nemours and Company is an acceptable yarn.

6.4 Twisting precautions.

a. Feed roll speed should be as follows for various Kevlar yarns and twist levels:

Yarn Denier	Twist (tpi)	Feed roll speed (yards per min)
200	5.0	70
400	4.0	90
1000	4.0	60
1500 and greater	1.8	20

b. Slightly heavier travelers than those used for nylon yarn should be used.

c. High humidity should be maintained to minimize electrostatic charge between filaments.

6.5 Winding precautions. Anti-wear wide tension gates (Leesona Corporation), or their equivalent, should be used.

6.6 Resin application. The following procedure has been found to be satisfactory:

Pass the thread through an impregnating bath containing 20 percent by weight of Butvar Dispersion BR (Monsanto Corporation, 50 percent solids in the product), followed by wiping over a soft felt, and drying in a heated oven or over drying cylinders.

Custodian:
Air Force - 11

Preparing Activity:
Air Force - 11

Project No. 8310-F119

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

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