

FEDERAL SPECIFICATION

STRAPPING, NONMETALLIC (AND CONNECTORS)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers nailless, flat nonmetallic strapping and connectors therefor, intended for use in securing packages and reinforcing bundles and containers (see 6.1).

1.2 Classification.

1.2.1 Types and grades. Strapping covered by this specification shall be of the following types and grades, as specified (see 6.2).

Type I - Strapping, cord.
Grade A - Regular duty.
Grade B - Heavy duty.

Type II - Strapping, water resistant, polyolefin plastic.

Type III - Strapping, water resistant nylon plastic.

2. APPLICABLE DOCUMENTS.

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified here-

Federal Specification:

PPP-S-636 - Boxes, Shipping, Fiberboard.

Federal Standard:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Office in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications:

MIL-P-116 - Preservation, Methods Of.

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
 MIL-STD-129 - Marking for Shipment and Storage.
 MIL-STD-147 - Palletized Unit Loads on 40 by 48 Inch Pallets.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Materials. Materials shall be of the quality normally used for the purposes in commercial practice and as hereinafter specified under each type and grade.

3.1.1 Type I. Strapping shall consist of longitudinal cords of high tensile strength bonded with a plastic binder, and shall meet the strength and dimensional requirements specified herein. The binder shall have a flash point of not less than 180°F. before it is combined with the cords to form strapping. The plastic binder shall comprise not less than 18 percent of the strapping by weight, and shall hold the individual longitudinal chords together to form a non-woven strapping material.

3.1.2 Type II. The type II strapping shall be an extruded, oriented polyolefin which meets the strength and dimensional requirements specified herein.

3.1.3 Type III. The type III strapping shall be an extruded, oriented nylon which meets the strength and dimensional requirements specified herein.

3.2 Breaking strength and elongation. The breaking strength and elongation of the nonmetallic strapping shall comply with the requirements shown in tables I, II, and III when tested in accordance with 4.4.2.

3.3 Dimensions.

3.3.1 Type I. Strapping shall be furnished in widths as specified in table I with an allowable tolerance of $\pm 1/32$ inch. The thickness of strapping shall be no less than 0.024 inch.

3.3.2 Type II. The strapping shall be furnished in the widths specified in table II, with an allowable tolerance of plus or minus 0.031 inch. Strapping with a smooth finish shall be furnished in the thickness specified in table II, with an allowable tolerance of ± 0.002 inch for strap 0.025 inch or less in thickness, and ± 0.003 inch for strap greater than 0.025 inch thick. When specified (see 5.2) the strapping shall have an embossed finish which yields an overall nominal thickness no greater than twice the nominal thickness of smooth strapping of the same width and breaking strength.

3.3.3 Type III. The strapping shall be furnished in the widths and thicknesses specified in table III. The width tolerance shall be ± 0.005 inch, and the thickness tolerance shall be ± 0.002 inch for strap 0.025 inch or less in thickness, and ± 0.003 inch for strap greater than 0.025 inch thick.

3.4 Spools. Unless otherwise specified, Type I strapping shall be furnished in one continuous length on spools, and shall be oscillated wound on fiber cores conforming to Table IV. The yardage of strap per spool shall be not less than that required by Table V. The number of splices per spool shall not exceed the following limits:

Spool weight approximately 20 pounds -	2 splices
ditto 40 pounds -	4 splices
ditto 80 pounds -	7 splices

TABLE I. Breaking strength, transverse strength and elongation percent of strapping (type I)

Nominal width of strapping, inch	Grade	Minimum breaking strength, pounds	Minimum elongation percent at break	Minimum transverse strength, grams
1/4	A	234	12	1250
3/8	A	350	12	1250
1/2	A	467	12	1250
5/8	A	585	12	1250
5/8	B	750	13	1250
3/4	A	700	12	1250
3/4	B	875	13	1250

TABLE II. Breaking strength and elongation percent of strapping (type II)

Nominal width of strapping	Nominal thickness inches (1)	Minimum breaking strength, pounds	Minimum elongation @ break, percent
7/32	.014	120	16
7/32	.018	160	16
1/4	.014	145	10
1/4	.015	180	10
1/4	.019	200	10
1/4	.027	290	10
3/8	.015	290	10
3/8	.018	250	10
3/8	.020	390	10
3/8	.024	350	10
7/16	.019	300	10
7/16	.025	450	10
7/16	.030	550	10
1/2	.0125	300	10
1/2	.015	390	10
1/2	.017	350	10
1/2	.020	530	10
1/2	.022	450	10
1/2	.025	660	10
1/2	.030	810	10
5/8	.015	500	10
5/8	.020	680	10
5/8	.025	850	10
5/8	.030	1030	10
3/4	.028	1050	10
1-1/4	.035	2350	10

(1) Nominal thicknesses for embossed strapping shall be no more than twice the figures shown hereinafter.

TABLE III. Breaking strength and elongation percent of strapping (type III)

Nominal width of strapping inch	Nominal thickness inch	Minimum breaking strength, pounds	Minimum elongation at break, percent
7/16	0.017	420	12
7/16	.023	560	12
7/16	.029	700	12
1/2	.015	420	12
1/2	.020	560	12
1/2	.025	700	12
1/2	.030	900	12

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TABLE IV. Core requirements for type I strapping

Approximate weight of spool, pounds	Length of core inch	Inside diameter of core, inch	Thickness of core wall, inch
15 to 25	5-1/2 ± 1/4	3 ± 1/8 - 0	0.060 ± 0.005
25 to 50	5-1/2 ± 1/4	3 ± 1/8 - 0	.250 ± .005
over 50	10 ± 1/4	3 ± 1/8 - 0	.250 ± .005

TABLE V. Types of spools, and yards per spool of type I strapping

Nominal width of strapping	Grade	Types of spool	Yards per spool
1/4	A	Regular	2,600
		Quad	10,400
3/8	A	Regular	1,750
		Quad	7,000
1/2	A	Regular	1,300
		Quad	5,200
5/8	A	Regular	1,000
		Quad	4,000
5/8	B	Double	1,400
		Quad	2,800
3/4	A	Regular	700
		Quad	2,800
3/4	B	Double	1,134
		Quad	2,268

3.5 Coil vardage. The minimum yards per coil of type II and III strapping shall be as specified in table VI for the size strap and coil width (when applicable) specified in the contract or order (see 6.2). The coil inside diameter and maximum outside diameter shall also be as specified in the ordering data (see 6.2). The coil shall be one continuous length of strapping.

TABLE VI. Coil vardage of type II and III strapping

Width, inch	Thickness, inch	Min. yards per 3- wide oscillated wound coil	Min. yards per 5-3/4" wide oscillated wound coil	Min. yards per 6" wide oscillated wound coil
7/32	.014			2500
7/32	.018			1360
1/4	.014		6500 ²	
1/4	.015	3150		
1/4	.019		5000 ³	
1/4	.022			6000
1/4	.027		3300	5000
3/8	.015	2166		
3/8	.018		3000	4000
3/8	.020	1600		
3/8	.024		2500	3000
7/16	.017			3175
7/16	.023			2350
7/16	.025			2600
7/16	.029			1860
7/16	.030			2150
1/2	.0125	2000		
1/2	.015	1500		2950
1/2	.017		1000 ⁴	3500
1/2	.020	1200		2360
1/2	.025	1000		1890
1/2	.030	750		1575

TABLE VI. (continued)

Width, inch	Thickness, inch	Min. yards per 3" wide oscillated wound coil	Min. yards per 5-3/4" wide oscillated wound coil	Min. yards per 6" wide oscillated wound coil
5/8	.015	1166		
5/8	.020	866		
5/8	.025	700		
5/8	.030	600		
3/4	.0285			
1 1/4	.0356			

Contractor may furnish more yards per coil than the minimum required unless otherwise specified.

22300 yards in self-contained dispensing carton.

31830 yards ditto

41000 yards ditto

51500 yards per 8" wide coil.

6167 yards per 1 1/4 inch wide ribbon wound coil.

3.6 Applicability. Strapping conforming to this specification shall be capable of practical application (see 6.1), using seals, buckles or welded joints, and strapping tools or equipment suitable for the size and type of strapping specified (see 6.2).

3.6.1 Seals and buckles. Seals and buckles shall be steel, and shall have a protective coating of zinc, cadmium, black iron oxide, or equivalent protection from corrosion.

3.6.2 Joint strength.

3.6.2.1 Type I strapping. Joints for Type I strap shall be made with seals or buckles. The joints shall have a tensile strength of not less than 40 percent of the required strap strength.

3.6.2.2 Type II and III strapping. Joints for types II and III strapping shall be made with seals or by welding. The joints shall have a tensile strength of not less than 40 percent of the required strap strength.

3.7 Workmanship. Strapping shall be straight, smooth, and clean and shall be free from kinks, grooves, edge curvature, indentation, cracks and other defects that may affect its serviceability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. 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 Inspection of materials and components. In accordance with 4.1, the supplier is responsible for insuring that materials and components used were manufactured, tested, and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or if none, in accordance with this specification. In the event of conflict, this specification shall govern.

4.2 Sampling. Sampling for inspection and testing shall be performed in accordance with the provisions set forth in MIL-STD-105, unless otherwise specified.

4.2.1 Lot. All nonmetallic strapping of the same type, grade, and dimension presented at one time, produced by one manufacturer shall be considered a lot for the purpose of inspection.

4.2.2 Sampling for examination. A random sample of spools or coils shall be selected from each lot of material offered for examination in accordance with table VII.

4.2.3 Sampling for tests. A random sample of spools or coils shall be selected from each inspection lot in accordance with table VIII and shall be subjected to the tests specified in 4.4.

4.3 Examination. Each of the sample spools or coils selected in accordance with 4.2.2 shall be examined to verify compliance with this specification. Examination shall be conducted as specified in table IX after first removing one or more turns of material from the spool or coil for a length of eight feet. Any spool or coil in the sample containing one or more defects shall be rejected and if the number of defective spools or coils in any sample exceeds the acceptance number for that sample, the lot represented by the sample shall be rejected.

TABLE VII. Sampling for examination

Number of spools or coils in a lot	Number of spools or coils in a sample	Acceptance number (defective)	Rejection number (defective)
20 and under	4	0	1
21 to 99	8	0	1
100 to 229	16	0	1
230 to 399	20	1	2
400 to 799	28	2	3
800 and over	40	3	4

TABLE VIII. Sampling for acceptance inspection tests

Number of spools or coils in a lot	Number of spools or coils in a sample	Acceptance number (number of spools or coils non-conforming on any test)	Rejection number
25 and under	5	0	1
26 to 40	7	0	1
41 to 65	10	0	1
66 to 110	15	1	2
111 to 180	25	1	2
181 to 300	35	1	2
301 to 500	50	2	3
501 to 800	75	3	4
801 to 1300	110	4	5

4.4 Tests. Each of the sample spools or coils selected in accordance with 4.2.3 shall be tested in accordance with prescribed tests to verify compliance with this specification. The average of five specimen breaks per spool or coil shall be considered a complete test. Any spool or coil which does not meet the requirements for these characteristics shall be rejected, and if the number of nonconforming spools or coils in any sample exceeds the acceptance number for that sample, the lot represented by the sample shall be rejected. Tests required by this specification shall be performed by the supplier in a laboratory acceptable to the Government.

TABLE IX. Classification of defects of nonmetallic strapping in accordance with MIL-STD-105

Categories	Defects
Critical: 1	None defined.
Major: 101	Nominal width and thickness of strapping not as specified or not within the allowable tolerances.
102	Plastic finish defective; coating less than 18 percent of the strapping by weight (type I).
103	Number of splices per spool or coil exceeds the permissible maximum.
104	Dimensions of core or coil not within allowable tolerance.
105	Type and grade not as specified.
Minor: 201	Packaging and packing not in accordance with 3.1 or 3.2 as specified.

4.4.1 Conditioning. Test samples shall be conditioned and tested in a uniformly maintained atmosphere of $23^{\circ} \pm 2^{\circ}\text{C}$. ($73.4^{\circ} \pm 3.6^{\circ}\text{F}$.) and 50 ± 2 percent relative humidity.

4.4.1.1 Type I strapping shall be conditioned to equilibrium prior to testing. A sample shall be considered at equilibrium when the change in weight during a 1 hour or longer period of conditioning does not exceed 0.02 percent of the sample's weight at the end of the period.

4.4.1.2 Type II and III strapping shall be conditioned for 48 hours prior to testing.

4.4.2 Breaking strength. Breaking strength of type I strapping shall be measured by a floor model Instron Tester equipped with a D-load cell, and utilizing upper clamps A-53-8, DJ rubber coated, measuring 2 inches by 3 inches and lower clamps A-53-2, DJ rubber coated measuring 1 inch by 2 inches. The free length between clamps shall be 3 inches, the cross head speed 2 inches per minute, and the chart speed 6 inches per minute. Full scale load shall be 500 or 1,000 pounds. A piece of strapping of the width to be tested shall be inserted in the clamps and the Instron Tester activated. Breaking strength shall be read directly from the chart to the nearest pound. Breaking strength of type II and type III strapping shall be measured on a tensile tester, such as an Instron Tester or equivalent, capable of load accuracies to within ± 1 percent. The crosshead speed shall be 2 inches per minute and the free length between clamps shall be no greater than 5 inches. Suitable clamping arrangements to prevent slippage or breakage within the clamps shall be used. Manual adjustment of testing equipment, after sample is in place, is required to remove slack and provide alignment prior to activating the test. The load in pounds at break shall be read directly from the testing unit or its chart. (Split barrel type clamps 2 to 4 inches in diameter have been found effective in gripping the type II and type III strapping.)

4.4.3 Elongation. Percent elongation of type I strapping at break shall be measured in the same manner, at the same time as breaking strength and using the same procedure (see 4.4.2). Percent elongation at break shall be read directly from the chart to the nearest percent. The percent elongation of type II and III strapping at break shall be determined by measuring in inches the extension of the sample gage length at its break, obtained by following breaking strength procedures (see 4.4.2), and then dividing this extension figure by the original free length and multiplying by 100. An extensometer or equivalent shall be used to measure the extension, since larger errors due to slippage or slack removal can be introduced if cross-head separation is used.

4.4.4 Transverse strength. Transverse strength of type I strapping shall be measured by a suitable tensile tester, utilizing flat-faced upper and lower clamps. The cross head speed shall be 6 inches per minute, and the full scale load shall be 10 pounds. Strapping samples shall be inserted in the clamps so that each clamp grips approximately one half of the width of the strap. Transverse strength shall be read directly from the recording device in pounds.

4.4.5 Percent of plastic binder. A sample of type I strap is conditioned for a minimum of 24 hours (see 4.4.1.1) and weighed. The sample is then treated with a suitable solvent to remove the plastic binder, washed and oven dried at $225^{\circ} \pm 5^{\circ}\text{F}$. for two hours. After removal from the oven, it is reconditioned for a minimum of 24 hours and reweighed. The percent binder, based on the conditioned weight of the complete strap is calculated as follows:

$$\frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100 = \text{Percent binder}$$

4.5 Inspection of preparation for delivery. The preservation, packaging, packing and marking shall be examined for conformance to section 5. The sample unit shall be one shipping container. The inspection level shall be S-3, and the AQL shall be 10.0 expressed as defects per 100 units. Defects are as follows:

<u>Examine</u>	<u>Defect</u>
Packaging	Not as specified.
Packing	Container not as specified.
	Closure not as specified.
	Gross weight exceeds specification limit.
Marking	Not as specified.

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5. PREPARATION FOR DELIVERY

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

5.1.1 Level A. Unless otherwise specified, the spools or coils of strapping or connectors shall be packaged in accordance with method III, of MIL-P-116, in quantities as specified in the contract or order.

5.1.2 Level C. Nonmetallic strapping or connectors shall be packaged in accordance with the manufacturer's commercial practice.

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

5.2.1 Level A. Nonmetallic strapping or connectors shall be packed in containers conforming to V1s or V2s of PPP-B-636. Insofar as practical containers shall be of uniform shape and size, be of minimum cube and tare consistent with the protection required and contain identical quantities. Containers shall be closed, sealed and reinforced in accordance with applicable container specification or appendix thereto. The weight of contents for fiberboard shipping containers shall be subject to the limitations of the container specification.

5.2.2 Level B. Nonmetallic strapping or connectors shall be packed in domestic or weather-resistant type containers conforming to PPP-B-636. Insofar as practical, containers shall be of uniform shape and size, be of minimum cube and tare consistent with the protection required and contain identical quantities. Containers shall be closed and reinforced in accordance with the applicable container specification or appendix thereto. The weight of contents for fiberboard shipping containers shall be subject to the limitations of the container specification.

5.2.3 Level C. Nonmetallic strapping or containers shall be packed in a manner which will insure arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Shipping containers shall comply with the carrier rules and regulations applicable to the mode of transportation.

5.3 Palletized unit load. Unless otherwise specified palletized unit loads shall be in accordance with MIL-STD-147.

5.3.1 When specified, palletized loads of nonmetallic strapping and closures may be secured with strapping conforming to the requirements of this specification. The gross weight of a palletized load of nonmetallic strapping secured with strapping meeting the requirements of this specification shall not exceed 1700 pounds.

5.4 Marking.

5.4.1 Civil agencies. In addition to any special marking required by the contract or order, coils, packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.4.2 Military agencies. In addition to any special marking required by the contract or order, coils, packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Strapping covered by this document is intended for reinforcement or closure of shipping containers, for securing or holding compressed materials in bales, for securing multiple units on skids or pallets, for bundling together loose or packaged material into bundles or lifts, for internal bracing of materials in containers, bulk-heading or tie-down lashings of containers and for securing or bracing, packages, loose materials or equipment in closed conveyances.

Type I strapping is for strapping of materials to be stored under cover or inside storage.

Types II and III strapping is intended for overseas shipment and for long time storage applications. Types II and III may also be substituted for type I.

6.1.1 Caution. Nonmetallic strapping is not intended for use in the reinforcement of nailed wood or cleated panel boxes or crates. Steel strapping should be used for this application.

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) Type, grade and dimensions required (see 1.2.1, 3.3 and applicable table).
- (c) Yardage per spool or coil (see table V or VI).
- (d) Level of packaging and level of packing required (see 5.1 and 5.2).
- (e) Palletized unit loads (see 5.3 and 5.3.1).
- (f) Seals and buckles (see 3.6.1), type, size and quantity required.
- (g) Make and model of strapping equipment that the strapping and seals must work in, if applicable.
- (h) When an embossed finish on type II strapping is desired or allowed (see 3.3.2).
- (i) Coil dimensions (see 3.5 and table VI).

6.3 Payment should be made on the basis of the yardage of nonmetallic strapping delivered.

MILITARY CUSTODIANS:

Army - GL
Navy - SA
Air Force - 69

Review activities:

Navy - WP

User activities:

Navy - SR, YD, MC
DSA - SC

CIVIL AGENCY COORDINATING ACTIVITY:

GSA-PSS

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