



# Standard Specification for Strapping, Nonmetallic (and Joining Methods)<sup>1</sup>

This standard is issued under the fixed designation D 3950; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers nonmetallic strapping and joining methods intended for use in closing, reinforcing, and bundling articles for shipment, unitizing, palletizing, and bracing for car loading and truck loading.

1.2 The values stated in inch-pound units are to be regarded as standard.

1.3 The following safety hazards caveat pertains only to the test method portion, Section 12, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- D 996 Terminology of Packaging and Distribution Environments
- D 3951 Practice for Commercial Packaging
- D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

### 2.2 Other Standards:

- ANSI/ASQC Z 1.4 Sampling Procedures and Tables for Inspection by Attributes<sup>3</sup>
- ANSI/ASQC Z 1.9 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming<sup>3</sup>

## 3. Terminology

3.1 For general definitions of packaging and distribution environments, see Terminology D 996.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.25 on Palletizing and Unitizing of Loads.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

## 4. Classification

### 4.1 Types and Grades:

- Type I — Strapping, bonded rayon cord.
  - Grade 1—Light duty.
  - Grade 2—Regular duty.
  - Grade 3—Heavy duty.
- Type IA — Strapping, bonded, or woven polyester cord.
  - Grade 1—Light duty.
  - Grade 2—Regular duty.
  - Grade 3—Heavy duty.
  - Grade 4—Extra heavy duty.
  - Grade 5—Special duty.
- Type II — Strapping, polyolefin plastic.
- Type III — Strapping, nylon plastic.
- Type IV — Strapping, polyester plastic.

## 5. Ordering Information

5.1 The inquiry and order shall indicate the following:

- 5.1.1 Type, grade, and dimensions required (see 4.1 and 7.1),
- 5.1.2 Length per coil (see 8.1),
- 5.1.3 Joining method (see 6.2), type and size required (if needed),
- 5.1.4 If an embossed finish on strapping is desired or allowed (see Footnote in Table 1),
- 5.1.5 Make and model of strapping equipment that the strapping and joining method must work in, if applicable,
- 5.1.6 Coil dimensions (see 8.1),
- 5.1.7 Level of packaging and packing if other than commercial (see Section 15), and
- 5.1.8 ASTM designation and date of issue.

## 6. Materials and Manufacture

6.1 Materials shall be of the quality necessary to meet the physical requirements within the allowable dimensions.

6.1.1 *Type I*—Strapping shall consist of longitudinal rayon cords bonded with a plastic binder so that a nonwoven material is formed.

6.1.1.1 *Type IA*—Strapping shall consist of longitudinal polyester cords bonded with a plastic binder to form a nonwoven material or longitudinal polyester cords woven with a weft thread and treated with a plastic binder to form a woven material.

**TABLE 1 Breaking Strengths of Type II Strapping (PP)**

Nominal Width of Strapping		Nominal Thickness of Strapping		Minimum Breaking Strength	
in.	(mm)	in.	(mm) <sup>A</sup>	lb	(N) <sup>B</sup>
0.197	(5.0)	0.0120	(0.30)	80	(360)
0.197	(5.0)	0.0145	(0.37)	100	(440)
0.234	(5.9)	0.0135	(0.34)	130	(580)
0.234	(5.9)	0.0140	(0.36)	155	(690)
0.236	(6.0)	0.0130	(0.33)	135	(600)
0.234	(5.9)	0.0160	(0.41)	180	(800)
0.236	(6.0)	0.0173	(0.44)	190	(850)
¼	(6.4)	0.0135	(0.34)	134	(600)
¼	(6.4)	0.0150	(0.38)	180	(800)
¼	(6.4)	0.0250	(0.64)	200	(890)
0.351	(8.9)	0.0130	(0.33)	200	(899)
0.354	(9.0)	0.0142	(0.36)	225	(1 000)
0.351	(8.9)	0.0160	(0.41)	270	(1 200)
0.354	(9.0)	0.0173	(0.44)	270	(1 200)
0.354	(9.0)	0.0181	(0.46)	270	(1 200)
⅜	(9.5)	0.0180	(0.46)	250	(1 110)
⅜	(9.5)	0.0150	(0.38)	290	(1 290)
⅜	(9.5)	0.0200	(0.51)	390	(1 730)
⅜	(9.5)	0.0250	(0.64)	400	(1 780)
0.413	(10.5)	0.0190	(0.48)	360	(1 600)
0.413	(10.5)	0.0201	(0.51)	360	(1 600)
0.413	(10.5)	0.0248	(0.63)	460	(2 050)
0.413	(10.5)	0.0295	(0.75)	550	(2 450)
0.413	(10.5)	0.0295	(0.75)	540	(2 400)
0.413	(10.5)	0.0230	(0.58)	450	(2 000)
⅞	(11.1)	0.0140	(0.36)	300	(1 330)
⅞	(11.1)	0.0190	(0.48)	350	(1 560)
⅞	(11.1)	0.0230	(0.58)	420	(1 870)
⅞	(11.1)	0.0250	(0.64)	450	(2 000)
⅞	(11.1)	0.0300	(0.76)	550	(2 450)
0.468	(11.9)	0.0215	(0.55)	450	(2 000)
0.472	(12.0)	0.0169	(0.43)	360	(1 600)
0.472	(12.0)	0.0212	(0.54)	460	(2 050)
0.472	(12.0)	0.0252	(0.64)	550	(2 450)
0.480	(12.2)	0.0190	(0.48)	400	(1 780)
½	(12.7)	0.0150	(0.38)	390	(1 750)
½	(12.7)	0.0170	(0.43)	350	(1 570)
½	(12.7)	0.0220	(0.56)	450	(2 020)
½	(12.7)	0.0200	(0.51)	530	(2 360)
½	(12.7)	0.0250	(0.64)	660	(2 940)
½	(12.7)	0.0260	(0.66)	550	(2 450)
½	(12.7)	0.0300	(0.76)	810	(3 600)
0.468	(12.0)	0.0255	(0.65)	540	(2 400)
⅝	(15.9)	0.0150	(0.38)	500	(2 200)
⅝	(15.9)	0.0200	(0.51)	680	(3 020)
⅝	(15.9)	0.0300	(0.76)	950	(4 220)
¾	(19.1)	0.0200	(0.51)	725	(3 220)
1¼	(31.8)	0.0350	(0.89)	2 200	(9 790)
1¼	(31.8)	0.0500	(1.27)	3 100	(13 790)

<sup>A</sup> When specified (see 5.1.4), the strapping as measured by a flat anvil micrometer shall have an embossed finish which yields an overall nominal thickness no greater than twice the nominal thickness of smooth-surfaced strapping of the same width and breaking strength.

<sup>B</sup> Range of elongation at break is from 10 to 35 %.

6.1.2 *Type II*—Strapping shall be an extruded, oriented polyolefin.

6.1.3 *Type III*—Strapping shall be an extruded, oriented nylon.

6.1.4 *Type IV*—Strapping shall be an extruded, oriented polyester.

6.2 *Joining Methods*— If seals or buckles are to be used, they shall be steel and have a coating of zinc, black iron oxide, or equivalent protection from corrosion, or buckles may be made of plastic.

## 7. Mechanical Properties

7.1 *Breaking Strength and Elongation* (see 12.2):

7.1.1 Type I and Type IA strapping shall conform to the breaking strengths and elongations prescribed in Table 2 and Table 3.

7.1.2 Type II strapping shall conform to the breaking strengths and elongations prescribed in Table 1.

7.1.3 Type III strapping shall conform to the breaking strengths and elongations prescribed in Table 4.

7.1.4 Type IV strapping shall conform to the breaking strengths and elongations prescribed in Table 5.

7.2 Transverse strength of Types I and IA strapping shall be a minimum of 2.75 lbf (12.2 N) and 2.25 lbf (10 N), respectively, when tested in accordance with 12.4.

7.3 *Joint Strength* (see 12.3).

7.3.1 Type I and Type IA Grade 1 and Grade 2 joined strapping shall have a strength of not less than 45% of the minimum breaking strength of the strapping grade and size listed in Table 2 and Table 3.

7.3.2 Type IA Grade 3, Grade 4, and Grade 5 joined strapping shall have a strength of not less than 55 % of the minimum breaking strength of the strapping grade and size listed in Table 3. Test data are available to substantiate this conclusion.

7.3.3 Types II, III, and IV joined strapping shall have a strength of not less than 45 % of the minimum breaking strength corresponding to the dimensions of the strap listed in Table 1, Table 4, or Table 5.

## 8. Dimensions and Permissible Variations

8.1 The minimum length per coil of strapping shall be as specified in the following tables according to type, grade, size, and coil width. The coil shall be an oscillating or ribbon wind.

**TABLE 2 Breaking Strengths<sup>A</sup> of Type I Bonded Rayon Cord Strapping**

Nominal Width of Strapping, in. (mm)	Grade	Minimum Breaking Strength, lbf (N)
¼ (6.4)	2	235 (1045)
⅜ (9.5)	1	290 (1290)
	2	350 (1555)
½ (12.7)	1	410 (1820)
	2	465 (2070)
⅝ (15.9)	1	525 (2335)
	2	585 (2600)
	3	765 (3400)
¾ (19.1)	1	640 (2845)
	2	700 (3110)
	3	900 (4000)
1¼ (31.8)	3	157 (7005)

<sup>A</sup> Range of elongation at break is from 10 to 15 %.

**TABLE 3 Breaking Strengths<sup>A</sup> of Type IA Bonded or Woven Polyester Cord Strapping**

Nominal Width of Strapping, in. (mm)	Grade	Minimum Breaking Strength, lbf (N)
1/4 (6.4)	2	300 (1 335)
	3	540 (2 400)
3/8 (9.5)	2	450 (2 000)
	3	780 (3 480)
1/2 (12.7)	1	400 (1 780)
	2	600 (2 670)
	3	1 050 (4 670)
	4	1 360 (6 050)
5/8 (15.9)	1	500 (2 225)
	2	725 (3 225)
	3	1 310 (5 830)
	4	1 650 (7 340)
3/4 (19.1)	2	900 (4 000)
	3	1 585 (7 060)
	4	1 830 (8 150)
	5	2 600 (11 570)
	5	2 600 (11 570)
1 1/4 (32.0)	2	1 830 (8 150)
	3	2 105 (9 370)
	4	3 285 (14 620)
	5	4 200 (18 680)
1 1/2 (38.0)	4	4 400 (19 570)
	5	5 400 (24 030)

<sup>A</sup> Range of elongation at break is from 9 to 15 %.

**TABLE 4 Breaking Strengths of Type III Strapping (Nylon)**

Nominal Width of Strapping, in. (mm)	Nominal Thickness of Strapping, in. (mm)	Minimum Breaking Strength, lbf (N) <sup>A</sup>
7/16 (11.1)	0.017 (0.43)	420 (1870)
	0.023 (0.58)	560 (2490)
	0.029 (0.74)	700 (3110)
1/2 (12.7)	0.015 (0.38)	420 (1870)
	0.020 (0.51)	560 (2490)
	0.025 (0.64)	700 (3110)
	0.030 (0.76)	900 (4000)

<sup>A</sup> Range of elongation at break is from 12 to 25 %.

8.1.1 Type I and Type IA strapping shall be furnished with the minimum feet per coil according to size and grade as prescribed in Table 6.

8.1.2 Types II, III, and IV strapping shall be furnished with the minimum feet per coil in accordance with the size and coil width in Table 7.

**9. Workmanship, Finish, and Appearance**

9.1 Type I and Type IA strapping shall be straight, clean, have good webbing, and be free of cracks and other defects that may affect the serviceability.

9.2 Types II, III, and IV strapping shall be straight, clean, and free of kinks, edge curvature, cracks, and other defects that may affect the serviceability.

9.3 Splices may be made if they do not affect the serviceability of the strapping in strapping equipment and have a break strength equal to at least 50% of the strap break strength. No more than one splice per coil will be permitted.

**TABLE 5 Breaking Strengths of Type IV Strapping (PET)**

Nominal Width of Strapping, in. (mm)	Nominal Thickness of Strapping, in. (mm)	Minimum Breaking Strength, lb (N) <sup>A</sup>
0.351 (8.9)	0.0190 (0.48)	390 (1 730)
0.354 (9.0)	0.0205 (0.52)	400 (1 780)
3/8 (9.5)	0.0150 (0.38)	310 (1 380)
3/8 (9.5)	0.0200 (0.51)	420 (1 870)
0.413 (10.5)	0.0195 (0.50)	430 (1 910)
0.413 (10.5)	0.0205 (0.52)	460 (2 050)
0.413 (10.5)	0.0220 (0.56)	500 (2 220)
0.413 (10.5)	0.0240 (0.61)	560 (2 490)
0.413 (10.5)	0.0255 (0.65)	575 (2 550)
0.413 (10.5)	0.0265 (0.67)	600 (2 660)
7/16 (11.1)	0.0160 (0.41)	360 (1 600)
7/16 (11.1)	0.0200 (0.51)	460 (2 050)
7/16 (11.1)	0.0220 (0.56)	500 (2 220)
7/16 (11.1)	0.0240 (0.61)	560 (2 490)
0.468 (11.9)	0.0168 (0.43)	470 (2 090)
0.468 (11.9)	0.0175 (0.44)	470 (2 090)
0.468 (11.9)	0.0205 (0.52)	560 (2 490)
0.468 (11.9)	0.0275 (0.70)	750 (3 340)
0.468 (11.9)	0.0280 (0.71)	750 (3 340)
0.472 (12.0)	0.0175 (0.44)	470 (2 090)
0.472 (12.0)	0.0205 (0.52)	560 (2 490)
0.472 (12.0)	0.0280 (0.71)	750 (3 340)
1/2 (12.7)	0.0150 (0.38)	420 (1 870)
1/2 (12.7)	0.0170 (0.43)	470 (2 090)
1/2 (12.7)	0.0200 (0.51)	560 (2 490)
1/2 (12.7)	0.0250 (0.64)	700 (3 110)
1/2 (12.7)	0.0280 (0.71)	750 (3 340)
1/2 (12.7)	0.0300 (0.76)	850 (3 780)
0.615 (15.6)	0.0300 (0.76)	1 000 (4 440)
0.615 (15.6)	0.0350 (0.89)	1 100 (4 890)
0.615 (15.6)	0.0360 (0.91)	1 150 (5 120)
0.615 (15.6)	0.0380 (0.97)	1 200 (5 328)
0.615 (15.6)	0.0400 (1.02)	1 200 (5 328)
0.615 (15.6)	0.0400 (1.02)	1 500 (6 670)
0.615 (15.6)	0.0410 (1.04)	1 200 (5 328)
0.615 (15.6)	0.0450 (1.14)	1 600 (7 120)
5/8 (15.9)	0.0200 (0.51)	700 (3 110)
5/8 (15.9)	0.0250 (0.64)	870 (3 870)
5/8 (15.9)	0.0300 (0.76)	1 000 (4 450)
5/8 (15.9)	0.0350 (0.89)	1 200 (5 340)
5/8 (15.9)	0.0350 (0.89)	1 300 (5 780)
3/4 (19.1)	0.0400 (1.02)	1 750 (7 780)
3/4 (19.1)	0.0500 (1.27)	2 250 (10 010)
3/4 (19.1)	0.0550 (1.40)	2 400 (10 680)
3/4 (19.1)	0.0600 (1.52)	2 500 (11 120)
3/4 (19.1)	0.0600 (1.52)	2 600 (11 550)
0.985 (25.0)	0.0400 (1.02)	2 300 (10 210)
0.985 (25.0)	0.0500 (1.27)	2 800 (12 460)
1 1/4 (32.0)	0.0320 (0.82)	2 250 (10 010)
1 1/4 (32.0)	0.0400 (1.02)	2 800 (12 460)

<sup>A</sup> Range of elongation at break is from 5 to 25 %.

**10. Sampling Plan**

10.1 Where it can be demonstrated that a supplier's quality control system provides a similar degree of assurance as that obtained through the use of this specification, the supplier may use that system in place of the system described in this specification. In case of conflict, provisions set forth in ANSI/ASQC Z1.4 shall be used.

10.2 Lot Size—The lot size shall be expressed in units of coils or joining methods, or both, and shall consist of all products of one type, grade, and size offered for acceptance at one time.

10.3 Unit Sample— One coil or one joining method shall be considered a unit. A minimum of 10 ft (3.05 m) per coil of strapping is required to perform the tests.

**TABLE 6 Minimum Feet Per Coil for Type I and Type IA Strapping**

Nominal <sup>A</sup> Width of Strapping, in. (mm)	Grade	Minimum feet (metres) Per 5½-in. (140-mm) Wide Coil <sup>B</sup>
¼ (6.0)	2	7800 (2380)
(6.0)	3	8250 (2520)
⅜ (9.0)	1 and 2	4950 (1510)
(9.0)	3	4950 (1510)
½ (13.0)	1 and 2	3900 (1190)
(13.0)	3	4170 (1270)
(13.0)	4	3300 (1010)
⅝ (16.0)	1 and 2	3000 (910)
(16.0)	3	3300 (1010)
(16.0)	4	2490 (760)
¾ (19.0)	2	2100 (640)
(19.0)	3	2490 (760)
(19.0)	4	1655 (500)
1¼ (32.0)	2, 3, and 4	330 (100)
(32.0)	5	450 (140)

<sup>A</sup> The width tolerance shall be + 1/32 in. (+ 0.79 mm) and - 3/32 in. (-2.37 mm).

<sup>B</sup> 1¼-in. (32-mm) strapping may be ribbon-wound 1¼-in. (32-mm) wide coil.

10.4 *Rate of Sampling*— The rate of sampling shall be in accordance with ANSI/ASQC Z1.9; Table A-2 reduced inspection level shall be used.

## 11. Number of Tests

11.1 *Tests*—For the determination of break strength, elongation, transverse strength, and sealed joint strength, an average of three specimens per coil shall be considered a complete test.

11.2 *Retests*—When testing for elongation, if the specimen fails outside of the center third of the gage length or within 1 in. of the jaws, a retest shall be made. If the percentage of elongation or the break strength is less than the specified minimum, a retest is permitted. In this retest, three consecutive specimens must meet the minimum requirements.

## 12. Test Methods

12.1 The purpose of these test methods is to determine the strength of the strapping and elongation, and the strength when the ends of the strapping are joined together.

12.2 The major properties of strapping used to reinforce packages or bundle objects are the strapping tensile strength, elongation, and the joint strength. A proper balance of these three properties is required for maximum performance.

### 12.3 Apparatus:

12.3.1 *Tensile Tester*— A test machine capable of load accuracies to within ±1 %. For greater accuracy in performing the elongation test, use an extensometer.

12.3.2 *Clamps*—Capstan or split-barrel-type gripping clamp 2 to 4 in. (51 to 100 mm) in diameter with adequate load capacity. Any grips chosen are to yield failures (specimen) within the effective gage length of the sample. For referee testing use Instron 4-in. Webbing Capstan grips.

12.4 *Sampling*—See Sections 10 and 11 for plan and number of tests.

12.5 *Conditioning*— Condition all samples in a standard atmosphere as described in Practice D 4332 for a minimum of 24 h. Conduct all tests at these conditions.

### 12.6 Test Procedures:

12.6.1 *Breaking Strength*—Select a load range of the tensile tester in which the point of maximum force will fall between 30 to 90 % of full scale. The crosshead speed shall be 5 in. (127 mm)/min with the free length between the clamps sufficient to accept the strap sample and the elongation measuring device, generally 6 to 10 in. (150 to 250 mm). Insert the sample of strap of a length adequate to accommodate the minimum gage length and clamping arrangement into the clamps. Manually adjust the sample to remove any slack and activate the tester. Read the breaking strength directly from the recording device to the nearest 5 lbf (22 N) or 10 lbf (44 N) for breaking strengths in excess of 1000 lbf (4448 N).

12.6.2 *Elongation*—Measure elongation at break at the same time as breaking strength using the same procedure (see 12.6.1), except use a chart recorder to measure the crosshead displacement. If greater accuracy is desired, use an extensometer to measure extension as errors due to slippage or slack removal can be introduced if crosshead separation is used.

12.6.3 *Joint Strength*— Determine the joint strength by the same procedure used for breaking strength (see 12.6.1), except for utilization of the elongation measuring technique. Elongation is not measured during a joint strength test. Read the maximum force directly from the recording device to the nearest 5 lbf (22 N).

12.6.3.1 *Percent of Breaking Strength*—The joint strength is recorded as a percentage of the minimum breaking strength of the parent material which is determined in accordance with the type, grade, and dimension tested (see 7.1).

### 12.7 Precision and Bias:

#### 12.7.1 Precision:

12.7.1.1 An interlaboratory test program has been conducted using nine laboratories and nine different materials. Ten samples of each material were tested within each laboratory.<sup>4</sup> See Table 8.

**TABLE 8 Research Report Summary**

Break Strength of Nonmetallic Strapping, lb		
Material	Within-Laboratory Coefficient of Variation (Repeatability)	Between-Laboratory Coefficient of Variation (Reproducibility)
Cordstrap	2.9 %	8.7 %
Polypropylene	4.3 %	6.5 %
Polyester	1.9 %	2.4 %
Elongation of Nonmetallic Strapping, %		
Material	Within-Laboratory Coefficient of Variation (Repeatability)	Between-Laboratory Coefficient of Variation (Reproducibility)
Cordstrap	8.6 %	41.4 %
Polypropylene	8.3 %	26.0 %
Polyester	6.5 %	37.3 %
Joint Strength of Nonmetallic Cordstrap, lb		
Material	Within-Laboratory Coefficient of Variation (Repeatability)	Between-Laboratory Coefficient of Variation (Reproducibility)
Cordstrap	5.0 %	7.0 %

12.7.1.2 Breaking strength and elongation precision are given as coefficient of variation for three types of materials.

<sup>4</sup> Supporting data are available from ASTM Headquarters. Request RR:D10-1010.

**TABLE 7 Minimum Feet (Metres) Per Coil; Types II, III and IV Strapping**

Nominal Width <sup>A</sup> of Strapping, in. (mm)	Nominal Thickness <sup>B</sup> of Strapping, in. (mm)	Minimum Feet (Metres) Per 3-in. Wide Coil <sup>C</sup>	Minimum Feet (Metres) Per 5¼-in. Wide Coil <sup>C</sup>	Minimum Feet (Metres) Per 6-in. Wide Coil <sup>C</sup>	Minimum Feet (Metres) Per 7½-in. Wide Coil <sup>C</sup>
¼ (6.4)	0.0135 (0.34)		19 500 (5 940)		
0.236 (6.0)	0.0130 (0.33)		19 995 (6 095)		21 990 (6 705)
0.236 (6.0)	0.0130 (0.33)		2 490 (760)		
¼ (6.4)	0.015 (0.38)	9 000 (2 740)		18 000 (5 490)	
¼ (6.4)	0.018 (0.46)		15 000 (4 570)		
0.236 (6.0)	0.0173 (0.44)		15 000 (4 570)		15 990 (4 875)
¼ (6.4)	0.025 (0.64)				12 900 (3 930)
0.354 (9.0)	0.0142 (0.36)				12 495 (3 810)
0.354 (9.0)	0.0173 (0.44)		9 990 (3 045)		
0.354 (9.0)	0.0181 (0.46)		13 500 (4 115)		11 250 (3 430)
0.354 (9.0)	0.0205 (0.52)		12 495 (3 810)		
⅜ (9.5)	0.018 (0.46)		9 000 (2 740)	12 900 (3 930)	9 000 (2 740)
⅜ (9.5)	0.015 (0.38)	6 495 (1 980)		12 900 (3 930)	9 000 (2 740)
0.413 (10.5)	0.0201 (0.51)		10 500 (3 200)		8 250 (2 515)
0.413 (10.5)	0.0205 (0.52)		10 500 (3 200)		
0.413 (10.5)	0.0240 (0.61)		9 000 (2 740)		
⅜ (9.5)	0.020 (0.51)	4 800 (1 460)		8 400 (2 560)	
⅜ (9.5)	0.025 (0.64)			8 400 (2 560)	
0.413 (10.5)	0.0248 (0.63)		7 995 (2 435)		6 000 (1 830)
0.413 (10.5)	0.0295 (0.75)		6 990 (2 130)		6 690 (2 040)
⅞ (11.1)	0.014 (0.36)			8 400 (2 560)	5 595 (1 705)
⅞ (11.1)	0.019 (0.48)		9 525 (2 900)		
0.472 (12.0)	0.0169 (0.43)		9 990 (3 045)		
0.472 (12.0)	0.0169 (0.43)		2 490 (760)		
0.472 (12.0)	0.0175 (0.44)		10 500 (3 200)		
0.472 (12.0)	0.0205 (0.52)		9 000 (2 740)		
⅞ (11.1)	0.020 (0.51)			7 500 (2 290)	
⅞ (11.1)	0.022 (0.56)			10 500 (3 200)	
⅞ (11.1)	0.023 (0.58)			7 050 (2 150)	
⅞ (11.1)	0.024 (0.61)			6 750 (2 060)	
⅞ (11.1)	0.025 (0.64)		7 200 (2 200)		
0.472 (12.0)	0.0210 (0.54)		6 090 (1 860)		
0.472 (12.0)	0.0252 (0.64)		6 990 (2 130)		
⅞ (11.1)	0.030 (0.76)		6 450 (1 970)		
0.472 (12.0)	0.0280 (0.71)		6 495 (1 980)		
½ (12.7)	0.017 (0.43)	4 500 (1 370)	9 525 (2 900)		
½ (12.7)	0.015 (0.38)	4 500 (1 370)		8 850 (2 700)	6 990 (2 130)
½ (12.7)	0.022 (0.56)		7 800 (2 380)		
½ (12.7)	0.020 (0.51)	3 600 (1 100)		7 050 (2 150)	5 700 (1 740)
½ (12.7)	0.026 (0.66)		6 450 (1 970)		
½ (12.7)	0.025 (0.64)	2 850 (870)		5 550 (1 690)	
½ (12.7)	0.030 (0.76)	2 400 (730)		4 725 (1 440)	
½ (12.7)	0.028 (0.71)		6 300 (1 920)		
⅝ (15.9)	0.015 (0.38)	3 498 (1 070)		6 900 (2 100)	
⅝ (15.9)	0.020 (0.51)	2 598 (790)		5 100 (1 550)	
⅝ (15.9)	0.030 (0.76)	1 800 (550)		3 528 (1 080)	
⅝ (15.9)	0.025 (0.64)	2 199 (670)			
¾ (19.1)	0.020 (0.51)			5 100 (1 550)	
1¼ (31.8)	0.035 (0.89)	495 (150)		900 (270)	
1¼ (31.8)	0.050 (1.27)	495 (150)		900 (270)	

<sup>A</sup> Width tolerances:

Type II, ±0.030 in. (±0.76 mm)

Type III, ±0.015 in. (±0.38 mm)

Type IV, ±0.030 in. (±0.76 mm)

<sup>B</sup> Thickness tolerances: (Embossed strap should be measured for thickness with a flat-face micrometer or similar measuring device so as to cover as much area as possible.)

Type II and III—For strapping 0.025 in. (0.635 mm) thick or less, ±0.0025 in. (±0.06 mm).

Type II and III—For strapping greater than 0.025 in. thick, ±0.003 in. (±0.08 mm).

Type IV—for all thickness, ±0.0025 in. (±0.06 mm).

<sup>C</sup> Coil widths may vary ±¼ in. (±3.175 mm).

These may be used as estimates of precision, but depending on the specific material, higher or lower values may be observed.

12.7.1.3 Joint strength precision is also given as a coefficient of variation but for only one type of material and joining system (cord strap with buckle). These values may be used as estimates of precision but, depending on the specific material and joining system, higher or lower values may be observed.

12.7.2 *Bias*—Bias is the difference between an average test value and the reference (true) test property value. Reference values do not exist for this test method since the value or level of the test property is exclusively defined by the test method. Therefore, no statement on bias is being given.

### 13. Rejection and Retesting

13.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may request retesting.

### 14. Certification

14.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser.

### 15. Preparation for Delivery

15.1 Unless otherwise specified in a contract or order, strapping and joining devices shall be packaged and packed in accordance with Practice D 3951. Such packaging shall ensure safe arrival at destination in satisfactory condition and shall be acceptable to the carrier used at lowest rates.

### 16. Keywords

16.1 closing; joining methods; nonmetallic strapping; palletizing; reinforcing; strapping; unitizing

## SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order for agencies of the U.S. Government.

### S1. Scope

S1.1 These Supplementary Requirements describe the Department of Defense requirements for the packaging, packing, and marking of nonmetallic strapping and joining devices.

### S2. Referenced Documents

S2.1 The following documents<sup>3</sup> form, in the parts referenced, a part of this document in the issue in effect at the time of placement of the order or contract:

*Federal Specifications:*

L-P-378 Plastic Sheet and Strip, Thin Gauge, Polyolefin.  
 PPP-B-636 Boxes, Shipping, Fiberboard  
 PPP-B-640 Boxes, Fiberboard, Corrugated, Triple-Wall

*Military Specification:*

MIL-P-116 Preservation—Packaging; Methods of  
*Military Standards:*  
 MIL-STD-129 Marking for Shipment and Storage  
 MIL-STD-147 Palletizing Unit Loads

### S3. Preparation for Delivery

S3.1 Packaging shall be Level A or C as specified in the purchase order or contract.

S3.1.1 *Level A*—Nonmetallic strapping and joining devices shall be unit protected in accordance with Method III of MIL-P-116.

S3.1.1.1 *Strapping*—Nonmetallic strapping shall be wound on a core of suitable material to support load and prevent collapse during dispensing. Core diameter and core width shall be of the proper size to be compatible for mounting in the designated dispenser. Secure each coil of strapping against unwinding and place in a close-fitting box conforming to PPP-B-636, class weather-resistant style RSC.

S3.1.1.2 *Joining Devices, Unit Packaging*—Unless otherwise specified in the procurement document, 100 of like type and size of joining devices shall be placed in bags constructed of material conforming to L-P-378 2 mil (0.05 mm) minimum or commercially equivalent polyethylene material. Bag closure shall be accomplished by heat sealing.

*Intermediate Containers*—Unless otherwise specified by the procuring agency, 10 unit packs of joining devices of a like type and size shall be placed in a fiberboard box conforming to PPP-B-636, class weather-resistant style RSC.

S3.1.2 *Level C*—Nonmetallic strapping and joining devices shall be packaged in accordance with Practice D 3951. Unless otherwise specified in the procurement document, quantity per unit pack requirements of Level A packaging shall apply.

S3.2 *Packing*—Unit packing need not be overpacked when S3.3 is specified. When the quantity procured does not lend itself to palletization, packing shall be specified as Level A, B, or C in the purchase order or contract.

S3.2.1 *Level A*—When nonmetallic material is specified in the procurement document, nonmetallic strapping and joining devices of like grade and type shall be packed in containers conforming to PPP-B-601, Overseas Type or PPP-B-621, Class 2, Style 4.

S3.2.2 *Level B*—Unit containers shall be packed for shipment as specified for Level A (S3.2.1) requirements except that containers shall conform to PPP-B-636, Class weather-resistant as a minimum or PPP-B-640, Class 1.

S3.2.3 *Level C*—Unit containers of nonmetallic strapping and joining devices packaged as specified in S3.1 shall be packed for shipment in accordance with Practice D 3951.

S3.3 *Palletization*—Unless otherwise specified, all unit containers of material of the same type and grade shall be palletized in accordance with load Type I requirements of MIL-STD-147. To meet Level A protection requirements, waterproof protection shall be provided by waterproof wrapping (storage aid 9) in accordance with MIL-STD-147. For Level C protection, the above waterproof requirements are not necessary. Pallets shall be expendable and nonreturnable. Gross weight of a palletized load shall not exceed 3000 lb (1360 kg).

S3.4 *Marking*—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.

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