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Standard Specification for Strapping, Flat Steel and Seals¹

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1. Scope

1.1 This specification covers flat steel strapping and seals intended for use in closing, reinforcing, bundling articles for shipment, unitizing, palletizing, and bracing for carloading and truckloading.

1.2 This specification includes strapping and seals made from carbon steel and applies only to the types and sizes as cataloged by strapping suppliers to be a standard, commercially available product. It does not include “specialty”-type strapping as developed for special applications or strapping produced from alloy metals.

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

1.4 The following safety hazards caveat applies only to the test method portion, Sections 11, 12, and 13, of this specification: *This standard does not purport to address all of the safety problems, 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:

A 90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles²

A 109 Specification for Steel, Strip, Carbon, Cold-Rolled³

A 239 Test Method for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)²

B 504 Method for Measurement of Thickness of Metallic Coatings by the Coulometric Method⁴

D 996 Terminology of Packaging and Distribution Environments⁵

D 3951 Practice for Commercial Packaging⁵

D 4332 Practice for Conditioning Containers Package, or Package Components for Testing⁵

2.2 Military Standard:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes⁶

2.3 AAR General Rules 15

¹ This specification is under the jurisdiction of ASTM Committee D-10 on Packaging and is the direct responsibility of Subcommittee D10.14 on Closure and Reinforcement.

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² Annual Book of ASTM Standards, Vol 01.06.

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 02.05.

⁵ Annual Book of ASTM Standards, Vol 15.09.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

AAR Rule Governing the Loading of Commodities on Open Top Cars⁷

3. Terminology

3.1 General definitions for packaging and distribution environments are found in Terminology D 996.

4. Strapping Classifications

4.1 Strapping shall be of the following types, finish and sizes:

Type 1, Flat Strapping: Power Machine and Hand Application:

Regular-duty

Heavy-duty

Heavy-duty, high elongation

Type 2: Nail-On

4.1.1 *Strapping Finish, Lubricated or Dry* (see 8.3):

4.1.1.1 *Finish A—Organic (Pigmented or Unpigmented Paint)*

4.1.1.2 *Finish B—Galvanized (Hot Dipped or Electro-Deposit Galvanized)* (see 8.10):

Grade 1—Heavy Coating

Grade 2—Moderate Coating

Grade 3—Commercial Coating

4.1.1.3 *Finish C—Organic Painted Metallic Filled (Aluminum or Zinc)*

4.1.1.4 *Finish D—Uncoated*

4.1.2 *Strapping Sizes*—Strapping shall have the widths and thicknesses in accordance with sizes shown in Tables 1 and 2.

5. Seal Classifications

5.1 Seals shall be of the following classes, finishes, types, and styles:

5.1.1 *Seal Classes:*

R—Regular duty

H—Heavy duty

5.1.2 *Seal Finishes:*

Finish A—Organic (painted)

Finish B—Galvanized (hot dipped or electro-deposit galvanized)

Grade 1—Heavy coating

Grade 2—Moderate coating

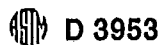
Grade 3—Manufacturer's standard commercial practice

Finish C—Uncoated

5.1.3 *Seal Styles:*

I—Snap-on or open

⁷ AAR Rule Governing the Loading of Commodities on Open Top Cars, Section No. 1 General Rules—Rule 15, available from the Association of American Railroads, Mechanical Division 50 F St., NW, Washington, DC 20001.



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TABLE 1 Type 1 Regular-Duty Strapping Widths, Thickness, and Breaking Strengths

Width, in. (mm)	Thickness, in. (mm)							
	0.010 (0.25)	0.012 (0.30)	0.015 (0.38)	0.018 (0.46)	0.020 (0.51)	0.023 (0.58)	0.028 (0.71)	0.035 (0.89)
Breaking Strength, min, lbf (N)								
3/8 (9.52)	300 (1335)	360 (1600)	450 (2000)	540 (2400)	600 (2670)	690 (3070)	...	...
1/2 (12.70)	400 (1780)	480 (2135)	600 (2670)	720 (3200)	800 (3560)	920 (4090)	...	...
5/8 (15.87)	500 (2225)	600 (2670)	750 (3335)	900 (4000)	1000 (4450)	1150 (5115)	...	...
3/4 (19.05)	...	...	900 (4000)	...	1200 (5340)	1380 (6140)	1680 (7470)	2100 (9340)

TABLE 2 Type 1 Heavy-Duty, Heavy-Duty/High Elongation Strapping Widths, Thickness, and Breaking Strengths

Width, in. (mm)	Thickness, in. (mm)										
	0.020 (0.51)	0.022 (0.56)	0.023 (0.58)	0.025 (0.64)	0.028 (0.71)	0.029 (0.75)	0.031 (0.79)	0.035 (0.89)	0.044 (1.12)	0.050 (1.27)	0.057 (1.45)
Breaking Strength, min, lbf (N)											
1/2 (12.70)	1 280 (5 690)	...	1 470 (6 540)	...	...	...	1 950 (8 675)	...	...	...	...
5/8 (15.87)	1 600 (7 120)	...	1 840 (8 185)	...	...	...	...	...	...	...	...
3/4 (19.05)	2 000 (8 896)	2 280 (10 140)	2 280 (10 140)	2 280 (10 140)	2 280 (10 140)	2 850 (12 675)	2 850 (12 675)	2 850 (12 675)	4 050 (18 015)	4 050 (18 015)	...
1 (25.4)	...	...	...	...	...	3 700 (16 455)	3 700 (16 455)	...	...	...	...
1 1/4 (31.75)	3 200 (14 240)	...	...	3 680 (16 370)	...	4 750 (21 130)	4 750 (21 130)	4 750 ^A (21 130)	6 750 (30 025)	6 750 (30 025)	7 700 (34 250)
2 (50.80)	...	...	...	...	...	...	...	...	10 600 (47 150)	10 600 (47 150)	...

^A Heavy-duty, or heavy-duty/high elongation.TABLE 3 Number of Feet Per Pound (Metres per Kilogram) of Type 1 Strapping^A

NOTE—Number of feet per pound (metres per kilogram) is based on nominal dimensions and will vary slightly with the width and thickness of the strapping within the tolerances as described in 8.2.

Width, in. (mm)	Thickness, in. (mm)														
	0.010 (0.25)	0.012 (0.311)	0.015 (0.38)	0.018 (0.46)	0.020 (0.51)	0.022 (0.56)	0.023 (0.58)	0.025 (0.64)	0.028 (0.71)	0.029 (0.75)	0.031 (0.79)	0.035 (0.89)	0.044 (1.12)	0.050 (1.27)	0.057 (1.45)
Length per Unit Mass, ft/lb (m/kg), approximate															
3/8 (9.52)	78.5 (52.7)	65.4 (43.9)	52.4 (35.2)	43.6 (29.3)	39.3 (26.4)	...	34.1 (22.9)	...	...	...	...	...	...	...	...
1/2 (12.70)	50.9 (39.6)	49.1 (33.0)	39.3 (26.4)	32.7 (22.0)	29.4 (19.7)	...	25.6 (17.2)	...	...	19.0 (12.7)	...	...	...	...	...
5/8 (15.87)	47.1 (31.6)	39.3 (26.4)	31.4 (21.1)	26.2 (17.6)	23.6 (15.8)	...	20.5 (13.7)	...	...	...	...	...	...	...	...
3/4 (19.05)	...	26.2 (17.6)	...	19.6 (13.1)	17.8 (11.9)	17.1 (11.5)	15.7 (10.5)	14.0 (9.4)	13.5 (8.95)	12.7 (8.5)	11.2 (7.5)	...	...	...	...
1 (25.4)	...	...	...	...	...	...	...	...	10.1 (6.7)	9.5 (6.3)	...	...	...	...	...
1 1/4 (31.75)	...	...	...	11.8 (7.9)	...	...	9.4 (6.3)	...	8.1 (5.5)	7.6 (5.1)	6.6 (4.4)	5.3 (3.5)	4.7 (3.1)	4.1 (2.8)	...
2 (50.80)	...	...	...	...	...	...	...	...	...	...	...	3.3 (2.2)	2.9 (1.9)	...	...

^A Commercial tolerances apply.

II—Thread-on or closed

III—Push-type or overlap

IV—Magazine-feed

V—Intersectional or cross-tie

5.2 Seal Sizes—Seals shall have widths in accordance with strapping width shown in Tables 1 and 2.

6. Ordering Information

6.1 The inquiry and order shall indicate the following:

6.1.1 Strapping type, duty, finish, grade, lubrication

(when applicable), dimension required, and quantity of each size (see Section 4).

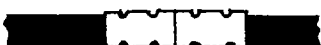
6.1.2 Coil of strapping dimensions, weight and feet per pound, oscillated, ribbon wound, or cut-to-length (see Section 9, Tables 3 and 4, and Figs. 1 and 2).

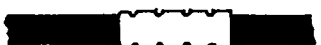
6.1.3 Seals (see Section 5) class, finish, grade (when applicable), type, style, and quantity by width (or nomenclature).

6.1.4 Make or model of strapping equipment that the strapping and seals must work in, if applicable.

6.1.5 Title, designation, and date of this specification.

TYPICAL
RECOMMENDED
CRIMP TYPE JOINTS

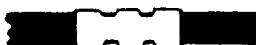

2 SEALS - 4 PAIRS OF CRIMPS


1 SEAL - 4 PAIRS OF CRIMPS

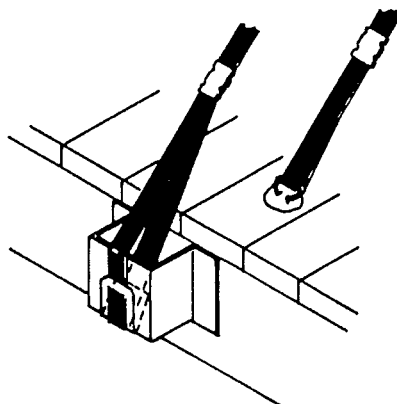

1 SEAL - 3 PAIRS OF CRIMPS


2 SEALS - 6 PAIRS OF CRIMPS

TYPICAL
RECOMMENDED
NOTCH TYPE JOINTS


1 SEAL - 2 PAIRS OF NOTCHES


2 SEALS - 4 PAIRS OF NOTCHES



LOOP TYPE SECUREMENT, AS ILLUSTRATED,
REQUIRES ONLY ONE SEAL PROPERLY SEALED,
TO PROVIDE ACCEPTABLE JOINT EFFICIENCY.

FIG. 1 Recommended Seal Joints

6.1.6 For Department of Defense, indicate selection of preservation, packing, marking, and palletization, if applicable (see Section 16).

6.2 Sizes or physical properties, or both, other than those covered by this specification shall be as specified in the contract or order.

7. Materials and Manufacture

7.1 Materials shall be cold-rolled carbon steel of the quality normally used for this purpose in commercial practice, and the physical mechanical property requirements, as determined by tests, shall be within the allowable limits.

7.1.1 *Type 1 Regular-Duty Strapping*—Regular-duty

strapping in Table 1 shall be low-carbon cold-rolled steel (see 6.1.1).

7.1.2 *Type 1 Heavy-Duty Strapping*—Heavy-duty strapping in Table 2 shall be cold-rolled, high-carbon, or medium carbon high-manganese steel which has been fully heat-treated; for example, austenitized and quenched.

7.1.3 *Type 1 Heavy-Duty, High-Elongation Strapping*—Heavy-duty, high-elongation strapping in Table 2 shall be high-carbon steel which has been fully heat-treated; for example, austenitized and quenched to provide the elongations in 8.1.2.

7.1.4 *Type 2 Nail-On Strapping*—Unless otherwise specified, Type 2 nail-on strapping shall be strapping made from Type 1 regular-duty or Type 1 heavy-duty strapping, avail-

TABLE 4 Size of Coils and Package

Type Coils	Size of Strapping, in. (mm)	Inside Diameter, in. (mm) (Commercial Tolerance)	Outside Diameter, max, in. (mm)	Coils Per Package, max
Oscillated	¾ by 0.010 (9.52 by 0.25) through ¾ by 0.035 (19.05 by 0.89)	16 (406)	23½ (597)	1
Ribbon	¾ by 0.022 (19.05 by 0.56) through ¾ by 0.035 (19.05 by 0.89)	16 (406)	27 (686)	2
	1 by 0.020 (25.4 by 0.75) through 1 by 0.031 (25.4 by 0.79)	16 (406)	27 (686)	1
	1¼ by 0.020 (31.75 by 0.51) through 1¼ by 0.057 (31.75 by 1.45)	16 (406)	27 (686)	1
	2 by 0.044 (50.80 by 1.12) through 2 by 0.050 (50.80 by 1.27)	16 (406)	25½ (657)	1

able in sizes ¾ in. (15.87 mm) in width or greater with punched nail holes. Hole diameters and hole spacing can vary depending upon strap size and duty, which shall be in accordance with manufacturer's standard practice. However, nail holes shall be spaced at intervals no more than 3 in. (76 mm) apart.

7.1.5 *Seals for Type 1 Strapping*—Unless otherwise specified, seals for Type 1 strapping shall be made of steel in accordance with the manufacturer's commercial practice.

8. Physical and Mechanical Properties

8.1 *Breaking Strength and Elongation, Type 1 Regular-*

Duty and Heavy-Duty Strapping:

8.1.1 *Breaking Strength*—The breaking strength of the strapping shall be as shown in Table 1 and Table 2 when tested as specified in 13.3.

8.1.2 *Elongation*—The elongation in 6 in. (152 mm) for Type 1 strapping, when tested as specified in 13.4, shall be as follows:

Regular-duty (see 7.1.1)	0.5 to 4.0 %
Heavy-duty (see 7.1.2)	
Thickness less than 0.031 in. (0.79 mm)	5.0 to 12 %
Thickness 0.031 in. (0.79 mm) and greater	6.5 to 12 %
Heavy-duty high elongation (see 7.1.3)	
Thickness 0.035 in. (0.889 mm) and greater	9.0 to 16 %

8.2 *Tolerances, Type 1 Strapping, Widths*—The widths of the strapping shall not vary from that shown in Tables 1 and 2 by more than ± 0.005 in. (0.13 mm) for all cold-rolled strapping.

8.2.1 *Type 1 Strapping, Thickness*—The thickness of strapping sizes listed in Tables 1 and 2 shall not vary from nominal thickness by more than the following:

Cold-rolled strapping 0.031 in. (0.79 mm) or less in thickness $+0.002$ in. (0.05 mm), -0.001 (0.03 mm).
Cold-rolled strapping greater than 0.031 in. (0.79 mm) in thickness up to 0.057 in. (1.45 mm) ± 0.002 in. (0.05 mm).

8.3 *Lubrication*—Unless otherwise specified, Type 1 strapping shall have a coating of wax or wax-like lubricant applied to the surfaces that will render the strapping suitable for application with tension tools of the feed wheel (friction) type (see 4.1.2 and 6.1.4). The lubrication of the strapping is intended to facilitate the use of strapping tools in which the two bands of the strapping are held in contact with each other under pressure by frictional grips, and sliding of the faces of the strapping is necessary during the tensioning operation. Test in accordance with 13.9.

8.4 *Type 1 Strapping, Coils*—Each coil shall consist of one continuous piece of strapping. Coils with lengths of strapping welded together shall be considered as one-piece coil. Type 1 strapping shall have no more than two welded joints in any coil.

8.4.1 *Dimensional Requirements at the Weld*—The thickness at the weld shall be no more than one and one half the

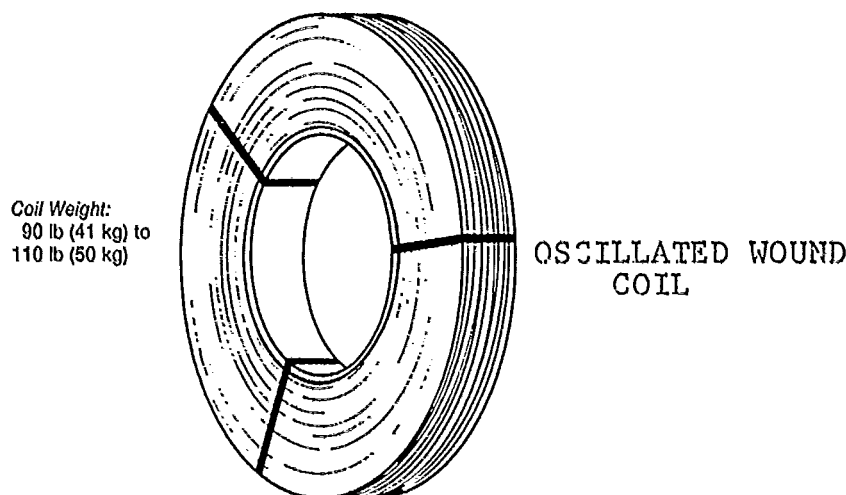


FIG. 2 Oscillated Wound Coil