



Designation: D 6573/D 6573M – 00<sup>ε1</sup>

## Standard Specification for General Purpose Wirebound Shipping Boxes<sup>1</sup>

This standard is issued under the fixed designation D 6573/D 6573M; 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.

<sup>ε1</sup> NOTE—Figure 3 was editorially corrected in March 2001.

### 1. Scope

1.1 This specification covers the fabrication of new wirebound general purpose (GP) panelboard (hereafter referred to as wirebound boxes) shipping boxes intended for use as containers for domestic and overseas shipment of general materials and supplies, not exceeding 500 lb [226.8 kg] for class 1 domestic, 400 lb [181.4 kg] for Class 2 overseas shipments or 300 lb [136.0 kg] for Class 3 extreme distribution hazard conditions or military contingency purposes.

1.2 Wirebound box performance is dependent on its fabricated components; therefore, a variety of types, classes, styles, and treatments reflecting varied performance are specified. This specification does not cover wirebound box performance under all atmosphere, handling, shipping, and storage conditions. Wirebound boxes in compliance with Hazardous Material Modal Regulations or United States Code of Federal Regulations (CFRs) are found in the Supplementary Requirements.

1.3 The use of other construction methods or techniques are acceptable and shall be permitted, provided the resulting packaging systems are of equal or better performance than would result from the use of these specified materials and procedures. The appropriate Practice D 4169 distribution cycle(s) can be used to develop comparative procedures and criteria.

1.4 *Units*—The values stated in inch-pound units are to be regarded as standard. The SI values given in brackets are mathematical. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. See IEEE/SI 10 for conversion of units.

1.5 *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 appro-*

*priate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- A 641 Specification for Zinc-Coated Galvanized Carbon Steel Wire<sup>2</sup>
- A 777 Specification for Galvanized Round Steel Tying Wire<sup>3</sup>
- A 809 Specification for Aluminum-Coated (Aluminized) Carbon Steel Wire<sup>2</sup>
- A 818 Specification for Coppered Carbon Steel Wire<sup>2</sup>
- D 996 Terminology of Packaging and Distribution Environments<sup>4</sup>
- D 1990 Practice for Establishing Allowable Properties for Visual-Graded Dimension, Lumber from In-Grade Tests of Full-Size Specimens<sup>5</sup>
- D 3950 Specification for Strapping, Nonmetallic (and Joining Methods)<sup>4</sup>
- D 3951 Practice for Commercial Packaging<sup>4</sup>
- D 3953 Specification for Strapping, Flat Steel and Seals<sup>4</sup>
- D 4169 Practice for Performance Testing of Shipping Containers and Systems<sup>4</sup>
- D 6199 Practice for Quality of Wood Members of Containers and Pallets<sup>4</sup>
- D 6254/D 6254M Specification for Wirebound Pallet-Type Wood Boxes<sup>4</sup>
- F 1667 Specification for Driven Fasteners: Nails, Spikes and Staples<sup>6</sup>
- IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI) (the Modern Metric System)<sup>7</sup>

#### 2.2 Federal Specification:

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.06.

<sup>3</sup> Discontinued. See 1995 Annual Book of ASTM Standards, Vol 01.06.

<sup>4</sup> Annual Book of ASTM Standards, Vol 15.09.

<sup>5</sup> Annual Book of ASTM Standards, Vol 04.10.

<sup>6</sup> Annual Book of ASTM Standards, Vol 15.08.

<sup>7</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.26 on Wooden Crates, Pallets, and Skids.

Current edition approved June 10, 2000. Published September 2000.

Fed-Std-123 Federal Standard Marking for Shipment (Civil Agencies)<sup>8</sup>

### 2.3 Military Specification:

MIL-HDBK-129 Department of Defense Handbook Military Marking<sup>9</sup>

2.4 *National Motor Freight Traffic Association Standard: National Motor Freight Classification*<sup>10</sup>

2.5 *National Freight Committee Standard: Uniform Freight Classification*<sup>11</sup>

2.6 *APA—The Engineered Wood Association Standard: PS1-95 Construction and Industrial Plywood*<sup>12</sup>

## 3. Terminology

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

## 4. Classification

### 4.1 Types:

4.1.1 *Type 1*—Easy load, one interior container that supports the top, bottom, and sides of the outer wirebound shipping box.

4.1.2 *Type 2*—Average load, interior or intermediate containers that support and fill the voids of outer wirebound container.

4.1.3 *Type 3*—Difficult load, interior contents that require a high degree of protection. Interior contents will not support outer wirebound shipping container top, bottom, or sides.

4.1.4 *Type 4*—Special use, wirebound wood boxes (see Supplementary Requirements section for specification requirements).

### 4.2 Classes:

4.2.1 *Class 1*—Domestic shipments capable of passing Practice D 4169, distribution Cycle 1 testing as a minimum, with no maritime shipment testing required.

4.2.2 *Class 2*—Overseas shipments capable of passing Practice D 4169 distribution Cycles 1 with 15, 16, or 17 as applicable to the type of shipping container selected.

4.2.3 *Class 3*—Extreme Distribution hazards or military contingency operations the wirebound container will be capable of passing Practice D 4169 distribution cycle 18 testing as a minimum requirement.

### 4.3 Style (based on the method of closure, see Fig. 1<sup>13</sup>):

4.3.1 *Style 1*—Twisted wire closure.

4.3.2 *Style 2*—Looped wire closure.

4.3.3 *Style 3*—Looped wire closure with wired ends.

### 4.4 Treatment:

4.4.1 *Grade A*—With preservative treatment.

4.4.2 *Grade B*—Without water preservative treatment.

## 5. Ordering Information

5.1 Purchasers should cite the following information in procurement and purchase order documents:

5.1.1 This specification title, ASTM number, and date.

5.1.2 Type of load, box type, class, style, and treatment, if specified, (see 4.1-4.4 and S2.1 respectively).

5.1.3 The material/product shall conform to the requirements stated in United States Customary Units of Specification IEEE/S1 10.

5.1.3.1 Inside box dimensions (see 7.1).

5.1.4 Intermediate cleats for special designs, their size and location. (see 7.3.1).

5.1.5 Weight of contents or load specified in lbs (kg).

5.1.6 Type of girth wire (see 7.8).

5.1.7 When palletization is required (see S3.4.3).

5.1.8 Marking required (see S3.4.2).

5.1.9 Exceptions to these specifications, if authorized.

5.1.10 When preservation treatment Grade A is required for class 2 or 3 boxes for overseas shipments (see 6.1.4).

5.1.11 When four-way entry skids are required and when 3½ by 4-in. [76 by 89 mm] built-up skids are required (see 7.14).

5.1.12 Purchasers should reference by paragraph number any supplemental requirements applicable to their purchase request (see S1.1).

## 6. Materials and Manufacture

6.1 *Materials*—It is encouraged that recycled material be used when practical. All recovered, recycled, or virgin materials used in the box manufacture shall meet the requirements of this specification and APA/EWA PSI-95. Panelboard shall have no more than 40 % post consumer recovered material.

6.1.1 *Lumber*—Lumber shall perform to Practice D 6199, Class 2 requirements, for cleats (see 7.3, Group III) for skids see Specification D 6254/D 6254M. Properties of lumber are in accordance with Practice D 1990

6.1.1.1 *Plywood Panel*—Requirements are found in APA PS1-95.

6.1.1.2 *Faceboards*—The material used for the faces of a box. Faceboards shall be as specified (see 7.2):

### 6.1.2 Wires:

6.1.2.1 *Binding Wire and Staple Wire*—Binding wire shall be low carbon annealed steel wire and have the properties listed in Table 1. Staple wire shall be hard tempered, low carbon steel wire, and have the properties listed in Table 1.

6.1.2.2 *Wire Coatings*—The surfaces of binding wire and staple wire for Class 2 and 3 boxes shall be galvanized. The surface of binding and staple wires for Class 1 boxes need not be galvanized. Galvanized coating shall be smooth and shall not flake or peel when tested in accordance with Specification A 641.

### 6.1.3 Fasteners:

6.1.3.1 *Nails*—Nails shall be made of steel wire and shall conform to the requirements of Specification F 1667. Nails will be clinched, cement-coated, or chemical etched to prevent premature withdrawal.

6.1.3.2 *Staples or Wire Stitches*—Staples or wire stitches

<sup>8</sup> Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

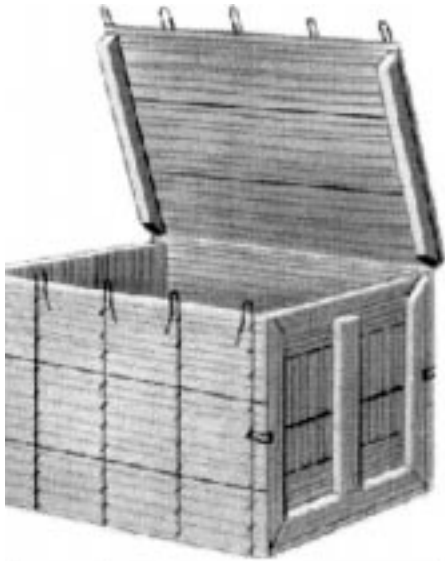
<sup>9</sup> Available from Standardization Documents Order Desk, Bldg. 4, Section D, Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

<sup>10</sup> Available from the National Motor Freight Traffic Association, American Trucking Associations, 2200 Mill Road, Alexandria, VA 22314.

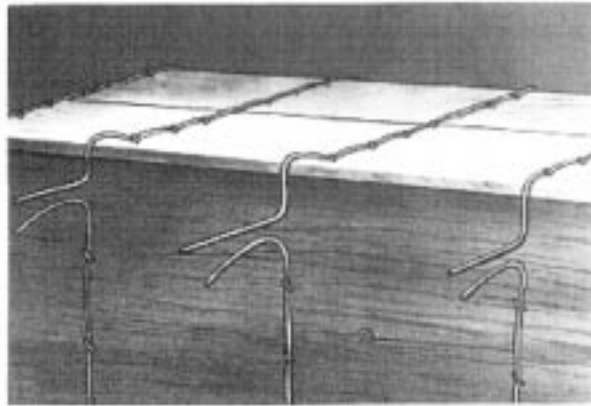
<sup>11</sup> Available from the National Railroad Freight Committee, Uniform Freight Classification, 151 Ellis Street, N.E., Suite 200, Atlanta, GA 30335-6201.

<sup>12</sup> Available from the APA, the Engineered Wood Association, 7011 S. 19<sup>th</sup> Street, P.O. Box 11700, Tacoma, WA 98411-0700.

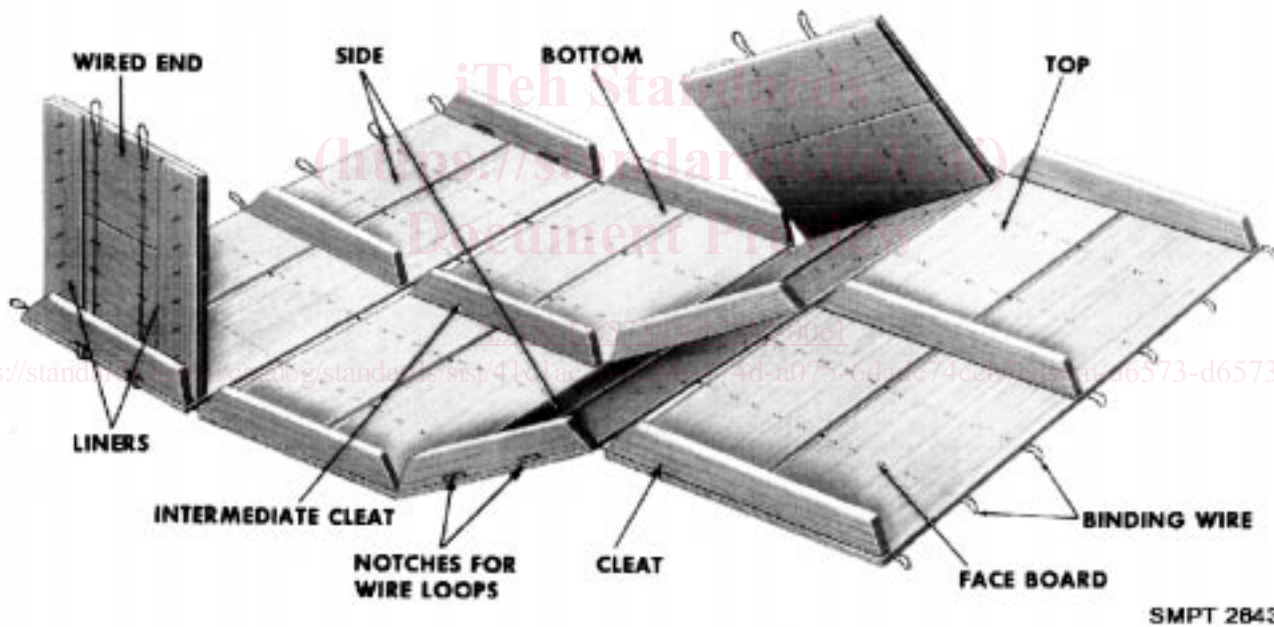
<sup>13</sup> Dean, School of Military Packaging Technology, 360 Lanyard Rd., Building 360, Attn: ATSL-MP, Aberdeen Proving Ground, MD 21005-5282.



STYLE 2



STYLE 1



STYLE 3

FIG. 1 Styles of Closures<sup>13</sup>

shall be made of steel wire not less than 0.0625 in. [2 mm] and comply with Specification F 1667.

6.1.4 *Wood Preservative, Water Repellent*—Water repellent preservative shall be composed of either a 2 % copper naphthenate, a 3 % zinc naphthenate, or a 1.8 % oxine copper (formerly referred to as copper-8-quinolinolate) solution.

**7. Construction**

7.1 *Dimensions*—Boxes shall be furnished having the dimensions as specified (see 5.1.3). Dimensions of boxes are

**TABLE 1 Tensile Strength of Binding and Staple Wire**

Type	K (psi)	MPa	Use
Twist binding	45–70	310–483	Twist closure
Medium binding	60–75	414–517	Groups 1, 2, 3 woods
Hard binding	70–85	483–586	Group 4 woods
Stapling wire	95–125	655–862	Group 1, 2, 3 woods
Stapling wire special	Up to 180	Up to 1241	Group 4 woods

measured between the inside surfaces of the faceboards, and calculated to the nearest 1/8 in. [3 mm], the preferred sequence



length, width, and depth is used to communicate size in the purchase order or contract.

**7.2 Faceboards**—Faceboards are the sheathing boards on the top, bottom, sides and ends of a box. The thickness of the faceboard can be determined by selecting the appropriate information from Tables 2 and 3. Weight of box contents, type of load and the groups of wood based on box class determine the appropriate faceboard.

**7.2.1 Grain of Faceboards**—End faceboards for Styles 1 and 2 boxes shall be placed with the grain horizontal, except that when horizontal battens are used in end panels, the grain of the faceboards shall be vertical. End faceboards for Style 3 boxes shall be placed with the grain vertical. A line of staples shall be located approximately 1 in. [25 mm] from the parallel to each horizontal edge of the end faceboard (see 7.9). The direction of grain of the ply to which the end wire is stitched shall be vertical.

**7.3 Cleats**—Cleats are pieces of lumber which form the framework of the box and to which faceboards of the top, bottom, and sides are stapled. Cleats shall be made from wood specified in Practice D 6199. The cleats shall be made of Group 2, 3, or 4 woods only. Each cleat shall be single piece of wood without joints. Cleats shall be made with mitered ends or with mortised and tenoned ends tongue- and groove. Dimensions shall be actual dimensions, 1 1/2 in. [26 mm]. Edge cleats of all styles of boxes shall be 1 3/16 in. [21 mm] wide and 7/8 in. [22 mm] in thickness for boxes having weight of contents up to 300 lb [136 kg]. Boxes having weight of contents from 300 to 500 lb [136 to 227 kg] edge cleats shall be 1 1/8 in. [29 mm] wide and 1 1/8 in. [29 mm] in thickness, except that HVB or HVBW end patterns are used (see Fig. 2), edge cleats shall be 1 3/16 in. [21 mm] wide and 7/8 in. [22 mm] in thickness.

**7.3.1 Intermediate Cleats**—Boxes for Types 2 and 3 loads, having greater between-cleat dimensions than specified in Table 4, shall be reinforced with one or more rows of intermediate cleats, except as below. Rows of intermediate cleats are not required on boxes for Type 1 loads. The distance between adjacent rows of cleats shall not exceed the distance indicated in Table 5. In special designs for Types 2 and 3 loads, where required, size and location of intermediate cleats shall be specified (see 5.1.4) If the use of intermediate cleats may be omitted but the thickness of faceboards shall be increased to the thickness specified for the between cleat dimension indicated in Table 5.

**7.3.2 Cleat Sizes**—Unless otherwise specified in the contract or purchase order (see 5.1.9), any of the sizes of cleats shown in Table 6 shall be used for intermediate rows. No part of any intermediate cleat shall be more than 1/32 in. [1 mm] less than the dimension shown in Table 6, for dimensions exceeding 1 3/16 in. [21 mm] or 1/4 in. [2 mm] less than the dimensions exceeding 1 3/16 in. [21 mm].

**7.4 Types of Loads**—For Types 1 and 2 loads, the inside dimensions of wirebound boxes shall be sufficiently exact so that the contents fit into the box when packed and give support to the faces of the box. If contents do not fit the box and permit shifting, a Type 3 load results and a box meeting the requirements for Type 3 load shall be used. For Type 3 loads, other than bulk loads, the contents shall be firmly bolted, blocked,

**TABLE 2 Minimum Thickness of Faceboards**

Weight of Contents in lbs [kg]		Group 1 Woods in Fractional in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
<b>Class 1 Boxes</b>				
0	85 [38.5]	7/32 [6]	1/4 [6]	5/16 [8]
85 [38.5]	125 [56.7]	1/4 [6]	5/16 [8]	3/8 [10]
125 [56.7]	200 [90.7]	5/16 [8]	3/8 [10]	7/16 [11]
200 [90.7]	300 [136.1]	3/8 [10]	7/16 [11]	A
300 [136.1]	400 [181.4]	A	A	A
400 [181.4]	500 [226.8]	A	A	A
<b>Class 2 Boxes</b>				
0	85 [38.5]	5/16 [8]	3/8 [10]	A
85 [38.5]	125 [56.7]	3/8 [10]	3/8 [10]	A
125 [56.7]	200 [90.7]	A	A	A
200 [90.7]	300 [136.1]	A	A	A
300 [136.1]	400 [181.4]	A	A	A
Weight of Box Contents in lbs [kg]		Group 1 Woods Fractional, in. [mm]		
<b>Class 3 Boxes</b>				
Exceeding		Type 1 Load	Type 2 Load	Type 3 Load
0	85 [38.5]	3/8 [10]	3/8 [10]	A
85 [38.5]	125 [56.7]	A	A	A
125 [56.7]	200 [90.7]	A	A	A
200 [90.7]	500 [226.8]	A	A	A
Weight of Box Contents in lbs [kg]		Group 2 and 3 Woods in Fractional in. [mm]		
<b>Class 1 Boxes</b>				
Exceeding		Type 1 Load	Type 2 Load	Type 3 Load
0	85 [38.5]	1/7 [4]	1/6 [4]	3/16 [5]
85 [38.5]	125 [56.7]	1/6 [4]	3/16 [5]	7/32 [6]
125 [56.7]	200 [90.7]	3/16 [5]	7/32 [6]	1/4 [6]
200 [90.7]	300 [136.1]	7/32 [6]	7/32 [6]	1/4 [6]
300 [136.1]	400 [181.4]	1/4 [6]	1/4 [6]	5/16 [8]
400 [181.4]	500 [226.8]	5/16 [8]	5/16 [8]	3/8 [10]
<b>Class 2 Boxes</b>				
0	85 [38.5]	3/16 [5]	7/32 [6]	5/16 [8]
85 [38.5]	125 [56.7]	7/32 [6]	1/4 [6]	5/16 [8]
125 [56.7]	200 [90.7]	7/32 [6]	1/4 [6]	5/16 [8]
200 [90.7]	300 [136.1]	1/4 [6]	3/8 [10]	3/8 [10]
300 [136.1]	400 [181.4]	5/16 [8]	3/8 [10]	3/8 [10]
<b>Class 3 Boxes</b>				
0	85 [38.5]	1/4 [6]	1/4 [6]	5/16 [8]
85 [38.5]	125 [56.7]	1/4 [6]	5/16 [8]	5/16 [8]
125 [56.7]	200 [90.7]	1/4 [6]	5/16 [8]	3/8 [10]
200 [90.7]	500 [226.8]	5/16 [8]	3/8 [10]	3/8 [10]
Weight of Box Contents in lbs [kg]		Group 4 Woods in Fractional in. [mm]		
<b>Class 1 Boxes</b>				
Exceeding		Type 1 Load	Type 2 Load	Type 3 Load
0	85 [38.5]	1/7 [4]	1/7 [4]	1/6 [4]
85 [38.5]	125 [56.7]	1/7 [4]	1/6 [4]	3/16 [5]
125 [56.7]	200 [90.7]	1/6 [4]	3/16 [5]	7/32 [6]
200 [90.7]	300 [136.1]	3/16 [5]	7/32 [6]	1/4 [6]
300 [136.1]	400 [181.4]	7/32 [6]	1/4 [6]	5/16 [5]
400 [181.4]	500 [226.8]	1/4 [6]	1/4 [6]	5/16 [5]
<b>Class 2 Boxes</b>				
0	85 [38.5]	3/16 [5]	3/16 [5]	7/32 [6]
85 [38.5]	125 [56.7]	3/16 [5]	3/16 [5]	7/32 [6]
125 [56.7]	200 [90.7]	3/16 [5]	7/32 [6]	1/4 [6]
Weight of Box Contents in lbs [kg]		Group 4 Woods in Fractional in. [mm]		
<b>Class 2 Boxes</b>				
Exceeding		Type 1 Load	Type 2 Load	Type 3 Load
200 [90.7]	300 [136.1]	7/32 [6]	1/4 [6]	5/16 [5]
300 [136.1]	400 [181.4]	1/4 [6]	5/16 [5]	3/8 [10]
<b>Class 3 Boxes</b>				
0	85 [38.5]	1/4 [6]	1/4 [6]	1/4 [6]
85 [38.5]	125 [56.7]	1/4 [6]	1/4 [6]	5/16 [5]
125 [56.7]	200 [90.7]	1/4 [6]	1/4 [6]	5/16 [5]
200 [90.7]	500 [226.8]	1/4 [6]	5/16 [5]	3/8 [10]

<sup>A</sup> Group 1 woods are not permitted.

braced, or otherwise anchored to the frame of the box in such manner that shifting of contents will not occur during handling of shipment.

**TABLE 3 Minimum Faceboard Requirements**

Resawn faceboard thickness not less than ½ in. [1 mm] Less than specified in Table 2	Faceboard edge piece not less than 2-½ in. [63.5 mm] wide	Space between Faceboards not more than ¼ in. [6 mm]
Faceboards no less than 2½ in. [63.5 mm] in width	One full piece of plywood thickness not less than 25 %	

**7.5 Battens**—A batten is a wooden board to which the end faceboard is nailed or stapled. A batten is a reinforcement used only on the ends of the wirebound container. Battens shall be attached to the outside face of the end faceboard and may be positioned horizontal, vertical, or both horizontal and vertical. Battens made for Group 1 woods shall be not less than 1¾ in. [45 mm] wide and those made from Groups 2, 3, and 4 woods shall be not less than 1⅜ in. [35 mm] wide. Battens shall be the same thickness as the cleats on the boxes. No part of a batten shall be more than ⅓ in. [1 mm] less than the specified thickness nor more than ⅓ in. [2 mm] less than the specified width.

**7.6 Liners**—A liner is a thin wooden board stapled to the end to reinforce the end face board. The grain of the liner shall be at right angles to the grain of the end face board. Liners for Styles 1 and 2 boxes shall always be vertical; liners for Style 3 boxes shall always be horizontal. When liners are attached to the edges of ends, the liners shall be not less than 1⅜ in. [30 mm] wide. For Style 3 boxes more than 14 in. [356 mm] in depth, or having vertical battens, the liners shall be not less than 2⅞ in. [73 mm] wide. The thickness of the liner shall be not less than the thickness of the end board, except that it need not exceed ¼ in. [6 mm], when the thickness of the end face board exceeds ¼ in. [6 mm]. Each edge and intermediate liner shall be fastened to the end face board by staples. Liners which are 2⅞ in. [73 mm] wide shall have two rows of staples.

**7.7 Ends**—Ends are composed of faceboards to which liners, battens, or both are attached forming a subassembly.

**7.7.1 Ends for Styles 1 and 2 Boxes**—Battens shall be required on the ends of Styles 1 and 2 boxes, except that vertical liners are permitted in lieu of battens under the conditions specified in (see Section 7). The number and arrangement of battens or liners depend on the class of box, type of load, dimensions, and weight of contents. Vertical liners shall be required on ends made from sawed boards when battens are not used. When ends are made from one-piece plywood, no liner are required. Standard arrangements of batted ends and lined ends for Styles 1 and 2 boxes are shown in Fig. 3.

**7.7.2 Ends for Style 3 Boxes**—Ends of Style 3 boxes shall have liners, battens, or both. The number and arrangement of battens, liners, and end-wires depend on the class of box, type of load, dimensions, and weight of contents. When ends shall be made from one-piece plywood, liners are not required. Standard arrangements of battens on the ends of Style 3 boxes are shown in Fig. 4.

**7.8 Wires**—Each girth wire shall be continuous around the girth of the box. Whenever practicable, all girth wires shall be spaced uniformly, except that when rows of intermediate cleats are used, a girth wire shall be placed over each row of cleats.

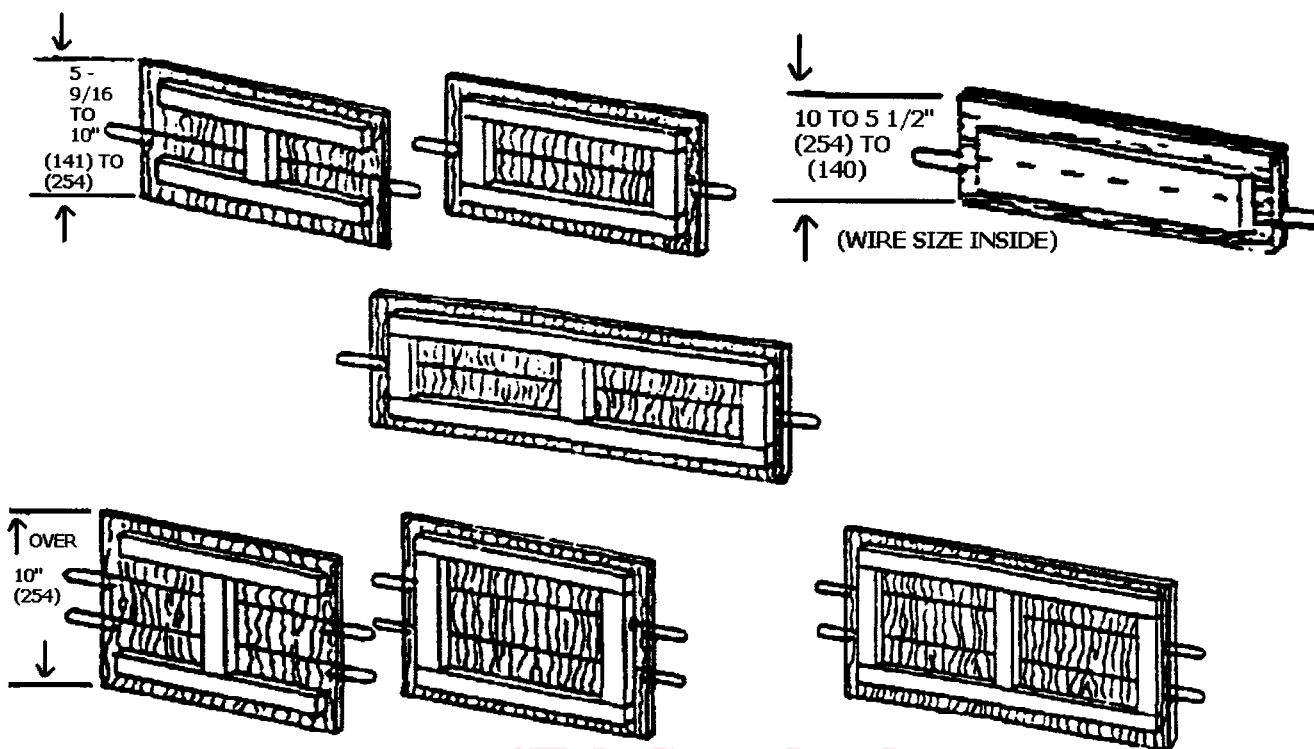
On the ends of Style 3 boxes, each wire shall be continuous across the end. These wires should be generally stapled to the outside face of the end or may be stapled to the inside face if it is more practical to do so. Stapling shall be as specified (see 7.9). Splicing or welding of a binding wire during manufacture is acceptable. The number and gage of girth wires shall conform to the requirements of Table 7 for the weight of contents and inside length of box specified.

**7.8.1 Wire Gage**—The gage of end wires on Style 3 boxes shall conform to the requirements of Table 8 for the weight of contents and class of box specified.

**7.8.2 Girthwise Wire Closure for Box Styles**—The length of girth wires for twisted and looped wire fasteners on Styles 1 and 2 boxes shall be such as to make satisfactory closure. The length of looped wire on the ends of Style 3 boxes shall be such as to make a satisfactory assembly of the box. On Style 1 boxes, for twisted wire closures, the ends of the girth wires shall not be less than 2¼ in. [57 mm] beyond the edge of the top boards and not less than 1 in. [25 mm] beyond the edge of the side boards. On Style 2 boxes, each end of each girth wire shall be a looped fastener formed by twisting the wires or by bending the wire back in the opposite direction, driving the ends of the wire through the boards and clinching. The manner of forming the looped fastener shall be at the option of the manufacturer. On Style 3 boxes, each end of each end wire shall be a looped fastener formed by bending the wire back in the opposite direction, driving the end of the wire through the boards and clinching. When specified in the contract or purchase order (see 5.1.6), each end of each girth wire may be a twisted wire closure, as specified for Style 1 closures above.

**7.9 Stapling**—Staples shall be used for fastening binding wires for both faceboards and cleats and for fastening liners to end faceboards. Staples also may be used for fastening end faceboards to battens. Binding wires shall be applied mechanically and be fastened by staples astride the wire. Staples shall pass through the faceboards and be clinched smooth, or shall pass through the faceboards and into the cleats. The points of the staples shall not protrude from the surface of the wood, but if driven through a board or cleat, they shall be clinched. Spacing of staples shall not exceed 2 in. [51 mm] when driven over binding wires for Class 1 boxes. For Class 2 and 3 boxes, spacing of staples shall not exceed 1½ in. [38 mm], except where the requirements for positioning end wires or the length of the cleat requires more staples than the spacing shall not exceed 1½ in. [38 mm]. Staples driven over binding wires into faceboards only, shall be not less than 0.0475 in. in diameter 18-gage [1.20 mm]. The length of staples shall be not less than indicated in Table 9 and shall be long enough to penetrate the boards and be clinched smooth.

**7.9.1 Staples for Securing Binding Wire to Cleats**—Staples driven over binding wires and through faceboards into cleats shall be not less than 0.0625 in. diameter 16 gage [1.6 mm], except that staples driven into cleats 1⅞ in. [28.6 mm] wide by 1⅞ in. [28.6 mm] deep shall be not less than 0.072 in. diameter 15 gage [1.8 mm]. Staples shall not be deformed or protrude from the cleats, except that when the thickness of the cleats is ⅞ in. [14 mm] or less, the staples shall be driven through the cleats and shall be sufficiently long to produce a smooth clinch.



Maximum Spacing of Vertical Battens in inches (mm)

	Class 1	Class 2	Class 3
Type 1 Load	18 [457]	15 [381]	12 [305]
Type 2 Load	16 [406]	13 [330]	10 [254]
Type 3 Load	14 [356]	11 [279]	7 [178]

NOTE 1—Wires may be placed on either side of face material.

FIG. 2 End Panel Arrangements for Style 3 Boxes Horizontal and Vertical Battens with Wires HVBW View (see 7.13.4)

TABLE 4 TENSILE STRENGTH OF BINDING AND STAPLE WIRE

Type	K (psi)	MPa	Use
Twist binding	45–70	310–483	Twist closure
Medium binding	60–75	414–517	Groups 1, 2, 3 woods
Hard binding	70–85	483–586	Group 4 woods
Stapling wire	95–125	655–862	Group 1, 2, 3 woods
Stapling wire special	Up to 180	Up to 1241	Group 4 woods

TABLE 5 Maximum Distance Between Adjacent Rows of Cleats

Thickness of faceboards in fractional in. [mm] <sup>a</sup>	Type 2 Load [Average]		Type 3 Load [Difficult]		
	Group 1 Woods, in. [mm]	Groups 2 and 3 Woods, in. [mm]	Group 1 Woods, in. [mm]	Group 2 and 3 Wood in. [mm]	
Class 1 Boxes					
1/6 [4]	—	32 [813]	36 [914]	—	24 [610]
7/32 [6]	—	40 [1016]	44 [1118]	—	28 [711]
1/4 [6]	32 [813]	44 [1118]	48 [1219]	—	32 [813]
5/16 [8]	36 [914]	48 [1219]	48 [1219]	24 [610]	36 [914]
3/8 [10]	36 [914]	48 [1219]	48 [1219]	24 [610]	40 [1016]
Class 2 and 3 Boxes					
7/32 [6]	—	28 [711]	32 [813]	—	20 [508]
1/4 [6]	—	32 [813]	36 [914]	—	20 [508]
5/16 [8]	—	36 [914]	40 [1016]	—	24 [610]
3/8 [10]	32 [813]	40 [1016]	44 [1118]	—	28 [711]

<sup>a</sup> When intermediate cleats are not desired (see 7.3.1). For Type 1 loads, intermediate cleats are not required.

The length of staples shall be not less than indicated in Table 10.

7.9.2 *Number of Cleat Staples*—The minimum number of staples in any cleat shall comply with the requirements of Table 11. Not less than two staples shall be driven over each girth wire through each faceboard, except that when a board is less than 2 1/2 in. [63.5 mm] wide, only one staple need be driven through the board.

7.9.3 *Placement of Staples*—At each corner of the box the distance from the end of the cleat to the nearest staple shall not exceed 1 5/8 in. [41 mm]. Staples used for fastening edge and intermediate liners to end faceboards or for fabricating edge and intermediate liners to end faceboards or for fabricating two-ply faceboards shall be not less than 0.0475-in. diameter 18 gage [1.2 mm], and shall be sufficiently long to pass through the liner and faceboard and produce a smooth clinch. Staples used for fastening end faceboards to battens shall be not less than 16 gage 0.0625-in. diameter [1.8 mm]. The points of the

staples shall not protrude from the battens unless clinched. Staples used for fastening end faceboards more than 1/16 in. [2 mm] thick to battens shall be clinched. The spacing of staples shall not exceed 2 in. [51 mm], measured along the length of the batten.

7.10 *Nailing*—Nails used for fastening end faceboards to end battens shall not be less than 14 1/2 gage (0.076-in. diameter) [2 mm]. The length of each nail shall be not less than