



Designation: ~~D6573/D6573M – 01 (Reapproved 2007)~~ D6573/D6573M – 13

Standard Specification for General Purpose Wirebound Shipping Boxes¹

This standard is issued under the fixed designation D6573/D6573M; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

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~~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~~, types of load, 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 **D4169** 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/ASTM 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 appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- [A641/A641M Specification for Zinc-Coated \(Galvanized\) Carbon Steel Wire](#)
- [A777 Specification for Galvanized Round Steel Tying Wire \(Withdrawn 1995\)³](#)
- [D996 Terminology of Packaging and Distribution Environments](#)
- [D1990/D3951 Practice for Establishing Allowable Properties for Visually-Graded Dimension Lumber from In-Grade Tests of Full-Size Specimens](#)
- [Commercial Packaging](#)
- [D3953 Specification for Strapping, Flat Steel and Seals](#)
- [D4169 Practice for Performance Testing of Shipping Containers and Systems](#)
- [D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials](#)
- [D4444 Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters](#)
- [D6199 Practice for Quality of Wood Members of Containers and Pallets](#)
- [D6253 Practice for Treatment and/or Marking of Wood Packaging Materials](#)
- [D6254/D6254M Specification for Wirebound Pallet-Type Wood Boxes](#)
- [F1667 Specification for Driven Fasteners: Nails, Spikes, and Staples](#)
- [IEEE/ASTM SI 10 Standard for Use of the International System of Units \(SI\) \(the Modern Metric System\)](#)

¹ This specification is under the jurisdiction of ASTM Committee **D10** on Packaging and is the direct responsibility of Subcommittee **D10.12** on Shipping Containers, Crates, Pallets, Skids and Related Structures.

Current edition approved ~~April 1, 2007~~ April 15, 2013. Published ~~May 2007~~ September 2013. Originally approved in 2000. Last previous edition approved in ~~2004~~ 2007 as ~~D6573/D6573M – 01~~ D6573/D6573M – 01 (2007). DOI: ~~10.1520/D6573_D6573M-01R07~~ 10.1520/D6573_D6573M-13.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



2.2 *Code of Federal Regulations:*³

[CFR Parts 107–180, Title 49 Hazardous Materials Regulations](#)

2.3 *Federal Specification:Standard:*

[Fed-Std-123 Federal Standard Marking for Shipment \(Civil Agencies\)](#)⁴

2.4 *Military Specification:Handbook:*

[MIL-HDBK-129 Department of Defense Handbook Military Marking](#)⁵

2.5 *National Motor Freight Traffic Association Standard:*

[National Motor Freight Classification](#)⁶

2.5 ~~APA—The Engineered Wood Association Standard:~~

[PS1-95 Construction and Industrial Plywood](#)⁷

2.6 *ANSI Standard:*

[ANSI/ASQC Q91-1987Q91-1987 Quality Systems-Model for Quality Assurance and Design/Development, Production, Installation, and Servicing](#)⁷

2.7 *Hardwood Plywood and Veneer Association Standard:*⁸

[ANSI/HPVA HP-1-2004 American National Standard for Hardwood and Decorative Plywood](#)

2.8 *National Institute of Standards and Technology (NIST) Standard:*⁹

[PS 1-07 Structural Plywood](#)

[PS 20-05 American Softwood Lumber Standard](#)

2.9 *International Standard:*¹⁰

[International Standards for Phytosanitary Measures Publication No. 15 \(ISPM 15\) Regulation of Wood Packaging Material in International Trade](#)

3. Terminology

3.1 *Definitions*—General definitions for packaging and distribution environments are found in Terminology [D996](#).

3.2 *Definitions of Terms Specific to This Standard:* The wood box components discussed herein were selected on the basis of part function. Alternate names are sometimes used by the wood packaging industry and end-users.

3.2.1 *batten*—lumber reinforcement nailed or stapled to the end faceboards together to create rigidity.

3.2.2 *binding wire*—round steel wire stapled to the faceboards which ends in a loop, the prong of which is firmly anchored in a board or twisted to form a loop.

3.2.3 *cleat*—lumber pieces which form the wirebound box framework and to which the faceboards are stapled.

3.2.4 *end*—composed of faceboard to which liners, battens, or both are attached forming a subassembly.

3.2.5 *faceboard*—sheathing materials used for the container faces (top, bottom, sides, and ends).

3.2.6 *liner*—thin wood board staples to the end to reinforce the end faceboard.

3.2.7 *lumber*—manufactured wood product derived from a log through sawing or planing.

3.2.8 *plywood*—panel built up of sheers of veneer called plies, united under pressure by a bonding agent to create a panel with an adhesive bond between plies.

3.2.9 *staple*—U-shaped piece of wire with pointed ends, driven astride the binding wires in fabricating the blank or attaching boards to battens.

3.2.10 *veneer*—thin layer or sheet of wood.

4. Classification

4.1 ~~Types:~~ *Type of Load:*

³ The last approved version of this historical standard is referenced on www.astm.org. Available from U.S. Government Printing Office, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, www.access.gpo.gov.

⁴ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. ASSIST Quicksearch, assist.daps.dla.mil/quicksearch.

⁵ Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS. ASSIST Quicksearch, assist.daps.dla.mil/quicksearch.

⁶ Available from the National Motor Freight Traffic Association, American Trucking Associations, 2200 Mill Road, Alexandria, VA 22314. Association (NMFTA), 1001 N Fairfax St., Ste 600, Alexandria, VA 22314, www.nmfta.org.

⁷ Available from the APA, the Engineered Wood Association, 7011 S. 19th Street, P.O. Box 11700, Tacoma, WA 98411-0700.

⁸ Available from the American National Standards Institute, 25 West 43rd St., New York, NY 10036.

⁹ Available from Hardwood Plywood and Veneer Association (HPVA), P.O. Box 2789, Reston, VA 22090-0789, www.hpva.org.

⁹ Dean, School of Military Packaging Technology, 360 Lanyard Rd., Building 360, Attn: ATSL-MP, Aberdeen Proving Ground, MD 21005-5282. Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, www.nist.gov.

¹⁰ Available from the International Plant Protection Convention (IPPC), www.ippc.int.



4.1.1 *Type 1*—Easy load, one interior container that supports the top, bottom, and sides of the outer wirebound shipping box. Articles of moderate density packed in and completely filling one and only one interior box, which, in turn, completely fills and supports all the faces of the outer shipping box into which it is packed. As examples, canned and boxed articles, which are repacked in a fiberboard box which completely fills the outer shipping box. A single article of moderate density which contacts and completely supports all the faces of the shipping box and has sufficient strength, even though not boxed, to withstand the forces encountered in transportation and handling, but required the protection of the box to prevent scratching or marring. As examples, wood or metal chests, tool kits, and boxed sturdy instruments packed one in a shipping box.

4.1.2 *Type 2*—Average load, interior or intermediate containers that support and fill the voids of outer wirebound container. Contents are moderately concentrated articles, which may either be packed directly into the outer shipping box or subject to an intermediate stage of packing, such as wrapping or packing in interior boxes, or protected by other types of suitable interior intermediate stage of packing, such as wrapping or packing in interior boxes, or protected by other types of suitable interior packing. The contents or interior packing provide support for all the faces of the shipping box. As examples, goods in metal cans, which are packed in an inner container, bottles individually cushioned, hardware in cartons.

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. Contents are articles, which are highly concentrated, required a high degree of protection, or do not support the faces of the shipping box. As examples, wrenches, long bolts, and rods, which can exert highly concentrated forces on faces of shipping box. Rivets, drop forgings, and bulk hardware which are packed loosely and according to no definite pattern and apply force on all faces of the shipping box, fragile articles and delicate instruments, which require special protection, valves, fittings, and machine parts which do not completely fill the shipping box.

4.2 *Classes: Class:*

4.2.1 *Class 1*—Domestic shipments capable of passing Practice D4169, distribution Cycle 1 testing as a minimum, with no maritime shipment testing required.

4.2.2 *Class 2*—Overseas shipments capable of passing Practice D4169 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 D4169 distribution cycle 18 testing as a minimum requirement.

4.3 *Style (based on the method of closure, see Fig. 1):*

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~~ Specification title, ASTM number, and date.

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

5.1.3 ~~The material/product shall conform~~ Inside box dimensions (see 7.1 to the requirements stated in United States Customary Units of Specification). ~~IEEE/ASTM SI 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/lb (kg).

5.1.6 Type of girth wire (see 7.7.7.2).

5.1.7 When palletization is required (see S3.1.4.3); S3.4.3).

5.1.8 Marking required (see S4).

5.1.9 Exceptions to these specifications, if authorized.

5.1.10 When ~~preservation~~ preservative treatment Grade A is required for ~~class~~ Class 2 or 3 boxes for overseas shipments (see 6.1.46.1.5).

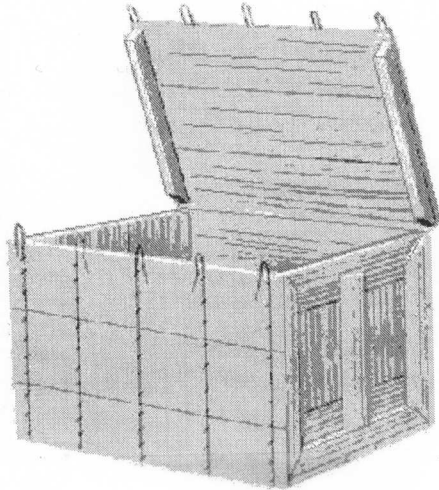
5.1.11 When four-way entry skids are required and when 3½ by 4-in. [76 by 89 mm] built-up skids are required (see 7.13).

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

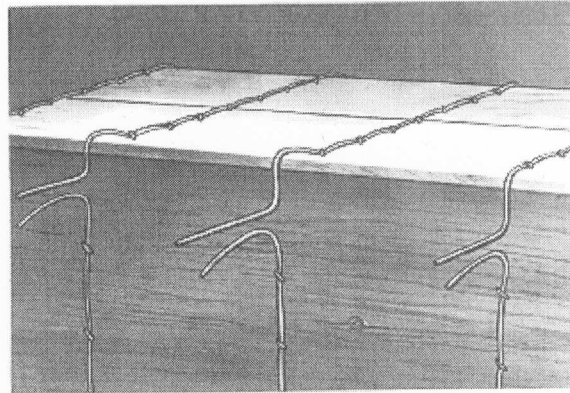
5.1.13 When ISPM 15 compliance is required (See 9.3).

6. Materials and Manufacture

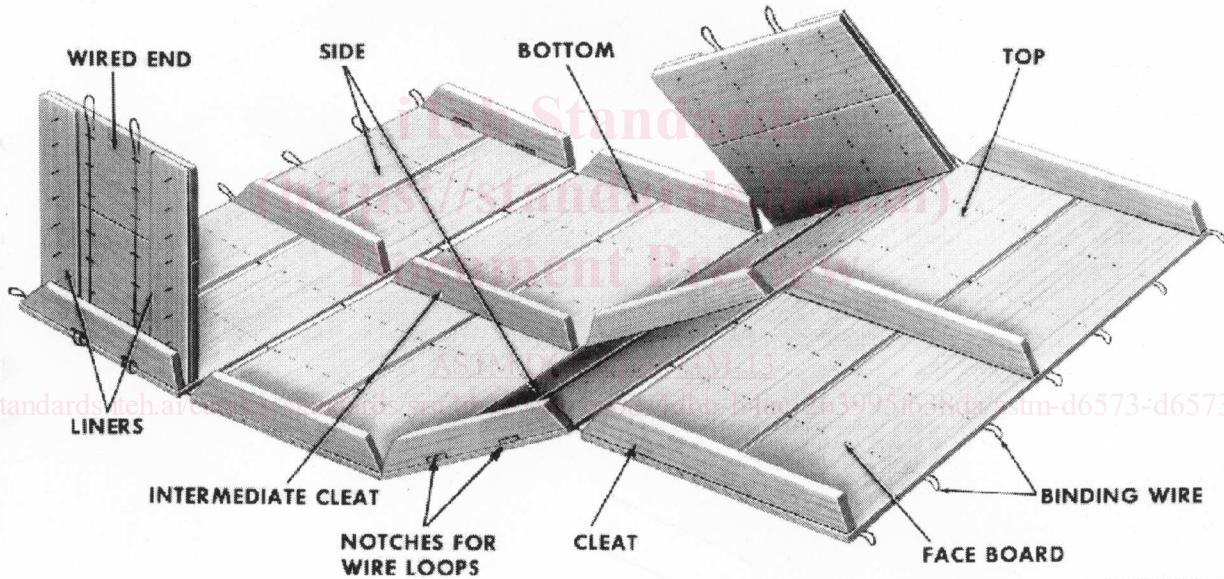
6.1 *Materials*—~~It is encouraged that recycled material be used when practical. All recovered, recycled, or virgin materials used in the box manufacture shall meet the requirements of this specification and APA/EWA PSI-95.~~ Materials shall be as specified



STYLE 2



STYLE 1



STYLE 3

SMPT 2643

FIG. 1 Styles-Box Styles Based on Method of Closures

herein. Materials not specified shall be selected by the contractor or box builder and shall be subject to all provisions of this specification. Materials shall be free of defects, which adversely affect performance or serviceability of the finished product.

6.1.1 Lumber—Lumber shall conform to Practice D6199, Class 2 requirements, for cleats (see PS 20 or the NHLA rules. All lumber sizes specified herein shall be nominal and shall be the minimum acceptable sizes for lumber components. 7.3, Group III) for skids see Specification Lumber components shall have a target thickness D6254/D6254M. Properties of lumber are in accordance with Practice and width uniform in dimension and 50 % of components shall meet or exceed the D1990 target dimensions at the time of component manufacture.

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 *Plywood Panel*—Plywood shall conform to ANSI/HPVA HP-1-2004 or PS 1, Exposure 1 or Exterior panel. Plywood shall have no defects (knot holes, worm holes, and so forth) extending through the panel. Unless otherwise specified, plywood shall be finished unsanded.

6.1.3 *Wires:*

6.1.3.1 *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**.

6.1.3.2 *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 **A641/A641M**.

6.1.4 *Fasteners:*

6.1.4.1 *Nails*—Nails shall be made of steel wire and shall conform to the requirements of Specification **F1667**. ~~Nails or other industry standards.~~ Nails are classified as plain-shank, helically threaded, annularly threaded, fluted, or twisted square wire. Nails will be clinched, cement-coated, or chemical etched to prevent premature withdrawal.

6.1.4.2 *Staples or Wire Stitches*—~~Staples or~~ have either round-wire or approximately square-wire legs, referring to the cross-sectional shape of the wire. ~~Staples or wire stitches shall be made of steel wire not less than 0.0625 in. 16 gage [2 mm] and comply with Specification F1667; or other industry standards.~~

6.1.5 *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 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 **7.8**). The direction of grain of the plyplywood 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~~ The cleats shall be made of Group II (medium density softwoods), III (medium density hardwoods), or IV (high density hardwoods and softwoods) woods only as listed with Practice **D6199** ~~from wood specified in Practice D6199.~~ 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 1/32 in. [9 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 horizontal and vertical battens (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 54**. 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

TABLE 1 Tensile Strength of Binding and Staple Wire

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



TABLE 2 Minimum Thickness of Faceboards

Weight of Box Contents in lbs [kg]		Group 1 Woods in Fractional in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
Class 1 Boxes				
Class 1 Boxes				
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
Class 2 Boxes				
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]		
Weight of Box Contents in lb [kg]		Group II and III Woods in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
Class 3 Boxes				
Class 3 Boxes				
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]		
Weight of Box Contents in lb [kg]		Group II and III Woods in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
Class 1 Boxes				
Class 1 Boxes				
0	85 [38.5]	1/2 [4]	1/8 [4]	3/16 [5]
85 [38.5]	125 [56.7]	1/8 [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]
Class 2 Boxes				
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]
Class 3 Boxes				
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]		
Weight of Box Contents in lb [kg]		Group IV Woods in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
Class 1 Boxes				
Class 1 Boxes				
0	85 [38.5]	1/2 [4]	1/2 [4]	1/8 [4]
85 [38.5]	125 [56.7]	1/2 [4]	1/8 [4]	3/16 [5]
125 [56.7]	200 [90.7]	1/8 [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]
Class 2 Boxes				
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]		
Weight of Box Contents in lb [kg]		Group IV Woods in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
Class 2 Boxes				
Class 2 Boxes				
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]
Class 3 Boxes				



Weight of Box Contents in lbs [kg]		Group 4I Woods in Fractional in. [mm]		
Exceeding	Not Exceeding	Type 1 Load	Type 2 Load	Type 3 Load
0	85 [38.5]	¼ [6]	¼ [6]	¼ [6]
85 [38.5]	125 [56.7]	¼ [6]	¼ [6]	5/16 [5]
125 [56.7]	200 [90.7]	¼ [6]	¼ [6]	5/16 [5]
200 [90.7]	500 [226.8]	¼ [6]	5/16 [5]	3/8 [10]

^A Group 4I woods—Woods (low density hardwoods and softwoods) are not permitted.

TABLE 3 Minimum Faceboard Requirements

Resawn faceboard thickness not less than 1/32 in. [1 mm] Less than specified in Table 2	Faceboard edge piece not less than 2-1/2 in. [63.5 mm] wide	Space between Faceboards not more than 1/4 in. [6 mm]
Faceboards no less than 2 1/2 in. [63.5 mm] in width	One full piece of plywood thickness not less than 25 %	

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 54.

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 65 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 65, for dimensions exceeding 1 3/16 in. [21 mm], or 1/16 in. [2 mm] less than the dimensions exceeding 1 3/16 in. [21 mm].

7.4 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 4I woods shall be not less than 1 3/4 in. [45 mm] wide and those made from Groups 2, 3, II, III, and 4IV woods shall be not less than 1 3/8 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 1/32 in. [1 mm] less than the specified thickness nor more than 1/16 in. [2 mm] less than the specified width.

7.5 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 1 3/16 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 2 7/8 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 1/4 in. [6 mm], when the thickness of the end face board exceeds 1/4 in. [6 mm]. Each edge and intermediate liner shall be fastened to the end face board by staples. Liners which are 2 7/8 in. [73 mm] wide shall have two rows of staples.

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

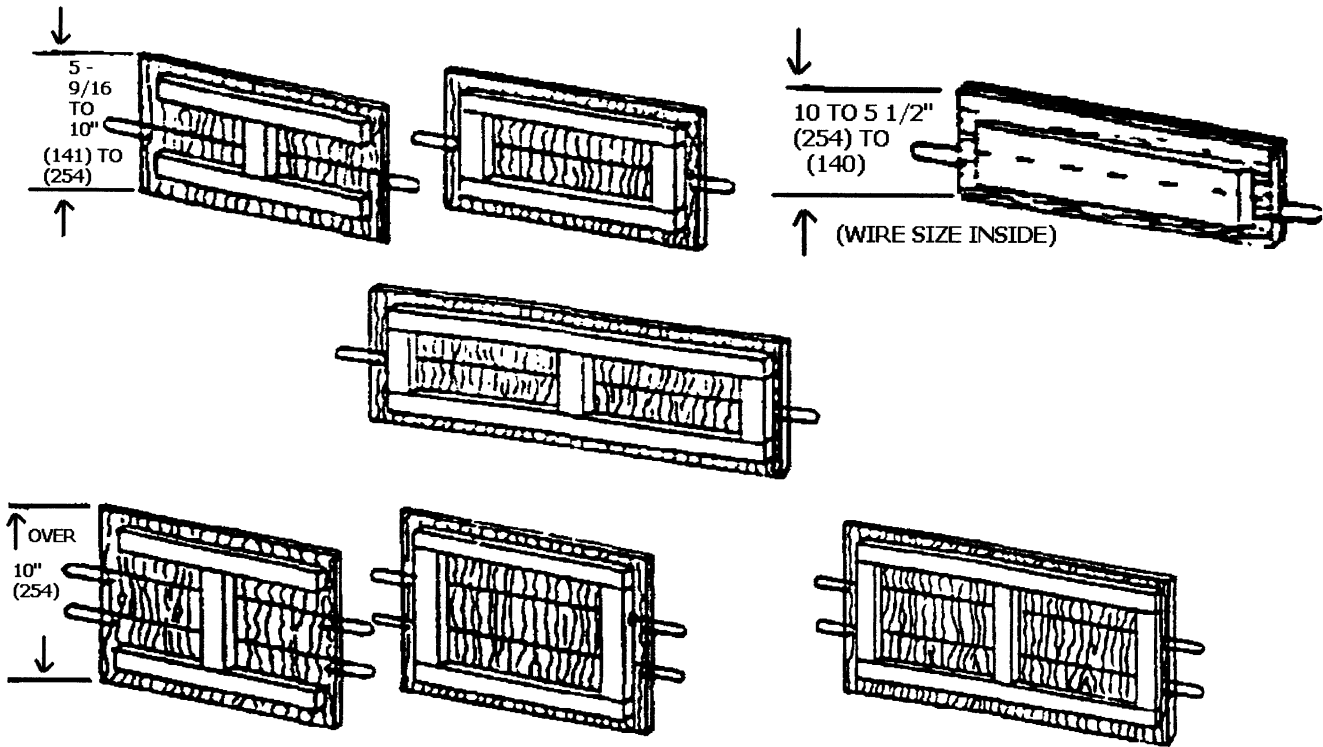
7.6.1 Ends for Styles 1 and 2 Boxes—Battens shall be required on the ends of Styles 1 and 2 boxes, except that vertical liners are permitted in lieu of battens under the conditions specified in (see Section 7.11.2). The number and arrangement of battens or liners depend on the class of box, type of load, 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 battened ends and lined ends for Styles 1 and 2 boxes are shown in Fig. 3.

7.6.2 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.

7.7 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 in 7.8). 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 76 for the weight of contents and inside length of box specified.

7.7.1 Wire Gage—The gage of end wires on Style 3 boxes shall conform to the requirements of Table 87 for the weight of contents and class of box specified.

7.7.2 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



	Maximum Spacing of Vertical Battens in inches (mm)		Class 3
	Class 1	Class 2	
Type 1 Load [Easy]	18 [457]	15 [381]	12 [305]
Type 2 Load [Average]	16 [406]	13 [330]	10 [254]
Type 3 Load [Difficult]	14 [356]	11 [279]	7 [178]

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

FIG. 2 End Panel Arrangements/Patters for Style 3 Boxes—Horizontal and Vertical Battens with Wires—HBW View (see 7.12.4)

TABLE 54 Maximum Distance Between Adjacent Rows of Cleats

Thickness of faceboards in fractional in. [mm] ^A	Type 2 Load [Average] Type 3 Load [Difficult]					
	Group 1I Woods, in. [mm]	Groups 2II and 3III Woods, in. [mm]	Group 4IV Woods, in. [mm]	Group 1I Woods, in. [mm]	Group 2II and 3III Wood in. [mm]	Group 4IV Woods in. [mm]
Class 1 Boxes						
1/6 [4]	—	32 [813]	36 [914]	—	—	24 [610]
7/32 [6]	—	40 [1016]	44 [1118]	—	28 [711]	32 [813]
1/4 [6]	32 [813]	44 [1118]	48 [1219]	—	32 [813]	36 [914]
5/16 [8]	36 [914]	48 [1219]	48 [1219]	24 [610]	36 [914]	40 [1016]
3/8 [10]	36 [914]	48 [1219]	48 [1219]	24 [610]	40 [1016]	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]	24 [610]
5/16 [8]	—	36 [914]	40 [1016]	—	24 [610]	28 [711]
3/8 [10]	32 [813]	40 [1016]	44 [1118]	—	28 [711]	32 [813]

^A When intermediate cleats are not desired (see 7.3.1). For Type 1 loads, intermediate cleats are not required.

than 2 1/4 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



TABLE 65 Sizes of Intermediate Cleats

Width, in. [mm]	Thickness, in. [mm]
2¾ [70]	¾ [10]
2¼ [57]	½ [13]
1¾ [45]	⅝ [16]
1¼ [32]	¾ [19]
1⅜ [21]	1⅜ [21]

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.

7.8 *Stapling—Staples*—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 then 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 98 and shall be long enough to penetrate the boards and be clinched smooth.

7.8.1 *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 1⅜ in. [29 mm] wide by 1 wide × 1⅜ in. [29 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 ⅝ in. [14 mm] or less, the staples shall be driven through the cleats and shall be sufficiently long to produce a smooth clinch. The length of staples shall be not less than indicated in Table 409.

7.8.2 *Number of Cleat Staples*—The minimum number of staples in any cleat shall comply with the requirements of Table 410. Not less than two staples shall be driven over each girth wire through each faceboard, except that when a board is less than 2½ in. [63.5 mm] wide, only one staple need be driven through the board.

7.8.3 *Placement of Staples*—At each corner of the box the distance from the end of the cleat to the nearest staple shall not exceed 1⅝ 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 16 gage [1.8 mm]. The points of the staples shall not protrude from the battens unless clinched. Staples used for fastening end faceboards more than ⅜ 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.

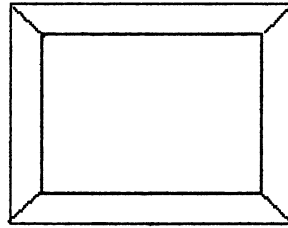
7.9 *Nailing—Nails*—Nails used for fastening end faceboards to end battens shall not be less than 0.076-in. diameter 14½ gage (0.076-in. diameter) [2 mm]. The length of each nail shall be not less than the thickness of the end faceboard plus three-fourths of the thickness of the batten, unless clinched. The point of the nail shall not protrude from the batten, unless clinched. Nails used to fasten end faceboard more than ⅜ in. [2 mm] thick to battens shall be clinched. When nails are clinched, they shall have a smooth clinch of ⅛ to ¼ in. [3 to 6 mm]. The spacing of nails shall not exceed 2½ in. [63.5 mm], measured along the length of the batten.

7.10 *Types of Loads*—For Types 1 and 2 loads, the inside dimensions of wire bound 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 the 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, braced, or otherwise anchored to the frame of the box in such manner that shifting of contents will not occur during handling of shipment.

7.11 *Styles 1 and 2 Boxes*—Styles 1 and 2 boxes shall be constructed with end patterns shown in Table 421 for the class of box, type of load, and weight of contents indicated. The end patterns shall be constructed with vertical liners (VL-pattern), vertical battens (VB-pattern), horizontal and vertical battens (HVB-pattern) as shown on Fig. 3. The following additional provisions and limitations for these end patterns also shall apply.

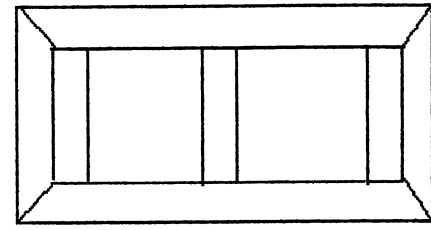
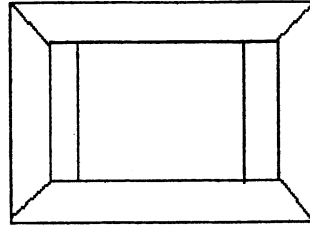
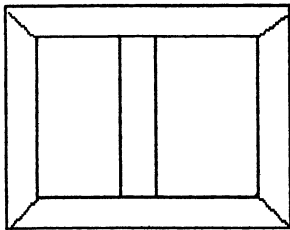
7.11.1 *VL-Pattern*—The maximum inside width or depth of box for which VL-pattern ends may be used is 16 in. [406 mm] for Type 1 loads or 14 in. [350 mm] for Type 2 loads. VL-pattern end shall not be used for Type 3 loads, for Class 3 boxes, or when strapping is required (see the Supplementary Requirements section). When the box width or depth exceeds the dimensions permitted for the VL-pattern, the VB-pattern shall be used.

7.11.2 *VB-Pattern*—VB-pattern ends shall be used in lieu of VL-pattern ends when the box width or depth exceeds the dimensions permitted for the VL-pattern. When the inside depth or width exceeds 16 in. [406 mm], at least two vertical battens



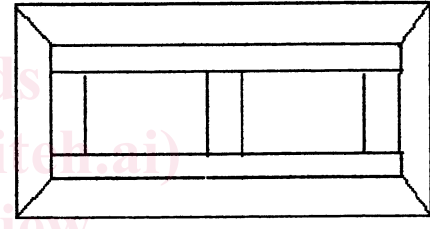
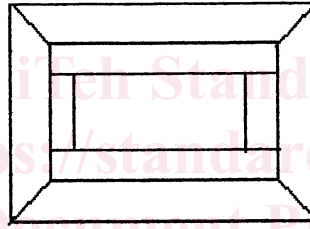
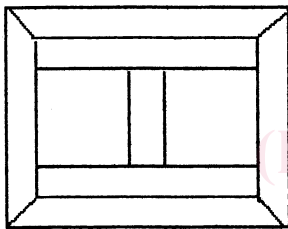
VL PATTERN VERTICAL LINERS

HORIZONTAL FACEBOARD GRAIN



VB PATTERN VERTICAL BATTENS

HORIZONTAL FACEBOARD GRAIN



HVB PATTERN HORIZONTAL & VERTICAL BATTENS

VERTICAL FACEBOARD GRAIN

in. [mm]	Maximum Spacing of Vertical Battens		
	Class 1 Class 1 in. [mm]	Class 2 Class 2 in. [mm]	Class 3 Class 3 in. [mm]
Type 1 Load [Easy]	15 [381]	12 [305]	12 [305]
Type 2 Load [Average]	13 [330]	10 [254]	10 [254]
Type 3 Load [Difficult]	11 [2793]	7 [178]	7 [178]

FIG. 3 End Panel Arrangements Patterns for Styles 1 & 2 Boxes (see 7.11.1-7.11.3)

shall be used, with a batten placed adjacent to each side cleat. A single center vertical batten may be used only when the end faceboard is two-ply crossed veneer or plywood. At least two vertical battens shall be used for Type 3 loads in Class 1 boxes and for Type 2 or 3 loads in Class 2 or 3 boxes.

7.11.3 *HVB-Pattern*—HVB-pattern ends shall be used where indicated on Table 4311 and may be used in lieu of VB pattern ends. When the inside depth exceeds 16 in. [406 mm], or the inside width exceeds 24 in. [610 mm] for Type 1 or 2 loads or 18 in. [457 mm] for Type 3 loads, at least two vertical battens shall be used with a batten placed adjacent to each side cleat.

7.12 *Style 3 Boxes*—Style 3 boxes shall be constructed with ends of the pattern shown in Table 4312 for the class of box, type of load, and weight of contents shown. The end patterns shall be constructed with horizontal liners (HLW-pattern), horizontal battens (HBW-pattern), horizontal liners and vertical battens (HLVBW-pattern), or horizontal and vertical battens (HVBW-pattern), as shown on Fig. 4. The maximum spacing between vertical battens shall be as shown in the Table 4312. In addition, the following provisions and limitations also shall apply:

7.12.1 *HLW-Pattern*—The HLW-pattern shall be used only when both the inside width and inside depth of box do not exceed 16 in. [406 mm], except that this pattern may be used for Class 1 boxes when the inside width or inside depth does not exceed 30 in. [762 mm], provided the edge cleats are increased to be not less than 1 1/8 in. [28.6 mm] by 1 1/8 in. [28.6 mm] in size. When the box width or width and depth exceed the dimensions permitted for this pattern, the HBW-pattern shall be used. When only the box depth exceeds the dimensions permitted for this pattern, the HVBW-pattern shall be used. (see Fig. 2-).