



Designation: D6254/D6254M – 20

Standard Specification for Wirebound Pallet-Type Wood Boxes¹

This standard is issued under the fixed designation D6254/D6254M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers the fabrication of new fully enclosed wirebound pallet-type wood boxes intended for use as containers for domestic and overseas shipment of general materials and supplies, not exceeding 2500 lb [1134 kg] (see 4.1 and 10.1).

1.2 Wirebound pallet-type wood box performance is dependent on its fabricated components; therefore, a variety of types, classes, and treatments reflecting varied performance are specified (see 4). This specification, however, does not cover wirebound pallet-type wood box performance under all atmosphere, handling, shipping, and storage conditions.

1.3 The use of other construction methods or techniques is acceptable and permitted (see 5.1.11), provided the resulting packaging systems shall be of equal or better performance than would result from the use of these specified materials and procedures. The appropriate distribution cycle provided in Practice D4169 can be used to develop comparative procedures and criteria.

1.4 *Units*—The values stated in either inch-pound or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. 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 nonconformance with the standard. See 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

D996 Terminology of Packaging and Distribution Environments

D3951 Practice for 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-Based 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

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

2.2 Code of Federal Regulations:³

CFR Parts 107–180, Title 49, Hazardous Materials Regulations

2.3 National Institute of Standards and Technology (NIST) Standard:⁴

PS 1–07 Structural Plywood

PS 20–05 American Softwood Lumber Standard

2.4 Hardwood Plywood and Veneer Association Standard:⁵

ANSI/HPVA HP-1-2004 American National Standard for Hardwood and Decorative Plywood

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.

³ 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 National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, www.nist.gov.

⁵ Available from Hardwood Plywood and Veneer Association (HPVA), P.O. Box 2789, Reston, VA 22090-0789, www.hpva.org.

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

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2.5 *National Motor Freight Traffic Association*.⁶

National Motor Freight Classification

2.6 *Uniform Classification Committee Standard*.⁷

Uniform Freight Classification

2.7 *American Wood Protection Association (AWPA)*.⁸

AWPA P36 Standard for Copper Naphthenate (CuN)

AWPA P37 Standard for Oxine Copper (Copper-8-Quinolinolate) (Cu8)

2.8 *Material Handling Industry of America (MHIA)/ANSI Standard*.⁹

MHIA/ANSI MH1–2005 Pallets, Slip Sheets, and Other Bases for Unit Loads

2.9 *International Standard*¹⁰

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

2.10 *U.S. Army Research, Development and Engineering Center (ARDEC)*¹¹

MIL-DTL-2427H Box, ammunition packing: Wood, nailed

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*—reinforcement used to hold the 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 *blank*—a flat unassembled wirebound box exclusive of pallet base and top.

3.2.4 *cleat*—lumber piece which forms the wirebound box framework and to which the faceboards are stapled.

3.2.5 *deckboard*—the material used to make up the pallet base top and bottom surfaces referred to as top and bottom deckboards.

3.2.6 *faceboard*—the material used for the front, end, bottom, sides, and top.

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

⁶ Available from National Motor Freight Traffic Association, Inc. (NMFTA), 1001 N Fairfax St., Ste 600, Alexandria, VA 22314, www.nmfta.org.

⁷ Available from the Uniform Classification Committee, Tariff Publishing Officer, 151 Ellis St., N.E. Suite 200, Atlanta, GA 30335.

⁸ Available from American Wood Protection Association (AWPA), P.O. Box 361784, Birmingham, AL 35236-1784, awpa.com.

⁹ Available from Material Handling Industry of America (MHIA) MH1 Secretariat, 8720 Red Oak Blvd., Suite 201, Charlotte, NC 28217, www.mhiastore.org.

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

¹¹ Available from ASSIST Quicksearch, assist.daps.dla.mil/quicksearch

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 *stringer*—a runner to which the riser batten and deckboards are attached and which serves as a spacer between top and bottom deckboards to permit mechanical handling equipment entry.

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

4. Classification

4.1 *Type*:

4.1.1 *Type I*—Sheathed lumber, 2500-lb [1134-kg] maximum load (see Fig. 1).

4.1.2 *Type II*—Sheathed lumber and veneer, 1500-lb [680-kg] maximum load (see Fig. 2).

4.1.3 *Type III*—Sheathed lumber and veneer with two different length sidewalls, 1500-lb [680-kg] maximum load (see Fig. 3).

4.1.4 *Type IV*—Sheathed plywood, 2500-lb [1134-kg] maximum load (see Fig. 4).

4.2 *Class*:

4.2.1 *Class 1*—Partial four-way entry base (see Fig. 5).

4.2.2 *Class 2*—Two-way entry base (see Fig. 5).

4.2.3 *Class 3*—Partial four-way entry base with two different length sidewalls (see Fig. 6).

4.2.4 *Class 4*—Two-way entry base with two different length sidewalls (see Fig. 6).

4.3 *Treatment*:

4.3.1 *Treatment A*—Without water-repellent preservative (see 6.1.6).

4.3.2 *Treatment B*—With water-repellent wood preservative (see 6.1.6).

5. Ordering Information

5.1 Purchasers should select the preferred permitted options and include the following information in procurement and purchase order documents:

5.1.1 Specification title, number, and date.

5.1.2 Box type, class, and treatment required (see 4.1 – 4.3 and 7.1).

5.1.3 Contents weight.

5.1.4 Modifications to container manufacturer's identification (see 7.5).

5.1.5 Box dimensions specified in order of length × width × depth (see 7.6 and Fig. 7).

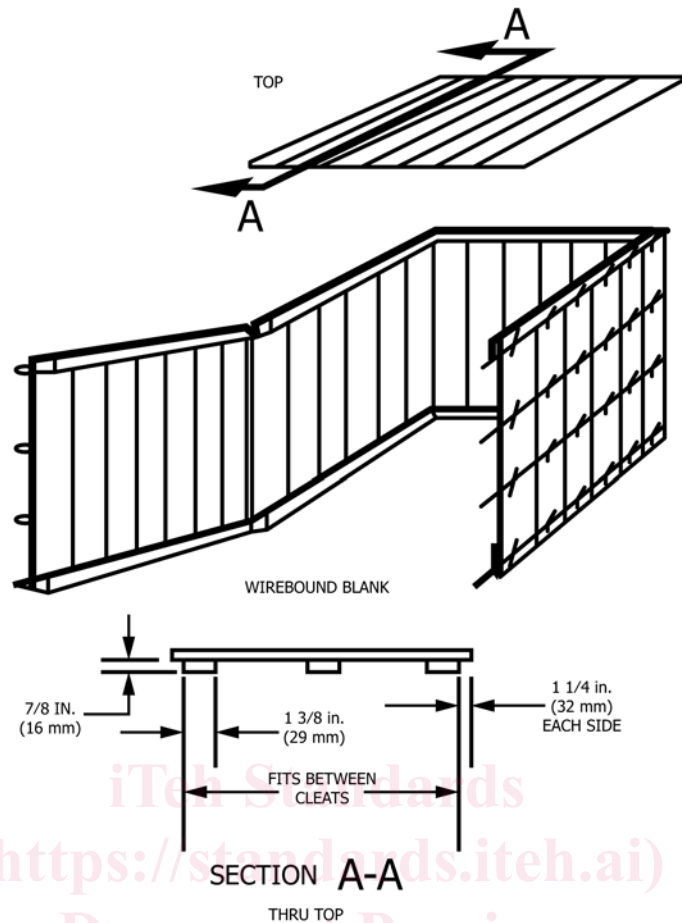
5.1.6 When preservative treatment is required (see 4.3 and 6.1.6).

5.1.7 Whether boxes are to be shipped assembled or knocked down (see 9.1).

5.1.8 Whether additional markings are required (see 9.2).

5.1.9 Whether different strapping materials are required (see S2.2).

5.1.10 Whether additional support is required (see S2.2.3).



NOTE 1—All cleats (see Figs. 5 and 7), $1\frac{3}{16} \times \frac{7}{8}$ in. nominal [16 × 16 mm]. Select Class 1 or 2 Base from Fig. 5.

FIG. 1 Type I Wirebound Box-Sheathed Lumber

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5.1.11 Whether other construction methods or techniques and proof are acceptable and permitted.

5.1.12 When ISPM 15 compliance is required (see 9.3).

6. Materials and Manufacture

6.1 *Materials*—Materials shall be as specified 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 components shall conform to Practice D6199, PS 20, or the NHLA rules. All lumber sizes specified herein shall be nominal and shall be the minimum acceptable sizes for lumber components. Lumber components shall have a target thickness and width uniform in dimension and 50 % of components shall meet or exceed the target dimensions at the time of component manufacture.

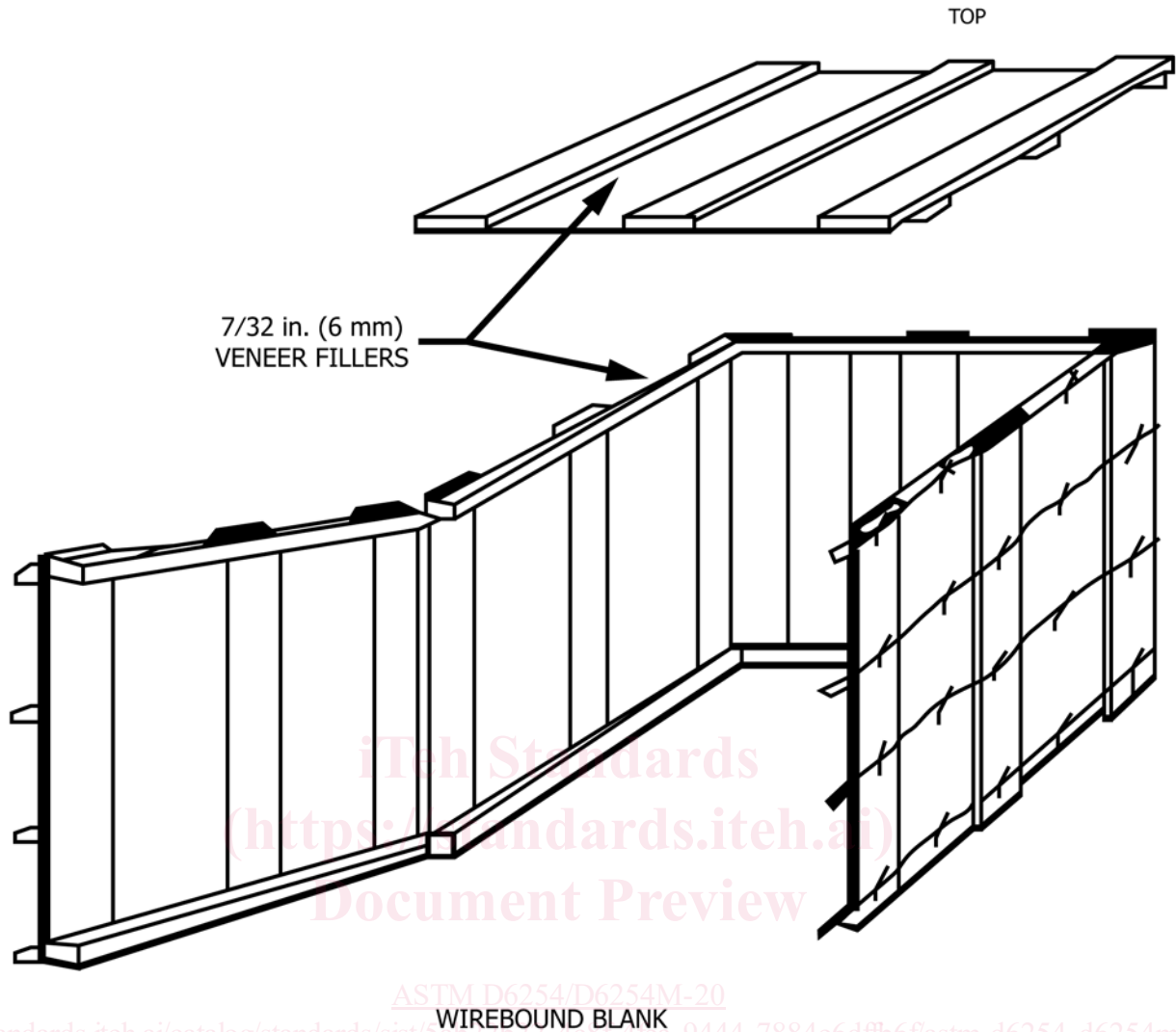
6.1.1.1 *Lumber Quality*—Grain divergence (grain slope), whether on a lumber face or edge, shall not exceed 1 in. [25 mm] per 10-in. [254-mm] length for pallet base and box frame members and shall not exceed 1 in. [25 mm] per 8-in. [203-mm] length for face boards. Members shall be free from decay and sufficiently smooth on the exterior surface to permit legible markings. Stains and discoloration not associated with

decay will be permitted provided they are not so pronounced as to obscure markings. Lumber components shall be free from all defects that will interfere with specified stapling and nailing. Each lumber component shall be a single wood piece without any joints.

6.1.1.2 *Cleat and Batten Knots*—Any cleat or batten knot width shall not exceed $\frac{1}{4}$ the width. Knots shall be sound and tight with no part within $1\frac{1}{4}$ in. [32 mm] of the cleat or batten end. Loose knots and knot holes shall not be permitted in cleats and battens. Group I Woods (low density hardwoods and softwoods) listed in Practice D6199 shall not be permitted for cleats.

6.1.1.3 *Faceboard and Deckboard and Stringer Knots*—Any faceboard, deckboard, or stringer knot width shall not exceed $1\frac{1}{2}$ in. [38 mm] nor $\frac{1}{3}$ the width. Knots shall be sound and tight with no part of any knot within 1 in. [25 mm] of the end. Loose knots or knot holes not more than 1 in. [25 mm] wide shall be permitted, provided they are not within 1 in. [25 mm] of the end.

6.1.1.4 *Splits Extending Entire Board Length*—Splits extending the entire board length shall be permitted for sides, top, bottom, and ends, provided the width of the narrowest piece of the board measured from the split is $1\frac{1}{2}$ in. [38 mm] or greater, and a staple holds each piece end in place.



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WIREBOUND BLANK

NOTE 1—Top battens (see Fig. 1 and Fig. 7) $\frac{7}{8} \times 1 \frac{3}{8}$ in. nominal [16 × 29 mm].
 All cleats (see Fig. 5 and Fig. 7) $\frac{1}{2} \times \frac{7}{8}$ in. nominal [16 × 16 mm].
 Corner and intermediate faceboards 4 in. nominal × $\frac{3}{8}$ in. [90 × 8 mm] (width × thickness).
 Select Class 1 or 2 Base from Fig. 5.

FIG. 2 Type II Wirebound Box-Sheathed Lumber and Veneer.

6.1.1.5 *Splits Diverging to Board Edge*—Splits diverging to an outer box edge shall not be permitted. Splits extending less than the entire board length and not diverging to a board edge shall be permitted for sides, top, bottom and ends, provided that if the split were extended, the resulting boards would comply with the minimum requirements of 6.1.1.4.

6.1.1.6 *Splits Extending Through Staple or Nail Holes*—Board-end slits, caused by a fastener, which are not longer than 3 in. [76 mm], are acceptable provided the split does not terminate in the board edge.

6.1.1.7 *Wane or Bark*—Wane along any lumber edge will be permitted for the full length provided it does not exceed $\frac{3}{8}$ in. [10 mm] in either direction from the edge. Bark shall not be permitted on any lumber component.

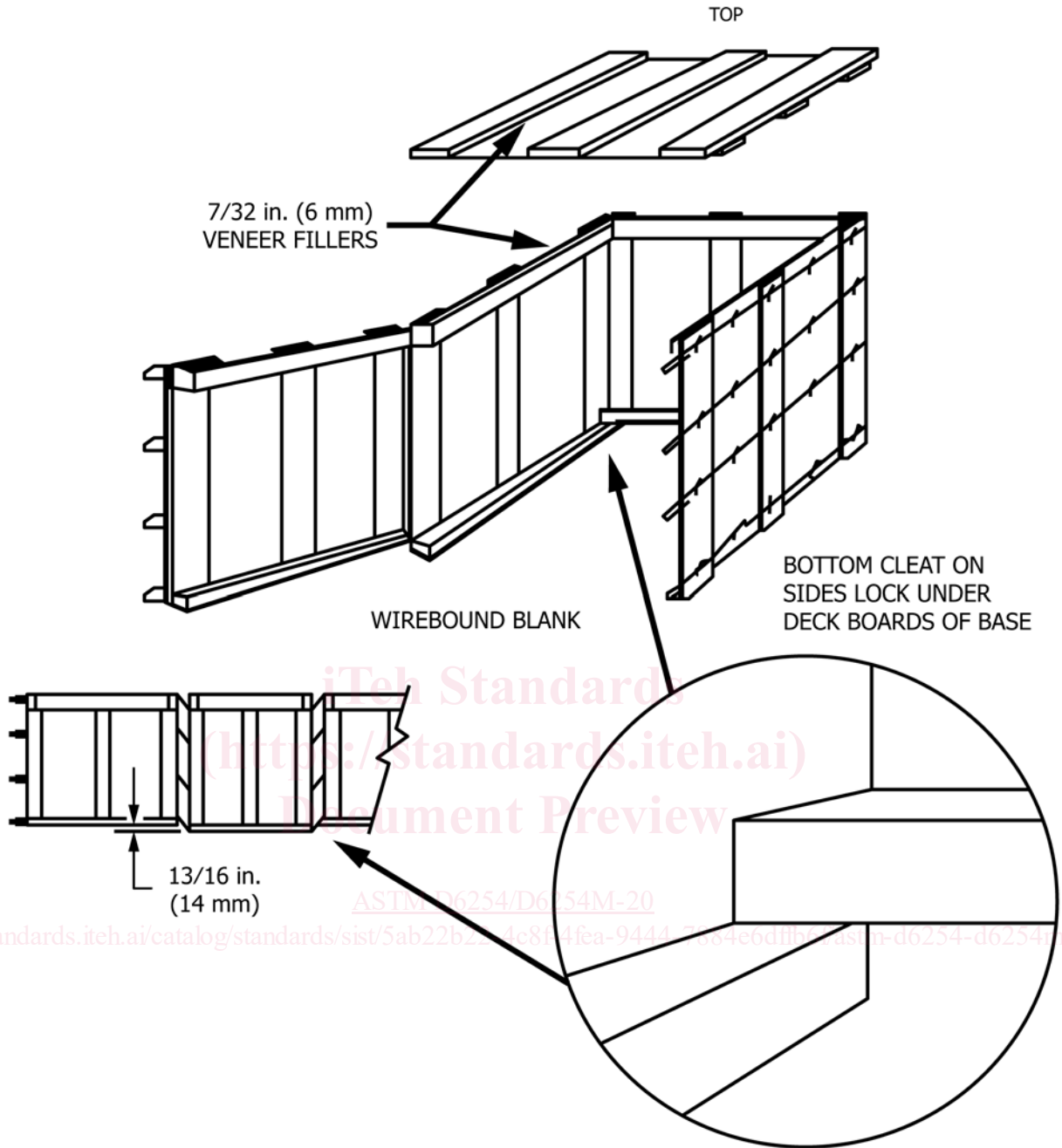
6.1.1.8 *Moisture Content*—At the time of box fabrication, wood member moisture content shall be in accordance with Practice D6199 except that there shall be no restriction on pallet base stringer's moisture content.

6.1.2 *Plywood*—Type IV boxes shall use plywood conforming to ANSI/HPVA HP-1-2004 or PS1-07, 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 *Binding Wire*—Binding wire shall be as a minimum, 13-gage, 0.0915-in. [2.324 mm] diameter, low carbon, annealed steel wire. The wire's physical properties shall permit satisfactory forming of the loop closures without fracturing the wire. The wire tensile strength shall be from 60 000 to 85 000-lb/in.² [413 685 to 586 054 kPa].

6.1.3.1 *Coating*—The binding wire surface shall be galvanized. The galvanized coating shall be smooth and shall not flake nor peel when the wire is wound around a $\frac{3}{16}$ -in. [5-mm] diameter mandrel (see 8.2).

6.1.4 *Staples*—Staples have either round-wire or approximately square-wire legs, referring to the cross-sectional shape of the wire. Staples shall be made from low carbon steel wire.



NOTE 1—Top cleat $1\frac{3}{16} \times 1\frac{5}{8}$ in. nominal [16 × 35 mm].
 Bottom cleat $1\frac{3}{16} \times \frac{7}{8}$ in. nominal [16 × 16 mm].
 Top battens $\frac{7}{8} \times 1\frac{3}{8}$ in. nominal [16 × 29 mm] (thickness × width).
 Corner and intermediate faceboards 4 in. wide nominal × $\frac{3}{8}$ in. thick [90 × 8 mm].
 Select Class 3 or 4 Base from Fig. 6.

FIG. 3 Type III Wirebound Box-Sheathed Lumber and Veneer with Two Different Length Sidewalls.

The wire tensile strength shall be from 95 000 to 125 000 lb/in.² [655 002 to 861 844 kPa]. Staples shall be in accordance with Specification F1667, Type IV, Style 3—Flat Top Crown Staples.

6.1.4.1 Coating—The staple wire surface shall be galvanized. The galvanized coating shall be smooth and shall not

flake nor peel when the wire is wound around a $\frac{3}{16}$ -in. [5-mm] diameter mandrel (see 8.2).

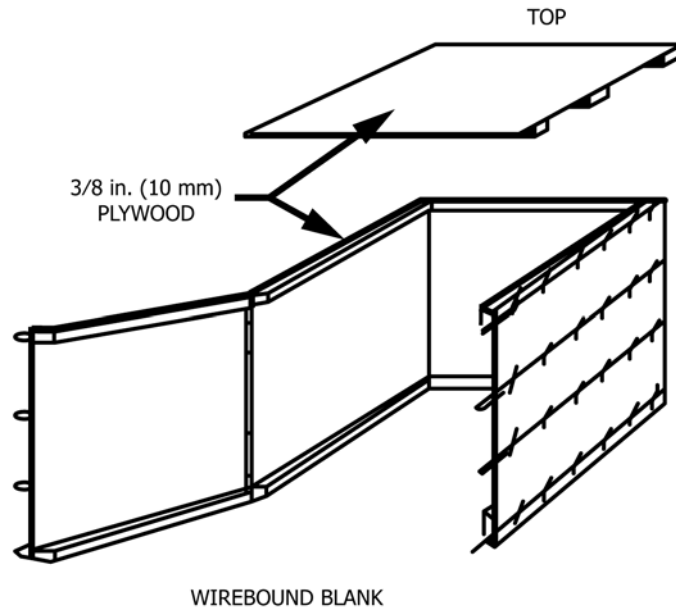


FIG. 4 Type IV Wirebound Box Sheathed Plywood.

NOTE 1—Top battens (see Fig. 1 and Fig. 7) $\frac{7}{8} \times 1\frac{3}{8}$ in. nominal [16 × 29 mm].
 All cleats (see Fig. 5 and Fig. 7) $1\frac{1}{16} \times \frac{7}{8}$ in. nominal [16 × 16 mm]
 Select Class 1 or 2 from Fig. 5

6.1.5 *Nails*—Nails shall conform to Specification F1667 or other industry standards. Nails are classified as plain-shank, helically threaded, annularly threaded, fluted, or twisted square wire.

6.1.6 *Water-Repellent Wood Preservative*—Water-repellent wood preservative shall be a solution containing either copper naphthenate conforming with Practice D6253, MIL-DTL-2427H and AWPA P36 with a minimum concentration of 2.0% copper metal, oxine copper (formerly referred to as copper-8-quinolinolate) conforming with Practice D6253, MIL-DTL-2427H and AWPA P37 with a minimum concentration of 1.8% copper metal, or 3 % zinc naphthenate conforming with Practice D6253 and MIL-DTL-2427H.

7. Construction

7.1 *Box Type and Class*—A partial four-way or two-way entry base may be used with each box type as specified (see 4.2 and 5.1.2).

7.1.1 *Type I Boxes*—Type I boxes shall conform to Fig. 1. Type I boxes shall be limited to 48-in. [1219-mm] maximum inside depth (load height). The inside length or width shall not exceed 60 in. [1524 mm], and when added together, shall not exceed 102 in. [2591 mm]. Bases shall conform to Fig. 5.

7.1.2 *Type II Boxes*—Type II boxes shall conform to Fig. 2. Type II boxes shall be limited to 40-in. [1016-mm] maximum inside depth (load height). The inside length and width dimensions, when added together, shall not exceed 96 in. [2438 mm]. Bases shall conform to Fig. 5.

7.1.3 *Type III Boxes*—Type III boxes shall conform to Fig. 3 and to the dimensional limitations of Type II boxes (see 7.1.2). Bases shall conform to Fig. 6.

7.1.4 *Type IV Boxes*—Type IV boxes shall conform to Fig. 4. Type IV boxes shall be limited to 48-in. [1219-mm]

maximum inside depth (load height). The inside length shall not exceed 96 in. [2438 mm]. The inside width shall not exceed 48 in. [1219 mm]. The inside length and width dimensions, when added together, shall not exceed 128 in. [3251 mm]. Bases shall conform to Fig. 5.

7.2 Wirebound Blank:

7.2.1 *Cleats*—Cleats shall be made of Group II (medium density softwoods), III (medium density hardwoods), or IV (high density hardwoods and softwoods) woods listed in Practice D6199. All cleat ends, except the bottom cleats for Type III boxes, shall be mitered. The bottom cleats for Type III boxes shall be butt-end. The cleat width and thickness shall be as shown on the applicable figure with a $\pm \frac{1}{32}$ -in. [± 1 -mm] width dimensional tolerance and the minimum thickness shall be $\frac{7}{8}$ in. [16 mm].

7.2.2 *Faceboards*—Face boards shall be made from any of the wood species permitted in Practice D6199. Face boards, where required by the applicable figures, shall be $\frac{3}{8} \pm \frac{1}{32}$ -in. [10 ± 1 -mm] thick. Type I box face board minimum width shall be $2\frac{1}{2}$ in. [51 mm], except at the box blank leading and trailing edges, which shall be 4-in. [90-mm] nominal width.

7.2.3 *Corner and Intermediate Face Boards*—All Type II and III box corner and intermediate face boards shall be nominal 4 in. [90 mm] wide and $\frac{3}{8}$ in. [8 mm] thick. Wood veneer $\frac{7}{32}$ in. [6 mm] thick shall be used between the face boards. The veneer thickness shall be not less than 95 % of the specified thickness.

7.2.4 *Plywood Face Boards*—Type IV box plywood face boards for sides and top shall be $\frac{3}{8}$ -in. [10-mm] thick. The box sides outer ply grain direction shall be vertical to the base. The plywood thickness shall be not less than 95 % of the specified

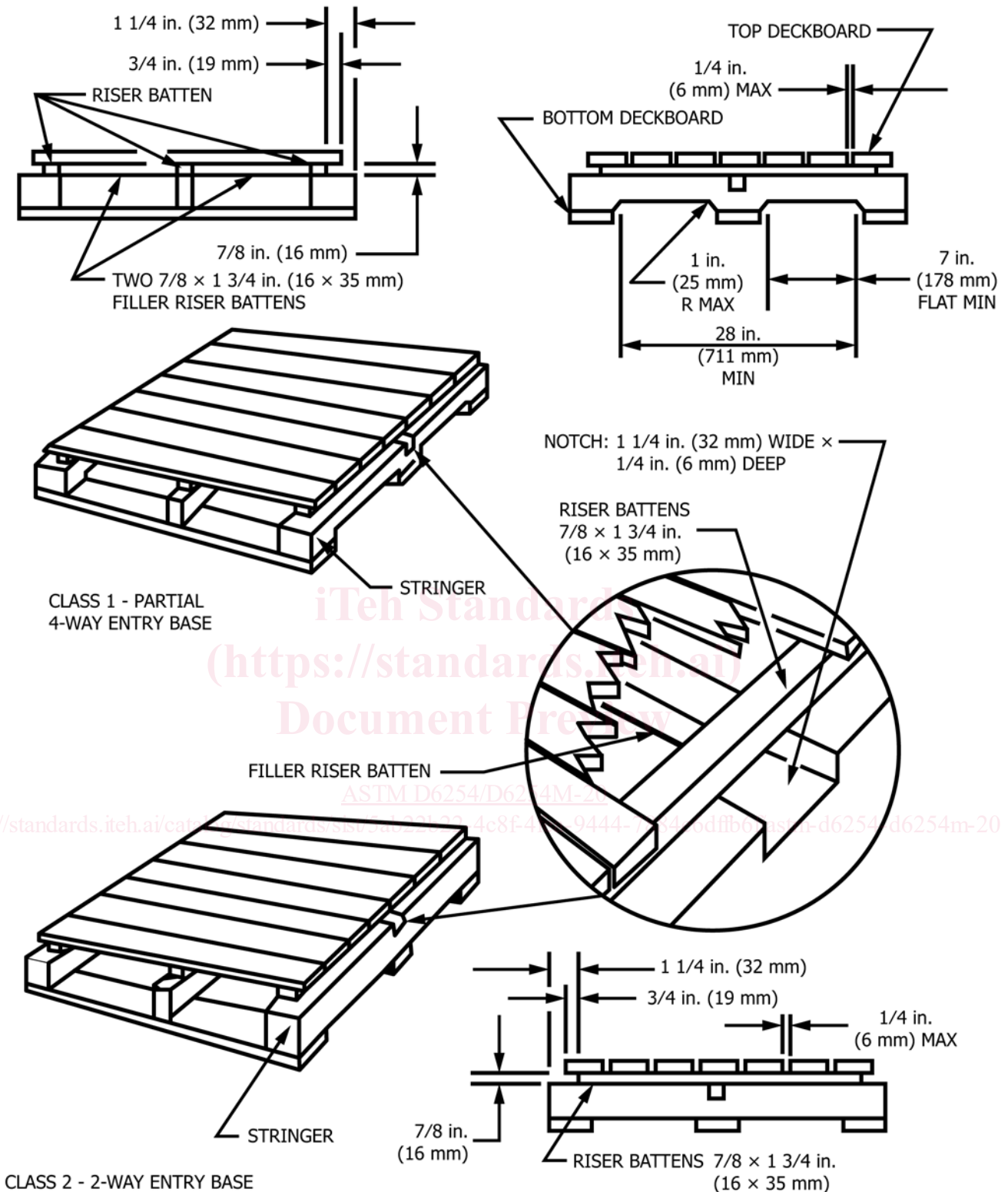


FIG. 5 Class 1 and 2—Pallet Bases (for Types I, II, and IV Boxes)

thickness. When a box panel width does not exceed 48 in. [1219 mm], the plywood used shall be one piece.

7.2.5 *Binding Wire*—Each binding wire shall be continuous around the box girth. Wire shall conform to the requirements of 6.1.3. The minimum number of binding wires shall be as

specified in Table 1. One binder wire shall be placed over each row of cleats. When possible, the remaining wires shall be spaced uniformly between the wires that are placed over each row of cleats (see Fig. 7). Binding wire splicing or welding during manufacture is permissible.