



Standard Specification for Wood-Cleated Shipping Boxes with Skidded, Load-Bearing Bases¹

This standard is issued under the fixed designation D6256/D6256M; 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 wood-cleated boxes with skidded, load-bearing bases. Boxes covered by this specification are designed for nonregulated domestic and overseas shipment of loads less than 2500 lb [1134 kg] and not greater than 16 ft [4877 mm] in length (see 9.1). Regulated commodities shipments may require better boxes than those specified herein (see 9.2).

1.2 The performance of wood-cleated boxes with skidded, load-bearing bases is dependent on their fabricated components; therefore, a variety of types, styles, and classes reflecting varied performance are specified. This specification, however, does not cover box performance under all atmosphere, handling, shipping and storage conditions.

1.3 If the use of other construction methods or techniques are acceptable and permitted (see 5.1.18), 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 specified in Practice D4169 can be used to develop comparative procedures and criteria.

1.4 The values stated in either inch-pound units 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 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 the standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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.

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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

D4675 Guide for Selection and Use of Flat Strapping Materials

D4727/D4727M Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes

D6039/D6039M Specification for Open and Covered Wood Crates

D6199 Practice for Quality of Wood Members of Containers and Pallets

D6251/D6251M Specification for Wood-Cleated Panel-board Shipping Boxes

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 American Wood Protection Association (AWPA) Standard:³

P36 Standard for Copper Naphthenate (CuN)

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

2.3 Code of Federal Regulations:⁴

CFR Parts 107–180 Title 49, Hazardous Materials Regulations

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 American Wood Protection Association (AWPA), P.O. Box 361784, Birmingham, AL 35236-1784, <http://www.awpa.com>.

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.



2.4 National Institute of Standards and Technology (NIST) Standards:

- PS1** Voluntary Product Standard, Structural Plywood⁵
- PS2** Performance Standard for Wood-Based Structural-Use Panels⁶

- PS20** American Softwood Lumber Standard⁶

2.5 American Society of Mechanical Engineers (ASME) Standards:⁷

- B18.2.1** Square and Hex Bolts and Screws—Inch Series

- B18.2.2** Square and Hex Nuts (Inch Series)

- B18.2.3.8M** Metric Hex Lag Screws

- B18.2.4.2M** Metric Hex Nuts, Style 2

- B18.5** Round Head Bolts (Inch Series)

- B18.5.2.2M** Metric Round Head Square Neck Bolts

- B18.22M** Metric Plain Washers

- B18.22.1** Plain Washers

2.6 Hardwood Plywood and Veneer Association (HPVA) Standard:⁸

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

2.7 National Motor Freight Traffic Association (NMFTA) Standard:⁹

- National Motor Freight Classification**

2.8 National Hardwood Lumber Association (NHLA) Standard:¹⁰

- NHLA Rules** for the Measurement and Inspection of Hardwood and Cypress

- 2.9 International Standard:¹¹**

- ISPM Publication No. 15** Regulation of Wood Packaging Material in International Trade

- 2.10 Federal Standard:¹²**

- MIL-DTL-2427H** Detail Specification Box, Ammunition Packing: Wood, Nailed

3. Terminology

3.1 **Definitions**—General definitions for packaging and distribution environments are found in Terminology **D996**.

4. Classification

4.1 Type:

- 4.1.1 **Type I**—Plywood base (see **Fig. 1**).

- 4.1.2 **Type II**—Lumber base (see **Fig. 1**).

4.2 Class:

- 4.2.1 **Class 1**—Domestic.

- 4.2.2 **Class 2**—Overseas.

4.3 Style:

- 4.3.1 **Style A**—Regular cleating arrangement (see **Fig. 2**).

- 4.3.2 **Style B**—Lock corner cleating arrangement (see **Fig. 2**).

4.4 Treatment:

- 4.4.1 **Treatment A**—Without preservative treatment.

- 4.4.2 **Treatment B**—With preservative treatment.

5. Ordering Information

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

- 5.1.1 Specification title, number, and date.

- 5.1.2 Box type, style, and class required (see Section 4).

- 5.1.3 Type of base flooring (see 4.1).

- 5.1.4 If plywood is treated (see 4.4 and 6.1.2).

- 5.1.5 If beveling of skids is required (see 6.2).

- 5.1.6 Contents weight (see Table 1).

- 5.1.7 If rubbing strips are required (see 6.2.4).

- 5.1.8 Type of superstructure (see 6.2.5).

- 5.1.9 Joist requirement (see 6.2.5.2).

- 5.1.10 Box inside dimensions specified in inches [millimetres] to the nearest ½ in. [13 mm] in order of length by width by height (see 7.1).

- 5.1.11 Whether boxes are to be shipped assembled or knocked-down (see 7.4.2 and 8.1).

- 5.1.12 When corner straps are required (see 7.4.2.4).

- 5.1.13 Whether ventilation holes or slots are required (see 7.5).

- 5.1.14 Whether special packing is required (see 8.3).

- 5.1.15 Whether special marking is required (see 8.3).

- 5.1.16 Load condition (see Figs. 3 and 4).

- 5.1.17 Whether a regulated materials box is required (see 9.2).

- 5.1.17.1 Physical characteristics of load, including contents dimensions, weight, and density.

- 5.1.17.2 Whether a test report is required.

- 5.1.18 Whether other construction methods or techniques are acceptable and permitted (see 1.3).

- 5.1.18.1 Whether proof that other construction methods or techniques are acceptable (see 1.3) is required.

- 5.1.19 When **ISPM Publication No. 15** compliance is required (see 7.8).

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 box. It is encouraged that recycled material be used when practical. All recovered, recycled, or virgin materials used in box manufacturing shall meet the requirements of this specification and the referenced documents. In addition, materials shall not affect or be affected by the product being packed.

6.1.1 **Lumber**—Lumber components shall conform to Practice **D6199**, **PS20**, or the **NHLA Rules**. Lumber components

⁵ Available from The Engineered Wood Association (APA), 7011 S. 19th St., Tacoma, WA 98466-5333, <http://www.apawood.org>.

⁶ Available from American Lumber Standards Committee, Inc. (ALSC), P.O. Box 210, Germantown, MD 20875-0210, <http://www.alsc.org>.

⁷ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, American National Standard Institute (ANSI) adopted.

⁸ Available from Hardwood Plywood and Veneer Association (HPVA), P.O. Box 2789, Reston, VA 22090-0789, <http://www.hpva.org>, American National Standards Institute (ANSI) adopted.

⁹ Available from National Motor Freight Traffic Association (NMFTA), 1001 N. Fairfax St., Alexandria, VA 22314, <http://www.nmfta.org>.

¹⁰ Available from the Uniform Classification Committee, Tariff Publishing Officer, 151 Ellis St. N.E., Suite 200, Atlanta, GA 30335.

¹¹ Available from International Plant Protection Convention, <http://www.ippc.int>.

¹² Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

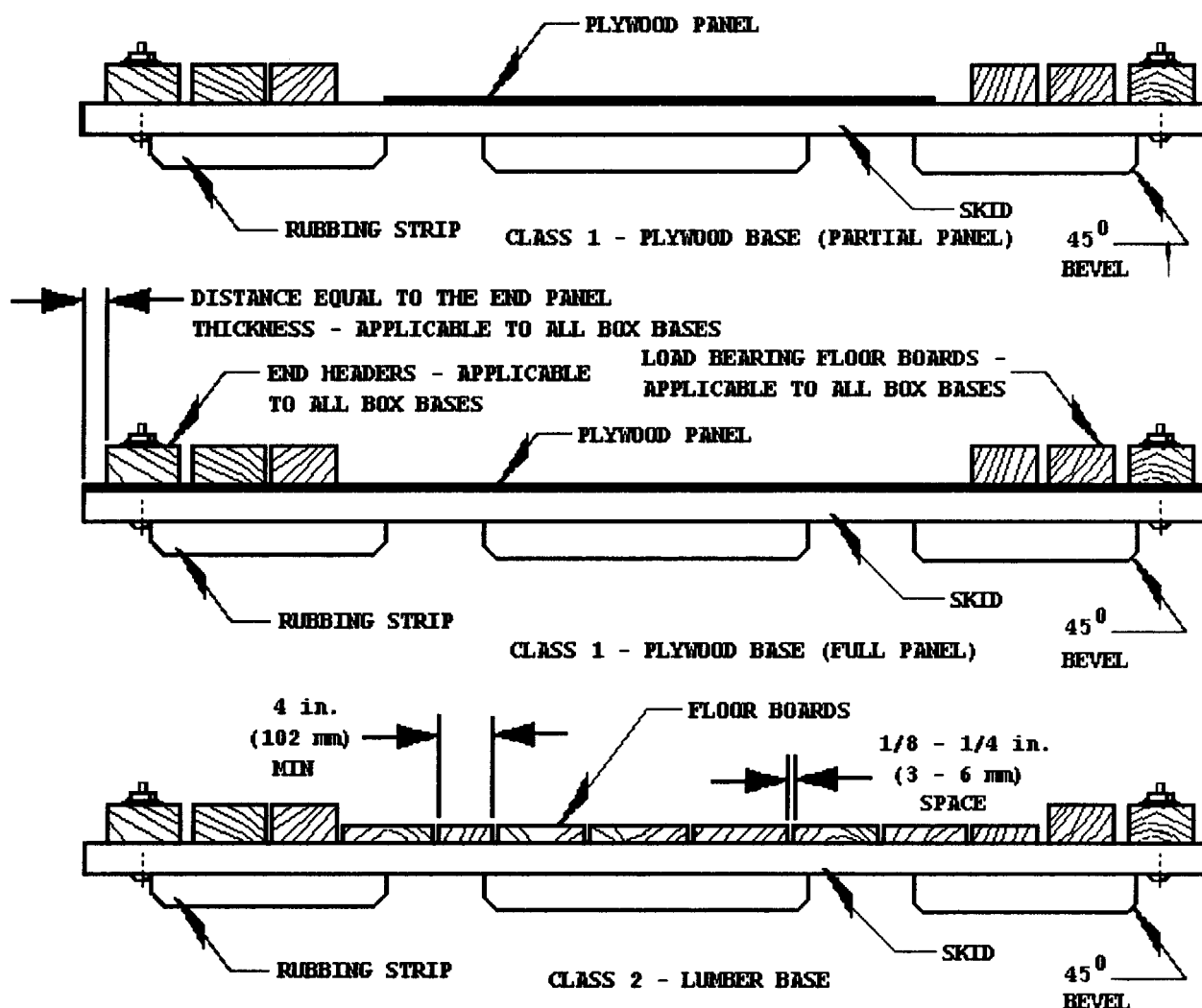


FIG. 1 Base Types

shall be the industries' commonly accepted practice for nominal sizes and wood species and shall conform to commercial practice standards in accordance with Practice [D6199](#), unless otherwise specified. Lumber components shall have a target thickness and width uniform in dimension and 50 % of components shall meet or exceed target dimensions at the time of component manufacture. Lumber for superstructure components shall conform to the requirements for cleated panel boxes, Specification [D6251/D6251M](#), and lumber for base components to those for crates, Specification [D6039/D6039M](#).

6.1.2 Plywood—Plywood shall be performance-rated paneling manufactured in accordance with [PS1](#), [PS2](#), or [ANSI/HPVA HP-1-2004](#). All panels shall be bonded with moisture resistant adhesive and be identified as either Exposure 1 or Exterior. Plywood shall have no defects (knot holes, worm holes, and so forth) extending through the panel. Water-repellent wood preservatives conforming to AWPAs Standards [P36](#) or [P37](#), or a commercial equivalent, shall be used when treatment is specified (see [4.4](#) and [5.1.4](#)).

6.1.3 Fiberboard—Unless otherwise specified, fiberboard shall conform to Specification [D4727/D4727M](#). Class 1 boxes shall be fabricated from Type SF, Class – Domestic, Grade 500

or 600. Class 2 boxes shall be fabricated from Type SF, Class – Weather-Resistant, Grade V2s, V3s, or V4s.

6.1.4 Fasteners—Fasteners are classified as driven nails, lag bolts, and bolts. shall be steel and conform to Specification [F1667](#), and other industry standards.

6.1.4.1 Nails—Nails shall be in accordance with Specification [F1667](#) and other industry standards. Nails are classified as plain-shank, helically threaded, annularly threaded, fluted, or twisted square wire.

6.1.4.2 Lag Bolts, Bolts, Nuts, and Washers—Lag bolts, bolts, screws, nuts, and washers shall be in accordance with ASME [B18.2.1 \(B18.2.3.8M\)](#), ASME [B18.5 \(B18.5.2.2M\)](#), ASME [B18.2.2 \(B18.2.4.2M\)](#), ASME [B18.22.1 \(B18.22M\)](#), and other industry standards.

6.1.4.3 Metallic Strips—Strapping used to reinforce the box shall conform to Specification [D3953](#), Guide [D4675](#), and other industry standards. Strapping finish shall be as specified herein.

6.1.5 Water-Repellent Wood Preservative—Water-repellent wood preservative shall be a solution containing either copper naphthenate conforming with Practice [D6253](#), [MIL-DTL-2427H](#), and AWPAs Standard [P36](#) with a minimum concentration of 2.0 % copper metal, oxine copper (formerly referred to

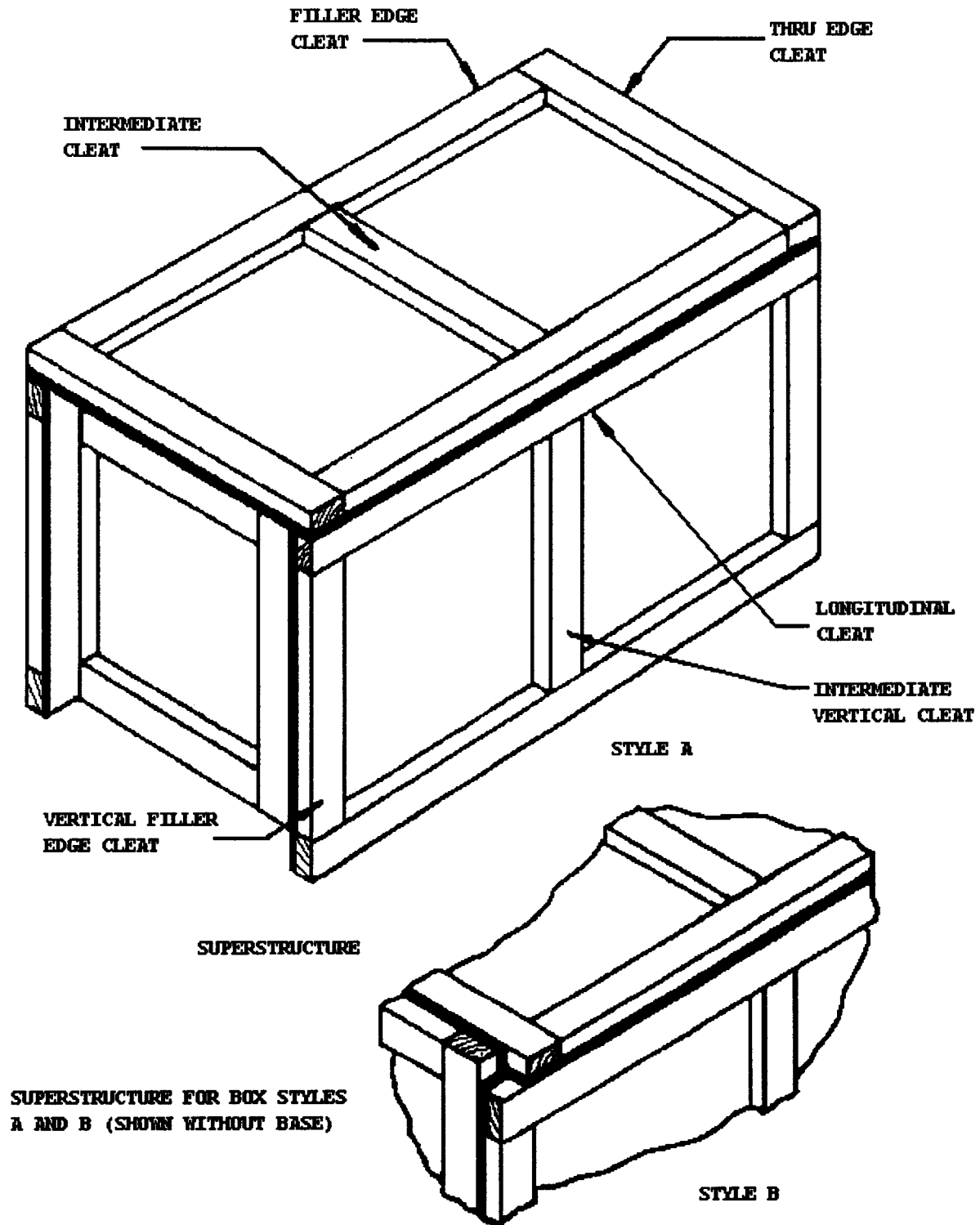


FIG. 2 Box Styles

as copper-8-quinolinolate) conforming with Practice D6253, MIL-DTL-2427H, and AWP Standard P37 with a minimum concentration of 1.8 % copper metal, or 3 % zinc naphthenate conforming to Practice D6253 and MIL-DTL-2427H.

6.2 *Base Components*—The base components are illustrated in Fig. 1. Lumber used in the skids shall be in accordance with the requirements of 6.1.1 except that Group I Woods shall not

be used. The skid dimensions shall be as shown in Table 1, and those with rectangular cross-sections are intended to be used flatwise. For boxes whose outside width does not exceed 36 in. [914 mm], two skids shall be required. When the outside width exceeds 36 in. [914 mm], a third skid conforming to Table 1 shall be placed equidistant between and parallel with the outer skids. When specified (see 5.1.5), the lower one-third of each



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TABLE 1 Skid Nominal Sizes^A and Maximum Lengths

Contents Weight lb [kg]	Load ^B Condition	Nominal Sizes ^A in. [mm]					
		2 by 4 [38 by 89]	2 by 6 [38 by 140]	2 by 8 [38 by 184]	4 by 4 [89 by 89]	4 by 6 [89 by 140]	6 by 6 [140 by 140]
		Skid Max Length ft [mm]					
0–100 [0–45]	A	16 [4877]	...	...	...	...	...
	B	16 [4877]	...	...	...	...	...
	C	16 [4877]	...	...	...	...	...
	D	16 [4877]	...	...	...	...	...
	E	16 [4877]	...	...	...	...	...
101–200 [45.8–90.7]	A	16 [4877]	...	...	...	...	...
	B	16 [4877]	...	...	...	...	...
	C	16 [4877]	...	...	...	...	...
	D	16 [4877]	...	...	...	...	...
	E	16 [4877]	...	...	...	...	...
201–400 [91.2–181.4]	A	11 [3353]	15 [4572]	16 [4877]	...	...	...
	B	13 [3962]	16 [4877]	...	...	...	...
	C	8 [2438]	12 [3658]	16 [4877]	...	...	...
	D	10 [3048]	15 [4572]	16 [4877]	...	...	...
	E	13 [3962]	16 [4877]	...	...	...	...
401–600 [181.9–272.2]	A	8 [2438]	11 [3353]	14 [4267]	16 [4877]	...	...
	B	9 [2743]	14 [4267]	16 [4877]	...	...	...
	C	5 [1524]	8 [2438]	11 [3353]	16 [4877]	...	...
	D	7 [2134]	10 [3048]	14 [4267]	16 [4877]	...	...
	E	9 [2743]	14 [4267]	16 [4877]	...	...	...
601–800 [272.6–363]	A	7 [2134]	9 [2743]	11 [3353]	16 [4877]	...	...
	B	7 [2134]	10 [3048]	14 [4267]	16 [4877]	...	...
	C	4 [1219]	6 [1829]	8 [2438]	16 [4877]	...	...
	D	5 [1524]	8 [2438]	10 [3048]	16 [4877]	...	...
	E	7 [2134]	10 [3048]	14 [4267]	16 [4877]	...	...
801–1000 [363.3–453.6]	A	6 [1829]	8 [2438]	10 [3048]	16 [4877]	...	...
	B	5 [1524]	8 [2438]	11 [3353]	16 [4877]	...	...
	C	3 [914]	5 [1524]	7 [2134]	16 [4877]	...	...
	D	4 [1219]	6 [1829]	8 [2438]	16 [4877]	...	...
	E	5 [1524]	8 [2438]	11 [3353]	16 [4877]	...	...



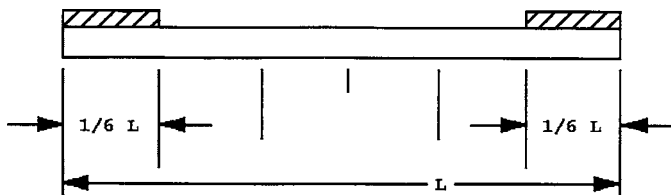
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TABLE 1 Continued

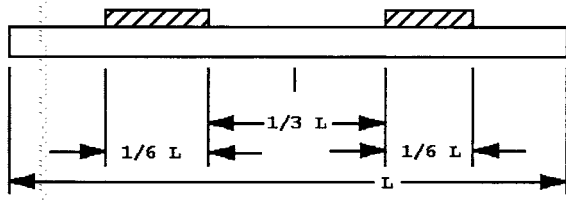
Contents Weight lb [kg]	Load ^B Condition	Nominal Sizes ^A in. [mm]					
		2 by 4 [38 by 89]	2 by 6 [38 by 140]	2 by 8 [38 by 184]	4 by 4 [89 by 89]	4 by 6 [89 by 140]	6 by 6 [140 by 140]
		Skid Max Length ft [mm]					
1001–1200 [454–544.3]	A	6 [1829]	7 [2134]	8 [2438]	16 [4877]	...	...
	B	4 [1219]	7 [2134]	9 [2743]	16 [4877]	...	...
	C	3 [914]	4 [1219]	5 [1524]	13 [3962]	16 [4877]	...
	D	3 [914]	5 [1524]	7 [2134]	16 [4877]	...	...
	E	4 [1219]	7 [2134]	9 [2743]	16 [4877]	...	...
1201–1400 [544.8–635]	A	5 [1524]	7 [2134]	8 [2438]	14 [4267]	16 [4877]	...
	B	5 [1524]	6 [1829]	8 [2438]	16 [4877]	...	...
	C	0 [0]	4 [1219]	5 [1524]	11 [3353]	16 [4877]	...
	D	3 [914]	4 [1219]	6 [1829]	14 [4267]	16 [4877]	...
	E	5 [1524]	6 [1829]	8 [2438]	16 [4877]	...	...
1401–1600 [635.5–725.7]	A	5 [1524]	6 [1829]	7 [2134]	13 [3962]	16 [4877]	...
	B	3 [914]	5 [1524]	7 [2134]	16 [4877]	...	...
	C	0 [0]	3 [914]	4 [1219]	18 [5486]	15 [4572]	16 [4877]
	D	3 [914]	4 [1219]	5 [1524]	12 [3658]	16 [4877]	...
	E	3 [914]	5 [1524]	7 [2134]	16 [4877]	...	...
1601–1800 [726.2–816.5]	A	5 [1524]	6 [1829]	7 [2134]	12 [3658]	16 [4877]	...
	B	3 [914]	5 [1524]	6 [1829]	15 [4572]	16 [4877]	...
	C	0 [0]	3 [914]	4 [1219]	9 [2743]	14 [4267]	16 [4877]
	D	0 [0]	3 [914]	4 [1219]	11 [3353]	16 [4877]	...
	E	3 [914]	5 [1524]	6 [1829]	15 [4572]	16 [4877]	...
1801–2000 [816.9–907.2]	A	4 [1219]	5 [1524]	6 [1829]	11 [3353]	15 [4572]	16 [4877]
	B	3 [914]	4 [1219]	5 [1524]	13 [3962]	16 [4877]	...
	C	0 [0]	0 [0]	3 [914]	8 [2438]	12 [3658]	16 [4877]
	D	0 [0]	3 [914]	4 [1219]	10 [3048]	15 [4572]	16 [4877]
	E	3 [914]	4 [1219]	5 [1524]	13 [3962]	16 [4877]	...
2001–2200 [907.6–997.9]	A	4 [1219]	5 [1524]	6 [1829]	10 [3048]	14 [4267]	16 [4877]
	B	0 [0]	4 [1219]	5 [1524]	12 [3658]	16 [4877]	...
	C	0 [0]	0 [0]	3 [914]	7 [2134]	11 [3353]	16 [4877]
	D	0 [0]	3 [914]	4 [1219]	9 [2743]	14 [4267]	16 [4877]
	E	0 [0]	4 [1219]	5 [1524]	12 [3658]	16 [4877]	...

TABLE 1 *Continued*

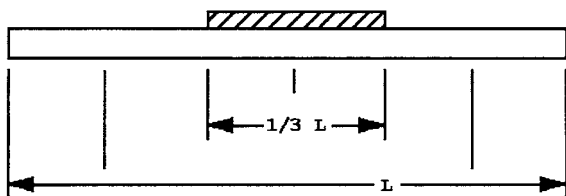
Contents Weight lb [kg]	Load ^B Condition	Nominal Sizes ^A in. [mm]					
		2 by 4 [38 by 89]	2 by 6 [38 by 140]	2 by 8 [38 by 184]	4 by 4 [89 by 89]	4 by 6 [89 by 140]	6 by 6 [140 by 140]
		Skid Max Length ft [mm]					
2201–2400 [998.4–1088.6]	A	4 [1219]	5 [1524]	6 [1829]	10 [3048]	13 [3962]	16 [4877]
	B	0 [0]	3 [914]	4 [1219]	11 [3353]	16 [4877]	16 [4877]
	C	0 [0]	0 [0]	3 [914]	7 [2134]	10 [3048]	16 [4877]
	D	0 [0]	0 [0]	3 [914]	8 [2438]	13 [3962]	16 [4877]
	E	0 [0]	3 [914]	4 [1219]	11 [3353]	16 [4877]	...
2401–2500 [1089.1–1134]	A	4 [1219]	5 [1524]	6 [1829]	9 [2743]	13 [3962]	16 [4877]
	B	0 [0]	3 [914]	4 [1219]	10 [3048]	16 [4877]	...
	C	0 [0]	0 [0]	3 [914]	6 [1829]	10 [3048]	16 [4877]
	D	0 [0]	0 [0]	3 [914]	8 [2438]	12 [3658]	16 [4877]
	E	0 [0]	3 [914]	4 [1219]	10 [3048]	16 [4877]	...

^A See 7.1 for definition.^B The load condition is determined by the manner in which the load is applied to the skids (see Figs. 3 and 4).

LOAD CONDITION A
LOAD BEARING POINTS ON OUTER ONE-SIXTHS OF SKID LENGTH

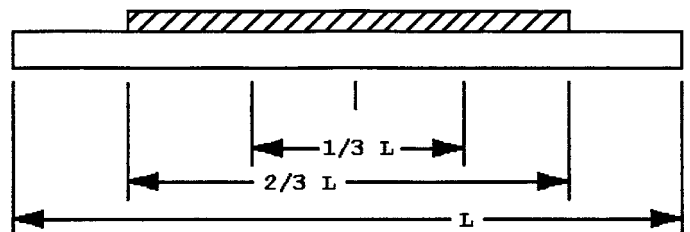


LOAD CONDITION B
LOAD BEARING POINTS OUTSIDE OF CENTRAL ONE-THIRD OF SKID LENGTH BUT NOT IN OUTER ONE-SIXTHS OF SKID LENGTH

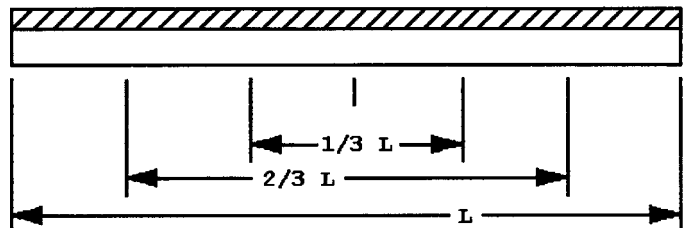


LOAD CONDITION C
LOAD BEARING POINTS WITHIN CENTRAL ONE-THIRD OF SKID LENGTH OR LOAD EVENLY DISTRIBUTED WITHIN CENTRAL ONE-THIRD OF SKID LENGTH

FIG. 3 Load Conditions A, B, and C



LOAD CONDITION D
LOAD EVENLY DISTRIBUTED OVER MORE THAN CENTRAL ONE-THIRD OF SKID LENGTH BUT NOT OVER MORE THAN CENTRAL TWO-THIRDS OF SKID LENGTH



LOAD CONDITION E
LOAD EVENLY DISTRIBUTED OVER MORE THAN CENTRAL TWO-THIRDS OF SKID LENGTH

FIG. 4 Load Conditions D and E

accordance with the requirements of 6.1.1 and shall be selected in accordance with Table 2. When the container width is 24 in. [610 mm] or less, the length 36 to 60 in. [914 to 1524 mm], and height is 72 in. [1829 mm] or greater, place skids crosswise (widthwise), rather than lengthwise, and adjust the other box components accordingly (headers, base, superstructure, and so forth) to match.

skid end and the adjacent side panel corner shall be beveled $45 \pm 5^\circ$. Lumber used for load-bearing floor members shall be in

**TABLE 2 Load Bearing Floor Members Allowable Load lb/in. of Width, [kg/mm of Width]**

Length Between Outside Skids in. [mm]	Nominal ^A 1-in. [19-mm] Thick Boards lb/in. [kg/mm]		Nominal ^A 2-in. [38-mm] Thick Boards lb/in. [kg/mm]		Nominal ^A 3-in. [64-mm] Thick Boards lb/in. [kg/mm]	
	Wood Groups		Wood Groups		Wood Groups	
	I or II	III or IV	I or II	III or IV	I or II	III or IV
12 [305]	38	46	176	211	459	551
	[0.7]	[0.8]	[3.1]	[3.8]	[8.2]	[9.8]
18 [457]	26	31	118	142	306	367
	[0.5]	[0.6]	[2.1]	[2.5]	[5.8]	[6.6]
24 [610]	19	23	88	106	230	276
	[0.3]	[0.4]	[1.6]	[1.9]	[4.1]	[4.9]
30 [762]	15	18	70	84	183	220
	[0.3]	[0.3]	[1.3]	[1.5]	[3.3]	[3.9]
36 [914]	13	16	58	70	154	185
	[0.2]	[0.3]	[1.0]	[1.3]	[2.8]	[3.3]
42 [1067]	11	13	52	62	131	157
	[0.2]	[0.2]	[0.9]	[1.1]	[2.3]	[2.8]
48 [1219]	10	12	44	53	115	138
	[0.2]	[0.2]	[0.8]	[1.0]	[2.1]	[2.5]
54 [1372]	9	11	39	47	102	122
	[0.2]	[0.2]	[0.7]	[0.8]	[1.8]	[2.2]
60 [1524]	7	8	35	42	92	110
	[0.1]	[0.1]	[0.6]	[0.8]	[1.6]	[2.0]

^A See 7.1 for definition.

6.2.1 *Lumber-Floored Base*—Lumber used for floorboards shall be as specified in 6.1.1. Floorboards shall not be less than 1 in. [19 mm] nominal thickness nor less than 4 in. [89 mm] nominal width.

6.2.2 *Plywood Base*—Plywood base shall be in accordance with 6.1.2. The plywood minimum thickness shall be 3/8 in. [10 mm].

6.2.3 *Headers*—End headers shall be placed at the ends of all bases, perpendicular to the skids. They shall be of nominal size lumber conforming to 6.1.1 and shall be unspliced. When the container width is 36 in. [914 mm] or less, 2 by 4 in. [38 by 89 mm] headers shall be used. When container width exceeds 36 in. [914 mm], 4 by 4 in. [89 by 89 mm] headers shall be used.

6.2.4 *Skid Rubbing Strips*—Unless otherwise specified (see 5.1.7), 3 +0 –1/8 in. [76 +0 –3 mm] thick rubbing strips, either nominal or build-up, shall be applied to skids to facilitate forklift entry. Rubbing strips shall be applied with two staggered rows of nails, length of nail dependent on whether nominal or build-up lumber, spaced 12 in. [305 mm] apart in each row, with a minimum of five nails required for each rubbing strip. When rubbing strips are used, the skids shall not be beveled. All rubbing strip ends shall be half-beveled at 45 ± 5° and set back from skid ends 2 1/2 to 4 in. [64 to 102 mm] to allow for sling placement. Openings for forklift access shall be a minimum 12 in. [305 mm] wide, 28 in. [711 mm] center-to-center, and positioned to straddle the loaded container's center of gravity. The rubbing strip center pieces shall be 16 in. [406 mm] long. On short boxes (less than 60 in. [1524 mm] long), forklift openings may be substituted for sling openings.

6.2.5 *Superstructure Components*—The sides, tops, and ends shall be of cleated panel construction. Panels shall be plywood or fiberboard as specified (see 5.1.8) and shall meet the material requirements of 6.1.2 and 6.1.3 respectively. The component sizes for the cleated plywood and fiberboard

superstructures shall comply with the applicable requirements of Specification D6251/D6251M. The maximum size components given in those specifications shall be used for net weights in excess of 1000 lb [453.6 kg]. Cleating shall be external only.

6.2.5.1 *Cleats*—Cleat arrangement on top, side, and end panels (see Fig. 2), as well as filler cleat tolerance and drainage provisions shall be in accordance with Specification D6251/D6251M. The longitudinal cleats shall always be parallel to the skids, and the same length as the skids.

6.2.5.2 *Joists*—Unless otherwise specified (see Section 5.1.9), joists shall be provided for all boxes in excess of 36 in. [914 mm] long and 24 in. [610 mm] wide. Lumber used for joists shall be in accordance with the requirements of 6.1.1. Joists shall be applied with their narrow surfaces in contact with the top panel. Joists shall be spaced equal distances apart along the box length, but not to exceed 24 in. [610 mm] apart (center-to-center). Joist sizes shall be in accordance with Table 3. When joists are required, they shall be supported vertically by supports in accordance with 7.3.1.2 and laterally by supports in accordance with 7.3.1.3.

7. Construction

7.1 *Dimensions*—Nominal lumber dimensions shall be as specified in subsection 6.3 of Practice D6199. Box dimensions shall be specified by length, width, and height (see 5.1.10). Inside dimensions shall specify the inside length from the inside of the end panels (outside edge of headers); the inside width shall be equal to the base width (outside of outer skids); and the inside height shall be measured from the top of base/flooring to the bottom of the top panel.

7.2 Base Fabrication:

7.2.1 *Plywood Flooring to Skids*—The plywood may be the full length and width of the container base or it may be a centrally located square piece with each side equal to the base width as illustrated in Fig. 1. Plywood flooring shall be oriented so that the grain direction of face plies are perpendicular to skid length. If more than one plywood panel is used, a spacing of 1/4 in. [6 mm] shall be left between panels for drainage. The plywood shall be nailed to the skids as illustrated in Fig. 5. All plywood flooring side edges shall be flush with the outer edges of the outside skids. When the plywood flooring is the full length of the base, end headers and load-bearing floor members shall be placed on top of the plywood and bolted to the skids. A 1/2-in. [13-mm] diameter drainage hole shall be drilled in each corner of full length plywood bases. An additional drainage hole shall be placed along the sides of the plywood base for each 36 in. [914 mm] of the inside length (see Fig. 6). When load-bearing floor members are placed over plywood bases, at least one drainage

TABLE 3 Joist Selection

Nominal Joist Size in. [mm]	Box Outside Width in. [mm]
none required	24 [610]
1 by 4	25–36
[19 by 89]	[635–914]
2 by 4	37–60
[38 by 89]	[940–1524]

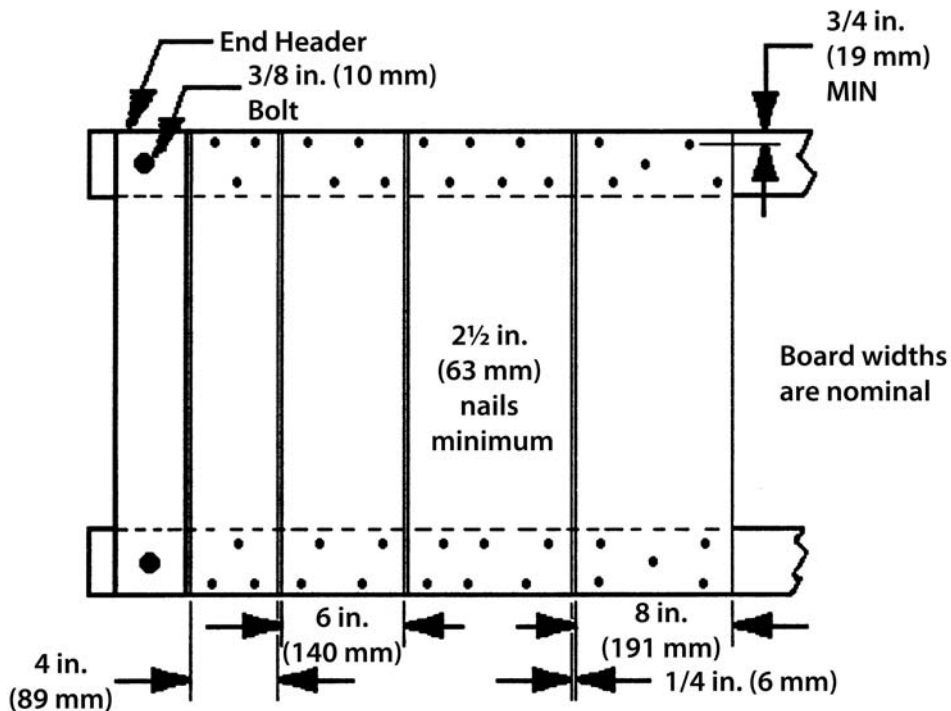
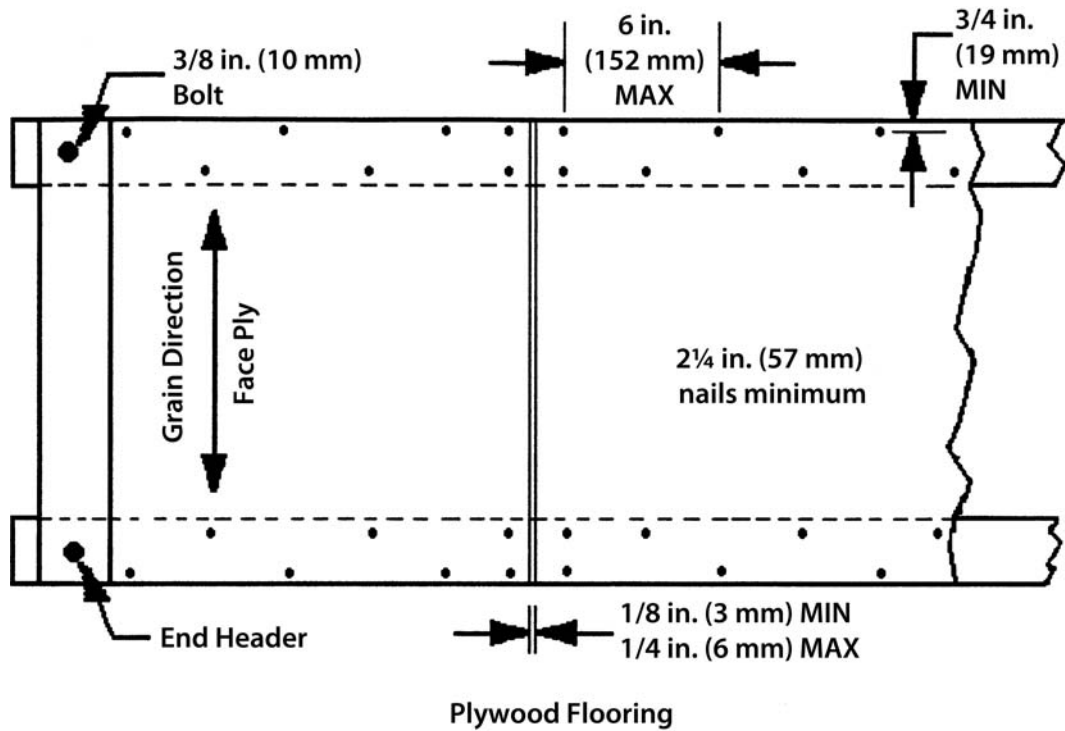


FIG. 5 Nailing Patterns For Base

hole shall be placed on each side of the plywood base between the load-bearing floor members.

7.2.2 *Lumber Flooring to Skids*—Lumber flooring shall be nailed to the skids as illustrated in Fig. 5. Lumber shall be laid

at right angles to the skids. The adjacent board edges shall be separated 1/8 to 1/4 in. [3 to 6 mm] to allow for swelling and drainage. The board ends shall be flush with the outer edges of the skids.

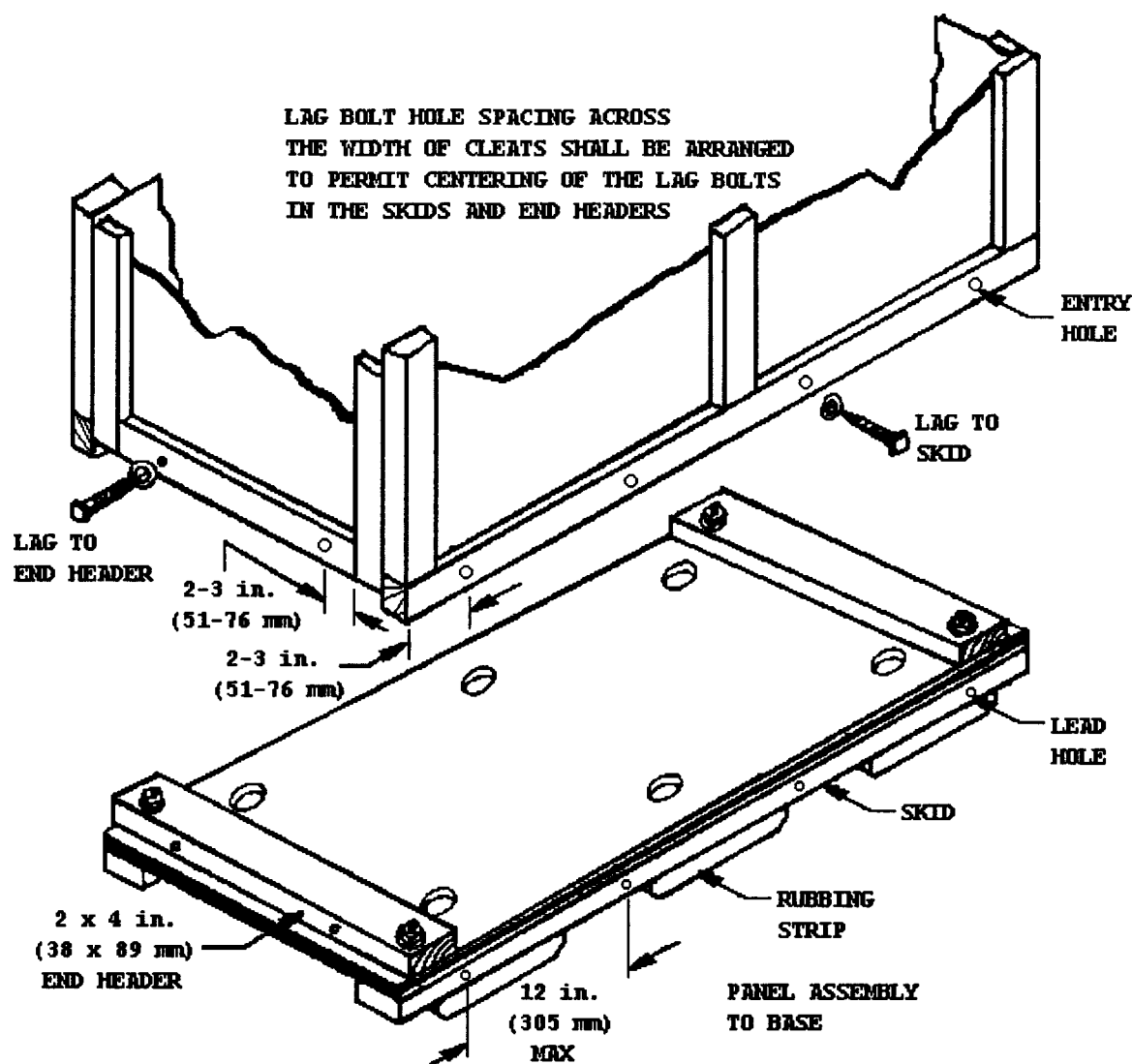


FIG. 6 Panel Assembly to Base

7.2.3 Load-Bearing Floor Members to Skids—Load-bearing floor members over 2 in. [38 mm] thick and up to 4 in. [89 mm] wide shall be bolted to each skid with one round head square neck bolt. Load-bearing floor members over 2 in. [38 mm] thick and over 4 in. [89 mm] wide shall be bolted to each skid with two round head square neck bolts. The load-bearing floor members shall be fastened to the skids with $\frac{3}{8}$ -in. [10-mm] diameter round head square neck bolts. Bolt holes shall be the same diameter as the bolt shank. Plain washers in accordance with 6.1.4.2 shall be placed under the nuts of all bolts. After tightening, nuts shall be prevented from turning by applying an anaerobic, sealing, lubrication, and wicking; single component, thread-locking compound to projecting threads. Load-bearing members less than 2 in. [38 mm] thick shall be nailed to the skids. Nails shall be as large as possible without splitting the piece. The load-bearing floor members shall be flush with the outer edges of the skids.

7.2.4 End Headers to Skids—End headers in accordance with 6.2.3, shall be fastened perpendicular to the skids with $\frac{3}{8}$ -in. [10-mm] diameter round head square neck bolts. Head-

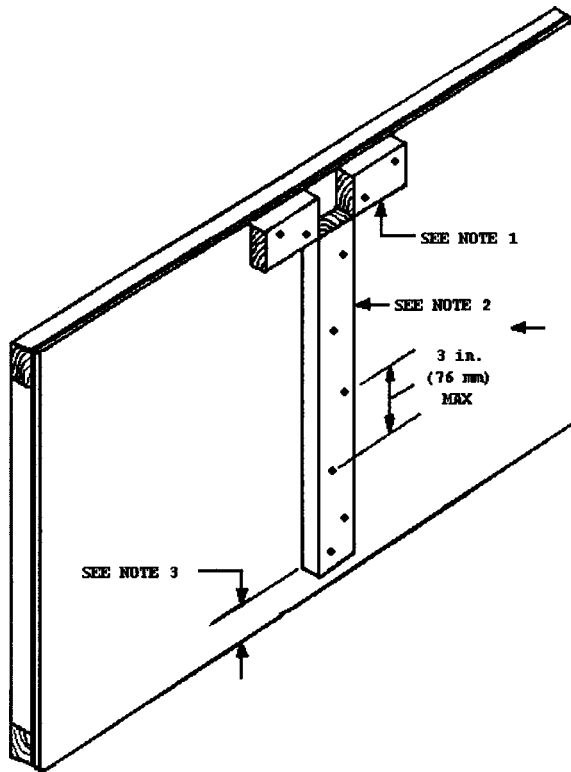
ers shall be placed back from the skid ends a distance equal to the end panel's thickness as illustrated in Fig. 1 and shall be flush with the skid outer edges as illustrated in Fig. 6. When plywood is used the full length of the base, headers shall be placed on the plywood.

7.3 Superstructure Fabrication—Except as noted in 6.2.5 and 7.3.1, cleated plywood and fiberboard panel fabrication, which form the superstructure, shall conform to the applicable requirements of Specification D6251/D6251M.

7.3.1 Side Panel Fabrication:

7.3.1.1 Joist Supports—When top bracing joists are used, vertical and lateral joist supports shall be affixed to the side panels as illustrated in Fig. 7. The vertical and lateral supports shall conform to the material requirements for cleat stock except that the thickness shall not be less than 1 in. [19 mm] nominal for container loads up to 1000 lb [454 kg] and not less than 2 in. [38 mm] nominal for loads in excess of 1000 lb [454 kg].

7.3.1.2 Vertical Joist Supports—The vertical joist supports shall be fastened to the side panels with nails spaced not greater



NOTE 1—Lateral support for joist.

NOTE 2—Vertical support for joist.

NOTE 3—Vertical support to rest on base floor or on loadbearing members as applicable.

FIG. 7 Joist Support Attachment

than 3 in. [76 mm] on centers (see Fig. 7). The nails shall be staggered as shown. Nails shall be of sufficient length to pass through the joist support, the panel, and the side panel intermediate cleat when matching occurs. Nails shall permit a clinch of not less than $\frac{1}{8}$ in. [3 mm] when Group II, III, or IV woods are used and $\frac{1}{4}$ in. [6 mm] when Group I woods are used. The supports shall be of sufficient length to extend from the joist under surface to the base decking or floor boards upper surface.

7.3.1.3 Lateral Joist Supports—The lateral joist supports shall be fastened to the side panels with not less than two nails. Nails shall be of sufficient length to pass through the support block, the panel, and the side panel longitudinal cleat. Nails shall permit a clinch of not less than $\frac{1}{8}$ in. [3 mm] when Group II, III, or IV woods are used and $\frac{1}{4}$ in. [6 mm] when Group I woods are used. These support blocks shall not be less than $3\frac{1}{2}$ in. [89 mm] long.

7.4 Box Assembly:

7.4.1 Superstructure Panel—Cleated plywood and fiber-board superstructure assembly shall comply with the applicable requirements of Specification D6251/D6251M.

7.4.2 Superstructure to Base—The end and side panels shall be assembled to the base with lag bolts specified in 6.1.4 and as illustrated in Fig. 6. Side panels shall not extend below the bottom of the skids. When specified, boxes may be furnished assembled (see 5.1.11).

7.4.2.1 Side to Skid—A lag bolt shall be placed through each side panel lower longitudinal cleat end and into the skid at a distance of not less than 2 in. [51 mm] nor more than 3 in. [76 mm] from the cleat end. Additional lag bolts shall be equally spaced between the two end bolts with no distance exceeding 12 in. [305 mm] on boxes 60 in. [1524 mm] or greater in length, and 18 in. [457 mm] on boxes 60 in. [1524 mm] or less.

7.4.2.2 End to Header—A lag bolt shall be placed through each lower filler cleat end and into the end header at a distance not less than 2 in. [51 mm] nor more than 3 in. [76 mm] from the filler cleat end. Additional lag bolts shall be spaced equally between the end bolts with no distance exceeding 12 in. [305 mm]. A minimum of two lag bolts are required through each end filler cleat.

7.4.2.3 Lag-Bolt Size and Placement—Lag bolts shall be $\frac{3}{8}$ -in. [10-mm] diameter and 3 in. [76 mm] long. Entry holes for lag bolts shall be $\frac{3}{8}$ -in. [10-mm] diameter. Lead holes shall be $\frac{1}{4}$ -in. [6-mm] diameter for Groups I, II, and III woods and $\frac{5}{16}$ -in. [8-mm] diameter for Group IV woods (see Fig. 6). The combined depth of the entry and lead holes shall equal the total length of the bolt shank and threaded portions. Lag bolts shall be turned in their holes the full distance. They shall not be driven by hammer. If the threads in the lead holes become stripped, the lag bolt shall be removed and placed in a new hole near the old position. A washer in accordance with 6.1.4 shall be placed under each lag bolt head. Countersinking for lag bolts shall not be permitted.

7.4.2.4 Corner Straps—When specified (see 5.1.12), corner straps shall conform to Specification D3953, or other industry standards, not less than $\frac{3}{4}$ in. [19 mm] wide by 0.020 in. [0.508 mm] thick by 12 in. [305 mm] long. Corner strapping shall be prepunched or drilled with $\frac{1}{8}$ -in. [3-mm] holes at 1-in. [25-mm] intervals. Nails shall conform to Specification F1667 or other industry standards. Nail length shall be $\frac{7}{8}$ to $1\frac{1}{8}$ in. [22 to 29 mm]. A minimum of three nails shall be used for each strap leg and strapping shall be located so that nailing is in a cleat. When intermediate cleats are required on the sides and top, or on the ends, an additional strap shall be placed over each intermediate cleat. See Fig. 8 for strap placement.

7.5 Ventilation—When specified (see Section 5), boxes shall be provided with ventilating holes or slots, which shall be located at each end, or at ends and sides, or around the box perimeter. These ventilating holes or slots shall be located immediately below the top cleats and be provided with a baffle located on the inside of the box as shown in Fig. 9 for each ventilating area. In boxes over 10 ft [3048 mm] long, the ventilation area shall be divided equally between the box sides and ends, and each of these areas must have a baffle. The ventilating area on the ends shall be placed as near the midpoint as practical. On the sides, the ventilation area will be placed as near the center between the intermediate and edge vertical cleats as practical. Single holes do not require baffles but shall be sloped at 45° to drain outward. No holes or slots shall be cut in any cleat.

7.5.1 Ventilation Slots—When required (see 5.1.13), the ventilation slots shall be provided with baffles and screens as shown in Fig. 9. The required ventilating area shall comply

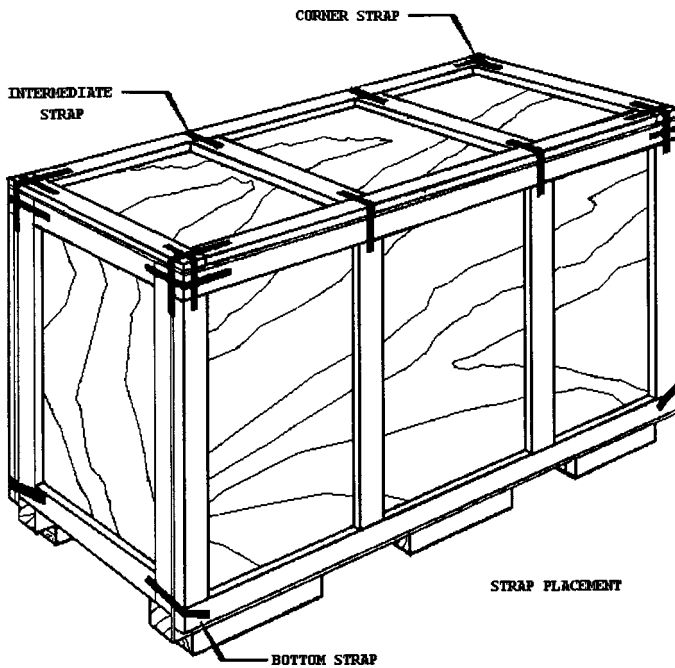


FIG. 8 Strap Placement

with Table 4. In small boxes, $\frac{3}{4}$ -in. [19-mm] diameter holes may be substituted for the slots in the proportion of two holes for each square inch [645 mm²] of required area.

7.5.2 *Ventilation Holes*—When required (see 5.1.13), boxes shall be provided with $\frac{3}{4}$ -in. [19-mm] diameter ventilating holes. All splinters and chips shall be removed from the holes. Ventilation holes shall be provided in each end in one or more clusters, placed near the upper cleats, provided with a baffle, and spaced 2 in. [51 mm] on center as shown in Fig. 9. As an alternative to end ventilation, the ventilating holes may be spaced evenly around the box perimeter just under the top cleats and drilled at a 45° angle to drain outward. The total number of holes shall comply with Table 4.

7.6 *Workmanship*—All boxes and components shall be free from imperfections, which may affect their utility. Boxes shall be free from defects, which will result in damage to the contents.

7.7 *Additional Markings*—The following marking in 1-in. [25-mm] high letters (minimum) shall be placed on the box end and side panels with 1-in. [25-mm] spacing between lines of text:

**CAUTION: LIFT BY BASE ONLY
TO OPEN REMOVE BOTTOM LAG BOLTS**

7.8 *Phytosanitation*—Phytosanitary treatment and marking must conform to Practice D6253 and ISPM Publication No. 15.

8. Shipping Preparation

8.1 Boxes shall be shipped completely assembled or knocked down as specified (see 5.1.11). The assembled or knocked down boxes will consist of the completely fabricated top, sides, and end panels, secured to the base. For boxes shipped knocked down, like-sized panels shall be bundled, boxed, or crated, in quantities that permit easy loading and handling. Boxes shall be packed in a manner to ensure carrier acceptance and safe delivery to destination at the lowest transportation rating in compliance with National Motor Freight Classification rules. Preserved assembly instructions, if required, shall be secured in a protected location on the bundle, box, or crate of complete boxes or component panels. Unassembled box units shall not be stacked higher than 43 in. [1092 mm].

8.2 *Hardware (for Unassembled Boxes)*—The hardware shall be placed in a container (box, bag, envelope) of suitable strength and size, located in a protected location, and secured to prevent separation from the packed unit. The hardware shall be treated to prevent corrosion.

8.3 *Packing and Marking*—Assembled or knocked down boxes shall be packed and marked in accordance with Practice D3951. The additional marking requirements (see 7.7), are required. Other special marking requirements may be required in the contract or purchase order (see 5.1.15).

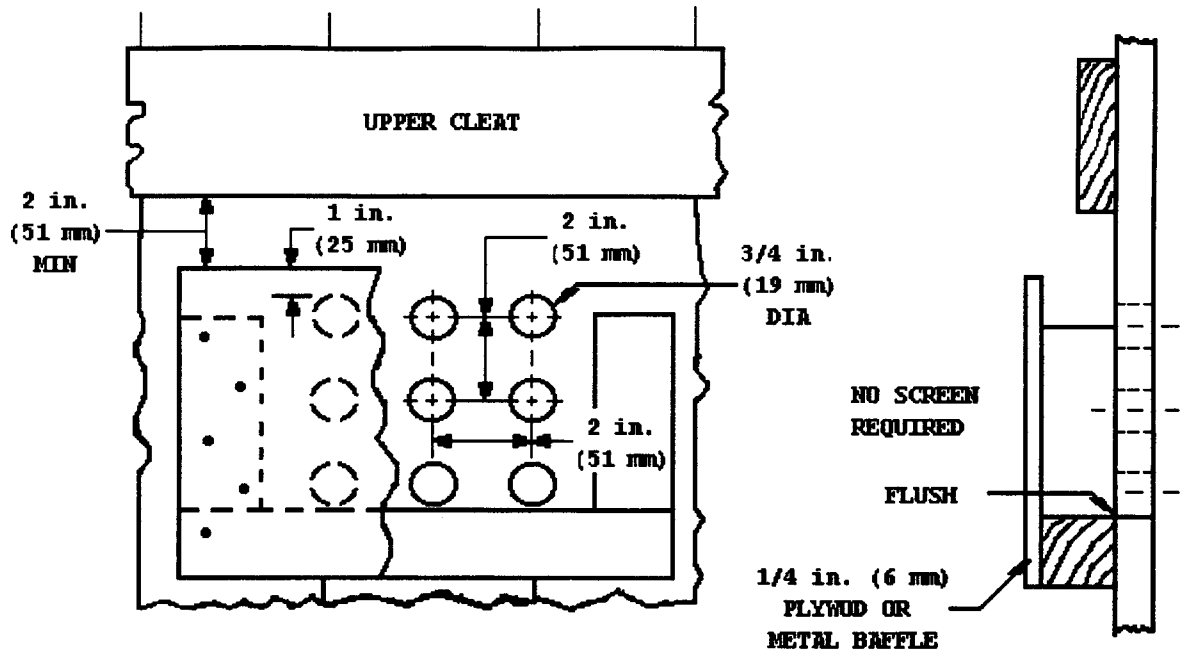
9. Notes

9.1 *Intended Use*—Boxes covered by this specification are intended to be used for items that can be attached to a load-bearing base. It is intended that the entire load be carried on the base, the superstructure providing support only for superimposed loads and protection against the elements. When the physical protection afforded by the superstructure is not required for storage and shipment, the superstructure may be removed. The box is not intended to be lifted and moved other than by the base.

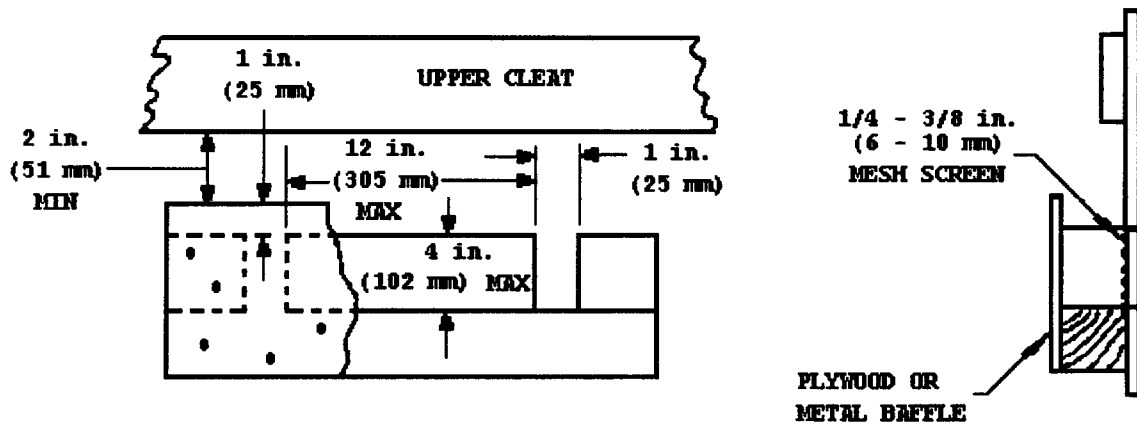
9.2 *Regulated Commodities Shipments*—Regulated commodities shipments may require better boxes than those specified herein. When the commodities are regulated by the U.S. Department of Transportation, all boxes must conform to the requirements of CFR Parts 107–180 Title 49, Hazardous Materials Regulations or appropriate international modal regulations.

10. Keywords

10.1 box; cleat; fasteners; load-bearing base; nails; packaging; panel; panelboard; shipping container; skid; wood



VENTILATION HOLES



VENTILATION SLOTS

FIG. 9 Box Ventilation (Inside View)



TABLE 4 Ventilation Hole Requirements

Box Volume ft ³ [m ³]	End Ventilation ^A	Perimeter Ventilation ^B	Area Required in Each End ^C in. ² [mm ²]
0–100 [0–2.8]	3	6	7 [4516]
100–150 [2.8–4.3]	4	8	10 [6451]
150–200 [4.3–5.7]	5	10	14 [9032]
200–400 [5.7–11.3]	9	18	27 [17419]
400–600 [11.3–17]	14	27	40 [25806]

^A Minimum number of 3/4-in. [19-mm] diameter holes required in each end (place in clusters and use baffle).

^B As an alternative, total minimum number of 3/4-in. [19-mm] diameter holes required around perimeter (space evenly and slope to drain out).

^C Use baffle and screen.

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