



Designation: D 6199 – 97 (Reapproved 2005)

Standard Practice for Quality of Wood Members of Containers and Pallets¹

This standard is issued under the fixed designation D 6199; 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 Department of Defense.

1. Scope

1.1 This practice covers the quality requirements for three classes of hard and soft wood members, excluding man-made or fabricated wood composites, used in the construction of boxes, crates, pallets, and blocking and bracing.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.3 *This practice 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 the regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D 9 Terminology Relating to Wood

D 996 Terminology of Packaging and Distribution Environments

D 4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials

2.2 *ASME/ANSI Standard:*³

ASME/ANSI MH1.8M Wood Pallets

3. Terminology

3.1 *Definitions*—General definitions for packaging and distribution environments are found in Terminology D 996. General definitions for wood are found in Terminology D 9.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *brash, n*—decay characteristic, which is the breaking of the grain without splintering.

3.2.2 *crate frame members, n*—those parts which form the fundamental structure upon which the strength and rigidity of crates depend.

3.2.3 *diagonals, n*—frame members placed at angles of nearly 45° to other frame members, to ensure the rigidity of the crate.

3.2.4 *linderman joint, n*—glued dove-tailed joint between two or more pieces of wood.

3.2.5 *longitudinal frame members, n*—horizontal members of the side, end, and top panels of crates.

3.2.6 *punk, n*—decay characteristic, which is very dry, powdery, and crumbly wood.

3.2.7 *siftproofness, n*—the prohibition of the migration of material, of any size, from the interior to the exterior of a container.

3.2.8 *struts, n*—vertical frame members placed between the upper and lower frame members of the side and end panels of a crate that serve as columns for supporting vertical stacking loads.

4. Significance and Use

4.1 Each wood member contains a combination of characteristics which affects the performance of the container or pallet in which it is used. The requirements for classes, herein specified, have been established as these characteristics are related to the functional application of members in container and pallet construction and to the service that the container or pallet may be called upon to perform.

4.2 Any other specified requirements or limitations peculiar to a particular container or pallet construction or use, such as prohibiting knotholes or loose knots to provide siftproofness, limitation to certain wood groups or species, or the selection of applicable classes for specific members of or types of containers or pallet shall be the responsibility of the standard for that container or pallet.

5. Wood Member Classification

5.1 *Class 1*—Structural (highly stressed members).

5.2 *Class 2*—Structural (moderately stressed members).

5.3 *Class 3*—Non-structural (lightly stressed members).

¹ This practice is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.26 on Shipping Containers, Crates, Pallets, Skids and Related Structures (Disbanded 5/05).

Current edition approved April 1, 2005. Published April 2005. Originally approved in 1997. Last previous edition approved in 1997 as D 6199 - 97^{e1}.

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 Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5900.

6. Wood Characteristics

6.1 Classification:

6.1.1 *Groups*—For the purposes of this practice, wood is broken into four groupings. These groupings are general in nature and do not include all species of wood. Woods used specifically in pallet construction include additional species that are listed in **ASME/ANSI MH1.8M, Table X1.1** provides a cross reference between the wood groups used herein and those listed in **ASME/ANSI MH1.8M**.

6.1.1.1 *Group I*—This group embraces the softer woods of both the coniferous and the broad-leafed species. These woods are relatively free from splitting in nailing, have moderate fastener withdrawal resistance, moderate strength as a beam, and moderate shock resisting capacity. They are soft, light in weight, easy to work, hold their shape well in manufacture, and are normally easy to dry.

6.1.1.2 *Group II*—This group consists of heavier coniferous woods, only. These woods usually have a pronounced contrast in the hardness of the springwood and the summerwood. They have a greater fastener withdrawal resistance than Group I woods, but are more likely to split, and the hard summerwood bands occasionally deflect the nails causing them to run out at the sides of the piece.

6.1.1.3 *Group III*—This group consists of hardwoods of medium density. These woods have about the same fastener withdrawal resistance and strength as a beam as the Group II woods, but are less likely to split and shatter under impacts. The species in this group are the most useful for constructing box ends and cleats. They also furnish most of the rotary-cut veneers for wirebound boxes and plywood panels for construction of plywood boxes.

6.1.1.4 *Group IV*—This group consists of the high density hardwood species. They have both the greatest shock resisting capacity and fastener withdrawal resistance, but because of their extreme hardness present difficulties with respect to the driving of nails, plus the greatest tendency to split at the nails. They are the heaviest and hardest domestic woods and are difficult to work. They are especially useful where high fastener withdrawal resistance is required and many of them make excellent rotary cut veneers for wirebound and plywood boxes.

6.1.2 *Species*—The species of wood, in the four groups, that may be used for wood members of containers or pallets are

classified as indicated in **Table 1** (see **Appendix X1, Table X1.1**, for groups specific to pallet construction). When it is stipulated that members shall be fabricated from a particular wood group, the species within that group may be mixed together or used interchangeably.

6.2 *Surfaces*—Rough lumber is permitted in the construction of the crate bases, sheathed-crate framing, boxes, and pallets. For box and crate sheathing, at least one surface of all wood members will be sufficiently smooth to permit legible marking.

6.3 Dimensional Requirements:

6.3.1 When nominal sizes of lumber are specified, the minimum sizes shall be as shown in **Table 2**.

6.3.2 When sizes of wood members other than the nominals cited in **Table 2** are specified, undersizing in thickness and width shall not be permitted in more than 10 % of the number of pieces. In addition, these parts shall be no thinner than 7/8 of the stated thickness and no narrower than 1/4 in. (6 mm) less than the stated width. An exception to this requirement is that if members of nailed-wood boxes 3/8 in. (10 mm) or more in thickness are surfaced on both sides (to protect the contents) then the thickness may be 1/32 in. (1 mm) less than stated.

6.3.3 When nominal 2 in. (50 mm) thick lumber is resawn to obtain 1 in. (25 mm) nominal thick members, the resulting minimum thickness shall be 11/16 in. (18 mm) for dry lumber; except that for Class 1 structural members, which shall be 3/4 in. (20 mm).

6.4 *Moisture Content*—Container and pallet members shall have a moisture content (as measured by an electric type moisture meter or by the oven drying method), at the time of fabrication, of not greater than 19 % nor less than 9 % of their oven-dry weight.

6.4.1 Methods of Determination:

6.4.1.1 *Moisture Meters*—Meters measuring moisture contents ranging as high as 30 % shall be used to determine moisture content of Group IV pallet members. Meters measuring moisture contents as high as 25 % shall be used for all other wood members. The accuracy of the meter used shall be ± 1 % of true moisture content. Electric-type moisture meters may be either the resistance type or radio frequency power loss type except that only the resistance type may be used on rough sawn lumber. In addition, readings using the resistance type meters

TABLE 1 Wood Groups

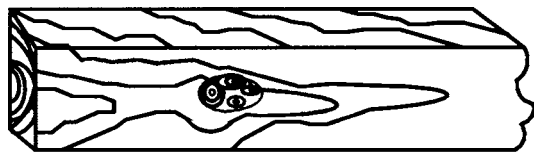
<i>Group I</i>					
Cottonwood Redwood	Aspen	Basswood Cypress Spruce	Buckeye Fir (true firs) Willow	Cedar Magnolia Yellow poplar	Chestnut Pine ^A Red alder
<i>Group II</i>					
	Douglas fir Western larch	Hemlock	Southern yellow pine	Tamarack	
<i>Group III</i>					
Soft Elm	Ash ^B Soft maple	California black oak Sweetgum	Sycamore	California maple Tupelo	
<i>Group IV</i>					
	Beech Oak	Birch Pecan	Hackberry Rock elm	Hard maple White ash	Hickory

^A Except Southern yellow pine.

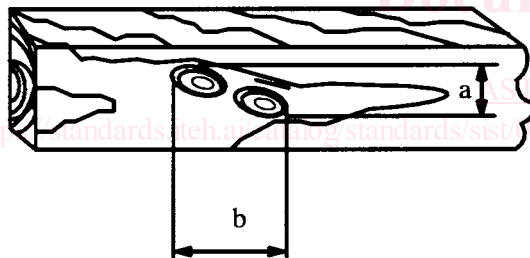
^B Except White ash.

TABLE 2 Relationship of Nominal to Minimum Dimensions for Dry Lumber

Nominal in. (mm)	Thickness (Smaller Dimension)		Width (Larger Dimension)	
	Minimum in. (mm)	Nominal in. (mm)	Minimum in. (mm)	Nominal in. (mm)
1 (25)	¾ (20)	2 (50)	1 ½ (40)	2 (50)
2 (50)	1 ½ (40)	3 (75)	2 ½ (65)	3 (75)
3 (75)	2 ½ (65)	4 (100)	3 ½ (90)	4 (100)
4 (100)	3 ½ (90)	5 (125)	4 ½ (115)	5 (125)
5 (125)	½ (12) off	6 (150)	5 ½ (140)	6 (150)
and thicker		7 (175)	6 ½ (165)	7 (175)
		8 (200)	¾ (20) off	8 (200)
		and wider		and wider



KNOT CLUSTER



TANDEM KNOTS

NOTE 1—The distance (a) is taken as the width when (b) is twice the width of the piece or less.

FIG. 1 Knot Clusters and Tandem Knots

shall be made only after the pins have penetrated to a depth of one-fourth the thickness of the piece being tested.

6.4.1.2 *Oven-Drying Method*—Samples shall be tested in accordance with Method A or B of Test Method D 4442, except that no sample shall be less than 1 oz (2835 mg).

6.5 *Wood Defects*—Members shall be so selected and cut so that allowable defects or imperfection will not occur in positions that would interfere with the prescribed fabrication or assembly of the container or pallet.

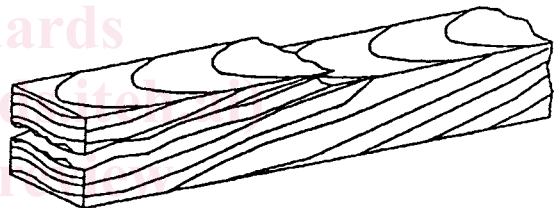
6.5.1 *Decay*—Any form of visible decay shall not be permitted. Stains or discoloration, not associated with decay,

will be acceptable, except for discoloration that would interfere with marking on the outside of the container or the pallet. Decay shall be detected by use of the pick test. The pick test is performed with a knife or chisel by lifting up some of the grain or fibers. If the material is softer, more punky, or more brash than healthy wood of the same species, it is decay. Suspicious areas are usually abnormally brown, bleached looking, or mottled and indicated by the absence of luster that is present in normal wood.

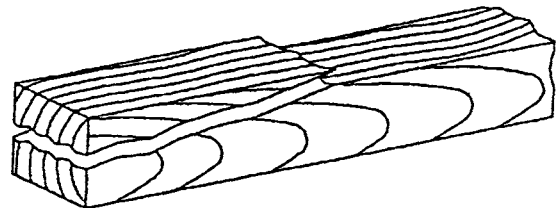
6.5.2 *Checks, Splits, and Shakes*—Checks, splits, and shakes that are not longer than the width of the member will be permitted. Checks that do not extend through the full thickness of the member are permitted.

6.5.3 *Warp*—The bow in a member shall not exceed 1/16 in. (2 mm) per foot (300 mm) of length. The cup in a member shall not exceed 1/4 in. (6 mm) in an 8 in. (200 mm) width, 1/8 in. (3 mm) in a 4 in. (100 mm) width, or a like proportion in other widths. The twist in a member shall not exceed 1/4 in. (6 mm) per foot of length in an 8 in. (200 mm) width, 1/8 in. (3 mm) per foot of length in a 4 in. (100 mm) width, or a like proportion in other widths.

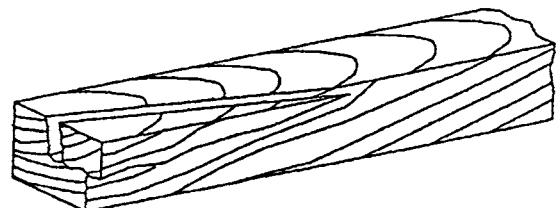
6.5.4 *Knots*—Sound knots, loose knots, knot holes, and knot clusters shall be measured and restricted as specified in Table



DIAGONAL GRAIN



SPIRAL GRAIN



SPIRAL AND DIAGONAL GRAIN IN COMBINATION

FIG. 2 Cross Grain