AMERICAN NATIONAL STANDARD

FOR HARDWOOD AND DECORATIVE PLYWOOD

ANSI/HPVA

HP-1-2024

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Consensus Standards Organization

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Supersedes ANSI/HPVA HP-1-2020

American National Standard
For Hardwood and Decorative Plywood

ABSTRACT

This American National Standard for Hardwood and Decorative Plywood establishes nationally recognized marketing classifications, quality criteria, test methods, definitions, and product marking and designation practices for plywood produced primarily from hardwoods. It is intended for voluntary use for reference in trade literature, catalogs, sales contracts, building codes, government regulations and standards of performance, and procurement specifications to describe the quality aspects of the product and the means to determine conformance.

Requirements are given for wood species, veneer face grades, back grades, inner ply grades, medium density fiberboard (MDF) core, lumber core, particleboard core, hardboard core, bond line performance, updated and revised formaldehyde emissions, panel constructions, dimensions, moisture content, sanding, and finishing. Sampling and testing provisions cover dry and cyclic-boil shear, cyclic cold soak test methods for bond line performance determinations, and field and laboratory moisture content measuring methods. A glossary of trade terms is provided for better communication and understanding, and provisions are made for panel marking to indicate compliance with this Standard. Any "Note" appearing in this Standard is explanatory in nature and not mandatory.

Key words: Decorative plywood; hardwood plywood; plywood, hardwood and decorative; veneer grades; decorative softwood and hardwood; and formaldehyde emission requirements.

THE METRIC SYSTEM OF MEASUREMENT

The 1975 Metric Conversion Act, as amended by the Omnibus Trade and Competitiveness Act of 1988, sets forth that the metric (SI) is the preferred system of measurement in the U.S. The publication of this Standard provides a unique opportunity to examine the metric system for a product that is predominately used in North America (less than 10% U.S. production is exported). This document contains metric units first with English (inch-pound) units in parentheses. The metric number in almost all cases is the "soft" conversion number for the accepted inch-pound system requirement. In order to make the metric number more conceptually coherent and for consistency, most conversions for less than 76 mm (3 inches) in dimension are "soft" converted to the nearest 0.1 mm. For measurements above 76 mm (3 inches), the "soft" value is converted to the nearest 1 mm.

Tables have presented a special challenge in presenting both metric and inch-pound numbers. In those cases where a limited number of conversions are necessary, both metric and inch-pound numbers appear. In other cases, two full and separate tables are provided, arranged to face each other on adjacent pages. In such cases, these tables are designated "Metric" or "Inch-Pound."

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FOREWORD

(This Foreword is not part of the American National Standard for Hardwood and Decorative Plywood, ANSI/HPVA HP-1-2024.)

This Voluntary Standard supersedes the American National Standard for Hardwood and Decorative Plywood, ANSI/HPVA HP-1-2020, a standard sponsored by the Hardwood Plywood & Veneer Association® (HPVA®), DBA Decorative Hardwoods Association (DHA), and developed under the HPVA® Policy for the Development and Maintenance of Voluntary American National Standards.

In April 1931, the commercial standard for hardwood plywood was established and published as Commercial Standard CS35-31 by the Commodity Standards Division, National Bureau of Standards, U.S. Department of Commerce. The standard was revised in 1942, 1947, 1961, and 1971 which was designated PS-52-71. In 1983, the standard became an ANSI standard which was subsequently revised in 1992, 1993, 1994, 2000, 2004, 2016, 2020, and the current ANSI/HPVA HP-1-2024.

Suggestions for improvement gained in the use of this Standard are welcome. They should be sent to the American National Standards Institute.

Consensus for this Standard was achieved by use of the "ANSI Essential Requirements: Due process requirements for American National Standards" and the ANSI-accredited "Hardwood Plywood and Veneer Association Policy for the Development and Maintenance of Voluntary American National Standards." The following organizations, recognized as having an interest in hardwood and decorative plywood, were contacted prior to the approval of this Standard. Inclusion in this list does not necessarily imply that the organization concurred with the proposed Standard as submitted to ANSI.

Architectural Woodwork Institute (AWI)	**Hexion**
Business and Institutional Furniture Manufacturers Association (BIFMA)	**Kitchen Cabinet Manufacturers Association (KCMA)**
Canadian Hardwood Plywood and Veneer Association (CHPVA)	**Murphy Plywood**
Columbia Forest Products	**National Wood Flooring Association (NWFA)**
Composite Panel Association (CPA)	**Roddis Lumber and Veneer Co.**
Franklin International	**States Industries**
Gail Overgard, Independent	**Timber Products**

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American National Standard for Hardwood and Decorative Plywood

1. PURPOSE AND INTENDED USE

1.1 PURPOSE – The purpose of this Standard is to establish an internationally recognized national standard covering the aesthetic and performance criteria for the principal types, grades, and sizes of hardwood and decorative plywood. The principal wood species used for hardwood and decorative plywood are hardwoods; however, certain softwood species and woody grasses are also used.[1]

1.2 INTENDED USE – This Standard is to apply to panels as originally manufactured. The products covered by this Standard are intended for use as decorative wall panels, industrial panels, cut-to-size panels, made-to-size panels, stock panels, door skins and other applications.[2] The Standard also provides architects, designers, contractors, builders, distributors, fabricators, retailers and end-users with a common basis for understanding the characteristics of decorative and hardwood plywood panels.

2. SCOPE AND CLASSIFICATION

2.1 SCOPE – This Standard covers the principal types, face grades, back grades, inner ply grades and constructions of plywood made primarily with hardwood faces. Included are requirements for wood veneer grading; cores of veneer, lumber, particleboard, Oriented Strand Board (OSB), fiberboard (MDF), and combinations thereof, i.e., bond line performance, panel construction, moisture content; formaldehyde emissions requirements; and panel dimensional tolerances. Test procedures are provided or referenced for determining conformance with the applicable requirements in this Standard. Definitions of trade terms, methods of ordering, and methods for identifying products which conform to this Standard are included.

Formaldehyde emission requirements are also set forth for industrial cut-to-size and stock panel plywood, and for hardwood plywood and certain reconstituted wood wall panels.[3, 4]

2.2 CLASSIFICATION – Plywood covered by this Standard is classified as follows:

2.2.1 COMMERCIAL SPECIES AND COMMERCIAL SPECIES GROUPS – The more commonly used species for plywood faces are listed in Table 1.

2.2.2 GRADES OF VENEERS – The grades of veneers are listed below with the identification symbol for each grade:

Face Grades	AA, A, B, C, D, and E
Rustic Grade	R
Specialty Grade	SP
Back Grades	1, 2, 3, and 4
Inner Ply Grades	J, K, L, and M

The veneer face thickness will vary according to the design and intended use as specified by the manufacturer.

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[1] This Standard also includes certain softwood species for decorative uses. Construction grades of plywood (predominately softwood species) are covered in the U.S. Product Standard PS 1-19 for Construction and Industrial Plywood, or the latest edition.

[2] Additional product information is available from the Hardwood Plywood and Veneer Association® (DBA Decorative Hardwoods Association), 42777 Trade West Drive, Sterling, VA 20166.

[3] The formaldehyde emission requirements set forth in this Standard for hardwood plywood and industrial panels are consistent with those established by Environmental Protection Agency (EPA) (40 CFR Part 770) and the California Air Resources Board (CARB) Air Toxic Control Measure (ATCM) CCR Title 17, section 93120 et seq. Formaldehyde emission requirements for reconstituted wood wall panels are consistent with those established by EPA and CARB for hardwood plywood; however, the chamber test loading rates applied to reconstituted wood wall panels in this voluntary product standard relate more to particleboard decking and underlayment than to wall panel applications in manufactured homes.

[4] This Standard also includes formaldehyde emission requirements for reconstituted wood wall panel products made with binders and used for decorative hardwood plywood. More extensive requirements for some reconstituted wood panel products are covered in other standards such as the latest edition of American National Standard ANSI A208.1 for Particleboard and ANSI A208.2 for MDF.

2.2.3 TYPES OF PLYWOOD – The types of plywood are listed below in descending order of water resistance of the bond line (see Table 9b).

Technical	(Exterior bond line)
Type I	(Exterior bond line)
Type II	(Interior bond line)

2.2.4 CONSTRUCTIONS – The constructions, based on the kinds of cores, commonly in 2-ply, 3-ply, 5-ply, and other odd or even configurations are listed below:

1. Veneer core
2. Lumber core
3. Particleboard core
4. Fiberboard (MDF) core
5. Hardboard core
6. Combination core (multiple plies of VC and composite core)
7. Oriented Strand Board (OSB) core
8. Special core

2.2.5 SIZES AND THICKNESSES – Hardwood Plywood may be manufactured in any specified length, width, and thickness depending on the capabilities of the manufacturer. Panel sizes such as 1219 x 1829 mm (48 by 72 inches), 1219 x 2438 mm (48 by 96 inches), and 1219 x 3048 mm (48 by 120 inches) with thicknesses ranging from 3.2 mm (1/8 inch) to 38 mm (1.5 inches) are common.

2.2.6 PANEL PERFORMANCE PROPERTIES – Hardwood Plywood is manufactured for non-structural decorative applications consisting of faces and backs applied to a variety of cores and core types, including veneer cores, composite cores, combination cores, and other specialty cores. Each core, species, thickness, and final construction has its own range of physical performance properties and natural characteristics. A variety of adhesives are also used in manufacturing. Due to the variability inherent in the final product, an agreement between buyer and seller shall be made when performance properties are necessary for the intended use and shall reference the appropriate performance standards (MOR, MOE, screw withdrawal, water absorption, thickness swell, etc.) For additional information, see Appendix D.

TABLE 1 – A COMPARISON OF THE PHYSICAL PROPERTIES OF SOME POPULAR SPECIES IN LUMBER FORM

Species		Average Dried Weight (lb./ft^3)	Category See § 3.7	Hardness (lbf)	Specific Gravity	Modulus of Elasticity (million PSI)
Ash, White, Avg. of 4 Species	*Fraxinus spp.*	42	A	1,320	0.60	1.17
Birch, Avg. of 3 Species	*Betula spp.*	42	A	1,213	0.61	1.92
Hickories, True Average of 4 Species	*Carya spp.*	51	A	1,574	0.75	2.2
Oaks, Commercial Red Average of 9 Species	*Quercus spp.*	43	A	1,290	0.63	1.82
Oaks, Commercial White Average of 6 Species	*Quercus spp.*	47	A	1,360	0.68	1.78
Cherry, Black	*Prunus serotina*	35	B	950	0.50	1.49
Douglas fir	*Pseudotsuga menziesii*	30	B	710	0.48	1.95
Gum	*Liquidambar styraciflua*	34	B	850	0.52	1.64
Mahogany, African	*Khaya ivorensis*	34	B	830	0.55	1.4
Maple, Hard	*Acer saccharum*	43	B	1,450	0.63	1.83
Maple, Soft	*Acer rubrum, Acer saccharinum*	38	B	950	0.54	1.64
Poplar, Yellow	*Liriodendron tulipifera*	29	B	540	0.45	1.58
Walnut (Black), American	*Juglans nigra*	38	B	1,010	0.55	1.68
Alder, Red	*Alnus rubra*	28	C	590	0.41	1.38
Basswood	*Tilia americana*	26	C	410	0.37	1.46
Meranti, Light Red	*Shorea spp.*	34	C	460	0.55	1.23
Meranti, Yellow	*Shorea spp.*	40	C	770	0.65	1.55
Meranti, Dark Red	*Shorea spp.*	44	C	780	0.71	1.77
Meranti, White	*Shorea spp.*	41	C	1,140	0.67	1.49
Pine, Southern Yellow	*Pinus spp.*	32	C	690	0.51	1.79
Pine, White	*Pinus spp.*	22	C	380	0.35	1.24

Notes:

Physical Properties values are given for wood at 12% moisture content.

Hardness represents the relative toughness of wood and its ability to withstand marks and wear. The numerical value represents the force needed to embed a 0.444-inch ball one-half its diameter in the wood. Note that many of these species are used as very thin (~1/50") face veneers. The true "hardness" of the plywood panel itself is therefore more dependent on the species of the inner plies and/or composition of the panel substrate (e.g. particleboard, medium density fiberboard, etc.)

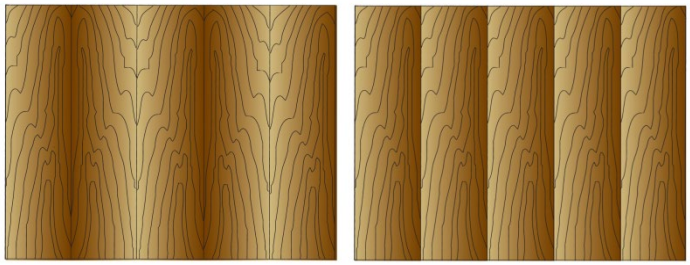
3. REQUIREMENTS

3.1 GENERAL – Products represented as complying with this Standard shall meet all of the applicable requirements specified herein. Terms used in this Standard shall be as defined in Section 5.

3.1.1 LEGALLY LOGGED WOOD – Wood used under this Standard shall be harvested in compliance with the laws of a U.S. state, U.S. federal government, or any foreign law that protects plants or timber. The American National Standard for Due Diligence in Procuring/Sourcing Legal Timber (LTDD) is an effective tool for supporting compliance with this section.

3.2 SPECIES FOR FACES, BACKS, AND INNER PLIES – The species for the face, back, and inner plies shall be from any hardwood, softwood, or woody grass. The panels shall be identified by the species of the faces (see 3.17). Designation of the face species is not required for wall panels when the surface is a decorative simulation, such as that of a wood grain of another species. The species of industrial panel backs shall be the same as the faces for panels having grade 1, 2, or 3 backs, unless otherwise designated (see 3.17). Special backs such as resin impregnated paper are permitted as agreed to by the buyer and seller, provided all requirements of this Standard are met. Species of wood commonly used for veneers are listed in Table 1.

3.3 FACE GRADE DESCRIPTIONS – The grade requirements and identification symbols for hardwood veneers are given in 3.3.2 through 3.3.10. The patterns achieved by the various cuts (rotary, flat, and quartered) for selected hardwood species are listed in Table 2. When faces consist of more than one piece, the edges shall appear parallel. Book and slip match faces are illustrated in Figure 1. Face grade characteristics for important commercial species appear in Tables 3.1a through 3.5b and Tables 4 and 5. Softwood veneer characteristics are given in 3.3.10 and in Table 6. The requirements for veneer and manufacturing characteristics relate to the minimum requirements for that grade. Natural characteristics which are not specifically limited in the paragraphs and tables referenced above, e.g., burls and pin knots that are not conspicuous, cross figure, and ray fleck in species other than oak, are not restricted unless specified otherwise and agreed upon by the buyer and seller. Other hardwood species not specifically listed in Table 1, Table 2, and Tables 3.1a through 3.5b are also covered by this Standard. For unlisted species, the buyer and seller shall select from species groupings in Tables 3.1a through 3.5b, Tables 4, 5, or 6 most similar to the product required as a basis for the grade of the unlisted species. For other applications, and as agreed to by buyer and seller, requirements for veneer and manufacturing characteristics are not prohibited from being more restrictive than those outlined in 3.3.2 through 3.3.10 and as listed in Tables 3.1a through 3.5b and in Tables 4, 5 and 6. When unsanded face veneers are graded, rough areas of grain, shallow depressions, machine marks and other such characteristics which are capable of being corrected by sanding are not considered. Panels shall be identified by the veneer species and grade of the face (see 3.17). A tolerance of 5 percent of the shipment or order is allowed (see Appendix A1).



BOOK MATCHING **SLIP MATCHING**

Figure 1 – Face Matching

(For more examples of face matching and matching arrangements, see ***Hardwood Plywood Handbook*** available at www.decorativehardwoods.org)

3.3.1 FACE APPEARANCE – GENERAL – Hardwood plywood shall be graded in accordance with sections 3.3.2 through 3.3.9, Tables 3.1a through 3.5b, and Tables 4, 5 and 6. The grade characteristics described in these paragraphs and tables are based primarily on appearance features with a fewer number of natural characteristics in grade AA. More and larger characteristics are allowed progressively with the alphabetical grade designation. In addition, grain configuration, figure, ability to achieve a full cathedral in plain sliced veneer, amount of distorted grain, amount of end grain, and other similar appearance features shall be taken into consideration when determining the grade classification. This provision applies to figure only in a general sense as mentioned in NOTE on the following page, and to certain elements of figure specifically addressed in the grade tables, e.g. color variation, burls, knots, cross bars, slope, sweep, and flake. It does not apply to any particular recognized decorative patterns, e.g., birdseye, burl, fiddleback, pommele, etc., which are sometimes requested for architectural or other special projects. Special decorative figure of this type is not defined in the Standard. Such figure characteristics should be clearly defined between buyer and seller and must be addressed independently of grade by other means such as a supplemental written specification, or by individual selection of specific flitches to be used.

TABLE 2 – COMMON FACE VENEER PATTERNS FOR SELECTED COMMERCIAL SPECIES

Primary Commercial Species	Face Veneer Patterns[a]			
	Plain-Sliced (Flat-Cut)	Quarter-Cut	Rift-Cut and Comb Grain	Rotary-Cut
Ash	Yes	Yes	---	Yes
Alder	Yes	---	---	---
Basswood	Yes	---	---	Yes
Birch	Yes	---	---	Yes
Cherry	Yes	Yes	---	Yes
Douglas fir	Yes	Yes	---	---
Gum	Yes	Yes	Yes	---
Hickory/Pecan	Yes	Yes	---	Yes
Lauan	---	Yes	---	Yes
Khaya	Yes	Yes	---	Yes
Maple	Yes	Yes	---	Yes
Meranti	---	Yes	---	Yes
Oak (Red)	Yes	Yes	Yes	Yes
Oak (White)	Yes	Yes	Yes	Yes
Southern Yellow Pine	Yes	Yes	---	---
Walnut (Black)	Yes	Yes	---	Yes
Yellow Poplar	Yes	---	---	Yes
Typical Methods of Cutting[b]	Vertical or Longitudinal Slicing, or Half-Round on Lathe	Quarter Slicing	Off-Set Quarter on Lathe	Rotary Lathe

[a] The headings above refer to the face veneer pattern, not to the method of cutting. Face veneer patterns other than those listed above are obtainable by special order.

[b] The method of cutting for a given face veneer pattern shall be at mill option unless otherwise specified by the buyer in an explicit manner to avoid the possibility of misunderstanding. For example, specifying plain sliced veneer cut on a vertical slicer or specifying plain sliced veneer cut on a half round lathe.

NOTE: Many of the products covered in this Standard are decorative. This note is provided only as explanatory information for linking various natural characteristics in wood to grades based on the appearance of such characteristics on the exposed face surface or surfaces. Wood is a natural material. Thus, its appearance is influenced by a number of factors uncontrolled by humans. In temperate zones, the primary growing seasons affect the formation of springwood and summerwood which can result in wood with different cellular porosity and appearance as it is formed during the spring and summer seasons. These differences can be pronounced in some species. The outer sapwood is often distinctly different and lighter in color from the inner heartwood due to the presence of colored extraneous components (chemical compounds) in the heartwood. The presence of adventitious buds and limbs that are pruned by nature are responsible for the formation of small pin knots and some larger knots. Minerals and other soil factors can result in color variation in wood. Insects, vines, other living things, and variants of nature can interact with the living tree causing colorations and wounds which are healed by the living tree organism. These natural processes are, in part, responsible for the inherent natural characteristics or imprints in wood. These factors often act differently in different species. For example, pecan can be characterized by much color variation in grain, in part, because of the "pecky" nature of the wood. Pecan, walnut, and cherry often have a relatively large number of pin knots. Some species, such as birch, have a relatively small number of conspicuous natural imprints; however, no species and no tree can be totally free of these characteristics. **Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.**

3.3.2 GRADE AA – The veneer shall be smooth, tight-cut, and full-length. When the face consists of more than one veneer component or piece, the edges shall appear parallel and be edge matched as described for the various species in Tables 3.1a through 3.5b, and Table 4. All components of a book or slip matched face shall be from the same flitch. Rotary-cut faces shall be whole piece or multi-piece with edge joints tight with no sharp color contrasts at the joints. Species specified for natural color will allow color contrasts but must be book matched or conform to the type of matching as specified. The components of plain-sliced (flat-cut) and multi-piece rotary-cut faces shall be book matched, unless otherwise specified with a running, balanced, or center matched arrangement. Unless otherwise specified, components in plain-sliced faces shall have a matching arrangement selected by the manufacturer. Plain-sliced faces shall consist of two or more components. Rotary-cut faces shall consist of one or more components. Neither plain-sliced nor rotary-cut faces shall have any components, except outside components, that are less than 152 mm (6 inches) in width. Outside components shall be sized to allow for certain types of matching or panel edge trim loss. No plain-sliced components shall have a split heart. No full quarter-cut is allowed in plain-sliced faces. The width of any single component in quarter-cut, rift-cut, or comb grain faces, except outside components, shall not be less than 76 mm (3 inches). Outside components shall be sized to allow for certain types of matching or panel edge trim loss.

3.3.3 GRADE A – The veneer shall be smooth, tight-cut, and full-length. When the face consists of more than one veneer component or piece, the edges shall appear parallel and be edge matched as described for the various species in Tables 3.1a through 3.5b, and Tables 4, 5, and 6. All components of a book or slip matched face shall be from the same flitch. Rotary-cut faces shall be whole piece or be multi-piece with edge joints tight; however, no sharp color contrasts are permitted at the joints and the face shall provide a good general appearance. Species specified for natural color will allow color contrasts, but must be book matched or conform to the type of matching as specified. The components of plain-sliced (flat-cut) and multi-piece rotary-cut faces shall be book matched, unless otherwise specified with a running, balanced, or center matched arrangement. Unless otherwise specified, components in plain-sliced faces shall have a matching arrangement selected by the manufacturer. Plain-sliced faces shall consist of two or more components. Rotary-cut faces shall consist of one or more components. Neither plain-sliced nor rotary-cut faces shall have any components, except outside components, that are less than 127 mm (5 inches) in width. Outside components shall be sized to allow for matching or panel edge trim loss. There shall not be any split heart in plain-sliced faces unless manufactured cathedral is achieved. (See definition for split heart in Section 5, DEFINITIONS). No full quarter-cut is allowed in plain-sliced faces. The width of any single component in quarter-cut, rift-cut, or comb grain faces, except outside components, shall not be less than 76 mm (3 inches). Outside components shall be sized to allow for matching or panel edge trim loss. Sapwood and heartwood requirements shall be in accordance with Tables 3.1a through 3.5b, Tables 4,5, and 6.

3.3.4 GRADE B – The veneer shall be smooth, tight-cut, and full-length as described for the various species in Tables 3.1a through 3.5b. Slip or book matched veneers are available if specified by the buyer. In sliced veneer, all components of a book or slip matched face shall be from the same flitch. If not specified, multi-piece faces shall be pleasing matched for color. Sharp color contrasts at the joints are not permitted. Species specified for natural color will allow color contrasts but must be pleasing matched or conform to the type of matching as specified. Plain sliced, quarter cut, rift cut, and comb grain faces shall consist of two or more components with no component, except outside components, being less than 76 mm (3 inches) wide. Rotary-cut faces shall consist of one or more components with no component, except outside components, being less than 102 mm (4 inches) wide. Outside components shall be sized to allow for certain types of matching or panel edge trim loss. Sapwood and heartwood requirements shall be in accordance with Tables 3.1a through 3.5b, Tables 4, 5, and 6.

3.3.5 GRADE C – Requirements for grade C faces appear in Tables 3.1a through 3.5b, Table 5, and Table 6. The grade permits unlimited color streaks and spots and color variation. An unlimited number of small burls and pin knots are allowed with no restrictions on the size of the dark pin knot centers as long as the diameter of pin knots does not exceed 6.4 mm (1/4 inch) in diameter. The size of sound and repaired knotholes and similar shaped openings shall not exceed 12.7 mm (1/2 inch) in diameter with a specified number allowed based on individual species. Grade C faces shall provide a sound face, free of open defects.

TABLE 3.1a – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Ash, Beech,[b] Birch, Maple and Poplar METRIC

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut	**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns											
Grade Description	**AA**			**A**			**B**			**C**	**D**	**E**
Color and Matching	Sap	Heart	Nat.	Sap	Heart	Nat.	Sap	Heart	Nat.			
Sapwood	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Heartwood	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots	Slight			Slight	Yes		Yes			Yes	Yes	Yes
Color Variation	Slight		Yes	Slight	Yes		Yes			Yes	Yes	Yes
Sharp Color Contrasts at Joints	Yes if Slip, Plank or Random matched			Yes if Slip, Plank or Random matched			Yes if Slip, Plank or Random matched			Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched	 Yes Specify --			 Yes Specify --			 Specify Specify Yes			 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[a] Plain-S. Quarter Rotary	 152 mm 76 mm 152 mm			 127 mm 76 mm 127 mm			 76 mm 76 mm 102 mm			No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)												
Inconspicuous Burls & Pin Knots – Combined Avg. Number	2 per 1 m^2			4 per 1 m^2			6 per 1 m^2			No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size	6.4 mm			9.5 mm			12.7 mm			No Limit	No Limit	No Limit
Conspicuous Pin Knots Avg. Number Max. Size: Dark Part Total	 No			 4 per 3 m^2 3.2 mm 6.4 mm			 3 per 1 m^2 3.2 mm 6.4 mm			No Limit	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired	 No			 No			 4 per 3 m^2 9.5 mm 3.2 mm 4 per 3 m^2			3 per 1 m^2 12.7 mm 12.7 mm 4 per 3 m^2	4 per 1 m^2 25.4 mm 19 mm 2 per 1 m^2	No Limit 38 mm 25.4 mm 6 per 1 m^2
Mineral Streaks	No; Maple, Slight			Slight			Slight			Yes	Yes	Yes
Bark Pockets	No			No			Few to 3.2 mm x 25.4 mm			Few to 6.4 mm x 50.8 mm	6.4 mm x 50.8 mm	Yes
Worm Tracks	Slight			Slight			Slight; Ash, yes			Yes	Yes	Yes
Vine Marks	Slight			Slight			Slight			Yes	Yes	Yes
Cross Bars	Slight			Slight			Yes			Yes	Yes	Yes
Manufacturing Characteristics												
Rough Cut / Ruptured Grain	No			No			Slight			Two 203 mm dia. areas or equivalent	5% of panel	10% of panel
Blended Repaired Tapering Hairline Splits	Two 0.8 mm x 76 mm on panel ends only			Two 1.6 mm x 152 mm			Four 3.2 mm x 203 mm			Four 4.8 mm x 203 mm	Six 6.4 mm x 254 mm	Yes
Repairs	Very Small Blending			Small Blending			Blending			Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)												
Quartered	25.4 mm in 305 mm maximum grain slope, 63.5 mm in 305 mm maximum grain sweep											

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching.

[b] American or European

TABLE 3.2a – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Mahogany, Anegre, Makore, Sapele and other veneers with similar characteristics See paragraph 3.3 METRIC

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut	**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns					
Grade Description	**AA**	**A**	**B**	**C**	**D**	**E**
Color and Matching						
Sapwood	No	No	No	Yes	Yes	Yes
Heartwood	Yes	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots	Slight	Slight	Occasional	Yes	Yes	Yes
Color Variation	Slight	Slight	Moderate	Yes	Yes	Yes
Sharp Color Contrasts at Joints	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched	 Yes Specify --	 Yes Specify --	 Specify Specify Yes	 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[a] Plain-S. Quarter Rotary	 152 mm 76 mm 152 mm	 127 mm 76 mm 127 mm	 76 mm 76 mm 102 mm	No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)						
Inconspicuous Burls & Pin Knots – Combined Avg. Number	2 per 1 m^2	4 per 1 m^2	6 per 1 m^2	No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size	6.4 mm	9.5 mm	12.7 mm	No Limit	No Limit	No Limit
Conspicuous Pin Knots Avg. Number Max. Size: Dark Part Total	 No	 4 per 3 m^2 3.2 mm 6.4 mm	 3 per 1 m^2 3.2 mm 6.4 mm	 No Limit	 No Limit	 No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired	 No	 No	 4 per 3 m^2 9.5 mm 3.2 mm 4 per 3 m^2	 3 per 1 m^2 12.7 mm 12.7 mm 4 per 3 m^2	 4 per 1 m^2 25.4 mm 19 mm 2 per 1 m^2	 No Limit 38 mm 25.4 mm 6 per 1 m^2
Mineral Streaks	No	Slight	Occasional	Yes	Yes	Yes
Bark Pockets	No	No	Few to 3.2 mm x 25.4 mm	Few to 6.4 mm x 50.8 mm	6.4 mm x 50.8 mm	Yes
Worm Tracks	No	No	Slight	Few	Yes	Yes
Vine Marks	Slight	Slight	Yes	Yes	Yes	Yes
Cross Bars	Occasional	Occasional	Yes	Yes	Yes	Yes
Manufacturing Characteristics						
Rough Cut / Ruptured Grain	No	No	Slight	Slight	Two 203 mm dia. areas or equivalent	5% of panel
Blended Repaired Tapering Hairline Splits	Two 0.8 mm x 76 mm on panel ends only	Two 1.6 mm x 152 mm	Two 3.2 mm x 203 mm	Four 4.8 mm x 203 mm	Six 6.4 mm x 254 mm	Yes
Repairs	Very Small Blending	Small Blending	Blending	Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)						
Unfilled Wormholes	No	No	No	1.6 mm max. dia.	1.6 mm max. dia.	1.6 mm max. dia.
Quartered	25.4 mm in 305 mm maximum grain slope, 63.5 mm in 305 mm maximum grain sweep					

Open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching.

TABLE 3.3a – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Red and White Oak METRIC

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut	**Plain-Sliced (Flat-Cut), Quarter-Cut, Rift and Comb Grain, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns								
Grade Description	**AA**		**A**		**B**		**C**	**D**	**E**
	Red Oak	White Oak	Red Oak	White Oak	Red Oak	White Oak			
Color and Matching									
Sapwood	No	No	5%[a]	Yes [a]	10-20%[b]	Yes	Yes	Yes	Yes
Heartwood	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots	Yes		Yes		Yes		Yes	Yes	Yes
Color Variation	Slight		Slight		Yes		Yes	Yes	Yes
Sharp Color Contrasts at Joints	Yes if Slip, Plank or Random matched		Yes if Slip, Plank or Random matched		Yes if Slip, Plank or Random matched		Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched	 Yes Specify --		 Yes Specify --		 Specify Specify Yes		 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[c] Plain-S. Quar/Rift Rotary	 152 mm 76 mm 152 mm		 127 mm 76 mm 127 mm		 76 mm 76 mm 102 mm		No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)									
Inconspicuous Burls & Pin Knots – Combined Avg. Number	3 per 1 m^2		Yes; Blending		Yes; Blending		No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size	6.4 mm		9.5 mm		12.7 mm		No Limit	No Limit	No Limit
Conspicuous Pin Knots Avg. Number Max. Size: Dark Part Total	 No		 4 per 1 m^2 3.2 mm 6.4 mm		 6 per 1 m^2 3.2 mm 6.4 mm		No Limit	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired	 No		 No		 4 per 3 m^2 9.5 mm 3.2 mm 4 per 3 m^2		 3 per 1 m^2 12.7 mm 12.7 mm 4 per 3 m^2	 4 per 1 m^2 25.4 mm 19 mm 2 per 1 m^2	 No Limit 38 mm 25.4 mm 6 per 1 m^2
Mineral Streaks	No		Blending		1 row unlimited up to 305 mm long		Yes	Yes	Yes
Bark Pockets	No		No		Few to 3.2 mm x 25.4 mm		Few to 6.4 mm x 50.8 mm	6.4 mm x 50.8 mm	Yes
Worm Tracks	No		No		Slight		Few	Yes	Yes
Vine Marks	No		Slight		Yes		Yes	Yes	Yes
Cross Bars	Slight		Slight		Yes		Yes	Yes	Yes
Manufacturing Characteristics									
Rough Cut / Ruptured Grain	No		No		Slight		Slight	Two 203 mm dia. areas or equivalent	5% of panel
Blended Repaired Tapering Hairline Splits	Two 0.8 mm x 76 mm on panel ends only		Two 1.6 mm x 152 mm		Four 3.2 mm x 203 mm		Four 4.8 mm x 203 mm	Six 6.4mm x 254 mm	Yes
Repairs	Very Small Blending		Small Blending		Blending		Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)									
Ray Fleck[d]	Slight, Blending		Slight, Blending		Slight, Blending		Yes	Yes	Yes
Rift and Comb Grain	Rift permits 25.4 mm in 305 mm maximum grain slope, 63.5 mm in 305 mm maximum grain sweep, fleck not to exceed 9.5 mm in width. Comb permits 12.7 mm in 305 mm maximum grain slope, 12.7 mm in 305 mm maximum grain sweep, fleck not to exceed 2.4 mm in width.								

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Sap allowed in rotary-cut only unless otherwise specified. [b] 10% sap allowed in rift, comb, quarter-cut and plain-sliced; 20% sap allowed in rotary-cut. [c] Outside components will be a different size to allow for edge trim loss and certain types of matching. [d] Unless otherwise specified, quartered permits unlimited fleck.

TABLE 3.4a – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Pecan and Hickory METRIC

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut		**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns				
Grade Description		**AA**	**A**	**B**	**C**	**1 (Back)**
Color and Matching						
Sapwood		Yes	Yes	Yes	Yes	Yes
Heartwood		Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots		Yes	Yes	Yes	Yes	Yes
Color Variation		Yes	Yes	Yes	Yes	Yes
Sharp Color Contrasts at Joints		Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched		 Yes Specify --	 Yes Specify --	 Specify Specify Yes	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[a]	Plain-S. Quarter Rotary	152 mm 76 mm 152 mm	127 mm 76 mm 127 mm	76 mm 76 mm 102 mm	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)						
Inconspicuous Burls & Pin Knots – Combined Avg. Number		11 per 1 m^2	22 per 1 m^2	No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size		6.4 mm	9.5 mm	12.7 mm	No Limit	No Limit
Conspicuous Pin Knots[b] Avg. Number Max. Size: Dark Part Total		 6 per 1 m^2 3.2 mm 6.4 mm	 22 per 1 m^2 3.2 mm 6.4 mm	 No Limit 3.2 mm 6.4 mm	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired		No	No	4 per 3 m^2 9.5 mm 3.2 mm 4 per 3 m^2	4 per 1 m^2 12.7 mm 12.7 mm 2 per 1 m^2	8 per 3 m^2 9.5 mm 3.2 mm 8 per 3 m^2
Mineral Streaks		Slight	Slight	Yes	Yes	Yes
Bark Pockets		No	Small, Occasional	Few to 6.4 mm x 50.8 mm	Few to 9.5 mm x 102 mm	Few to 9.5 mm x 102 mm
Worm Tracks		No	Slight	Few	Yes	Yes
Vine Marks		Slight	Occasional	Yes	Yes	Yes
Cross Bars		Slight	Occasional	Yes	Yes	Yes
Manufacturing Characteristics						
Rough Cut / Ruptured Grain		No	No	Slight	Two 203 mm dia. areas or equivalent	Two 203 mm dia. areas or equivalent
Blended Repaired Tapering Hairline Splits		Two 0.8 mm x 76 mm on panel ends only	Two 1.6 mm x 152 mm	Four 3.2 mm x 203 mm	Four 4.8 mm x 203 mm	Four 4.8 mm x 203 mm
Repairs		Very Small Blending	Small Blending	Blending	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)						
Bird Peck[c]		No	Slight	Yes	Yes	Yes
Knife Marks		Knife marks may occur in these high-density species.				
Quartered		25.4 mm in 305 mm maximum grain slope, 63.5 mm in 305 mm maximum grain sweep				

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching.

[b] For pecan and hickory, conspicuous pin knots means sound knots 6.4 mm or less in diameter with dark centers larger than 1.6 mm. Blending pin knots are sound knots 6.4 mm or less in diameter with dark centers 1.6 mm or less and are allowed in all grades of pecan and hickory.

[c] To achieve a more rustic appearance, bird peck shall be specified.

TABLE 3.5a – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Walnut and Cherry METRIC

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut		**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns					
Grade Description		**AA**	**A**	**B**	**C**	**D**	**E**
Color and Matching							
Sapwood		No	No[a]	No[a]	Yes	Yes	Yes
Heartwood		Yes	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots		Slight	Slight	Yes	Yes	Yes	Yes
Color Variation		Slight	Slight	Yes	Yes	Yes	Yes
Sharp Color Contrasts at Joints		Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched		 Yes Specify --	 Yes Specify --	 Specify Specify Yes	 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[b]	Plain-S. Quarter Rotary	152 mm 76 mm 152 mm	127 mm 76 mm 127 mm	76 mm 76 mm 102 mm	No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)							
Inconspicuous Burls & Pin Knots – Combined Avg. Number		3 per 1 m^2	8 per 1 m^2	22 per 1 m^2	No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size		6.4 mm	9.5 mm	12.7 mm	No Limit	No Limit	No Limit
Conspicuous Pin Knots[c] Avg. Number Max. Size: Dark Part Total		 3 per 1 m^2 3.2 mm 6.4 mm	 6 per 1 m^2 3.2 mm 6.4 mm	 11 per 1 m^2 3.2 mm 6.4 mm	No Limit	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired		No	No	4 per 3 m^2 9.5 mm 3.2 mm 4 per 3 m^2	3 per 1 m^2 12.7 mm 12.7 mm 4 per 3 m^2	4 per 1 m^2 25.4 mm 19 mm 2 per 1 m^2	No Limit 38 mm 25.4 mm 6 per 1 m^2
Mineral Streaks		Slight	Slight	Yes	Yes	Yes	Yes
Bark Pockets		No	No	Few to 3.2 mm x 25.4 mm	Few to 6.4 mm x 50.8 mm	6.4 mm x 50.8 mm	Yes
Worm Tracks		No	No	Slight	Few	Yes	Yes
Vine Marks		Slight	Occasional	Yes	Yes	Yes	Yes
Cross Bars		Slight	Occasional	Yes	Yes	Yes	Yes
Manufacturing Characteristics							
Rough Cut / Ruptured Grain		No	No	Slight	Slight	Two 203 mm dia. areas or equivalent	5% of panel
Blended Repaired Tapering Hairline Splits		Two 0.8 mm x 76 mm on panel ends only	Two 1.6 mm x 152 mm	Four 3.2 mm x 203 mm	Four 4.8 mm x 203 mm	Six 6.4 mm x 254 mm	Yes
Repairs		Very Small Blending	Small Blending	Blending	Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)							
Gum Spots		Occasional gum spots in cherry	Occasional gum spots in cherry	Gum spots and gum streaks in cherry	Gum spots and gum streaks in cherry		
Quartered		25.4 mm in 305 mm maximum grain slope, 63.5 mm in 305 mm maximum grain sweep					

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Sap is allowed in grades A and B; however, the percentage must be agreed upon between buyer and seller.

[b] Outside components will be a different size to allow for edge trim loss and certain types of matching.

[c] For walnut and cherry, conspicuous pin knots means sound knots 6.4 mm or less in diameter with dark centers larger than 1.6 mm. Blending pin knots are sound knots 6.4 mm or less in diameter with dark centers of 1.6 mm or less and are allowed in all grades of walnut and cherry.

TABLE 3.1b – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Ash, Beech,[b] Birch, Maple and Poplar INCH-POUND

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut	**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns											
Grade Description	**AA**			**A**			**B**			**C**	**D**	**E**
Color and Matching	Sap	Heart	Nat.	Sap	Heart	Nat.	Sap	Heart	Nat.			
Sapwood	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Heartwood	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots	Slight			Slight	Yes		Yes			Yes	Yes	Yes
Color Variation	Slight		Yes	Slight	Yes		Yes			Yes	Yes	Yes
Sharp Color Contrasts at Joints	Yes if Slip, Plank or Random matched			Yes if Slip, Plank or Random matched			Yes if Slip, Plank or Random matched			Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched	 Yes Specify --			 Yes Specify --			 Specify Specify Yes			 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[a] Plain-S. Quarter Rotary	 6 in. 3 in. 6 in.			 5 in. 3 in. 5 in.			 3 in. 3 in. 4 in.			No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)												
Inconspicuous Burls & Pin Knots – Combined Avg. Number	1 per 5 sq ft 6 per 4 ft x 8 ft panel			1 per 3 sq ft 10 per 4 ft x 8 ft panel			1 per 2 sq ft 16 per 4 ft x 8 ft panel			No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size	¼ in.			3/8 in.			½ in.			No Limit	No Limit	No Limit
Conspicuous Pin Knots Avg. Number Max. Size: Dark Part Total	 No			 1 per 8 sq ft 4 per 4 x 8 ft panel 1/8 in. ¼ in.			 1 per 4 sq ft 8 per 4 x 8 ft panel 1/8 in. ¼ in.			No Limit	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired	 No			 No			 1 per 8 sq ft 4 per 4 x 8 ft panel 3/8 in. 1/8 in. 1 per 8 sq ft			1 per 4 sq ft 8 per 4 x 8 ft panel ½ in. ½ in. 1 per 8 sq ft	1 per 3 sq ft 10 per 4 x 8 ft panel 1 in. ¾ in. 1 per 6 sq ft	No Limit 1 ½ in. 1 in. 1 per 2 sq ft
Mineral Streaks	No; Maple, slight			Slight			Slight			Yes	Yes	Yes
Bark Pockets	No			No			Few to 1/8 in. x 1 in.			Few to ¼ in. x 2 in.	¼ in. x 2 in.	Yes
Worm Tracks	Slight			Slight			Slight; Ash, yes			Yes	Yes	Yes
Vine Marks	Slight			Slight			Slight			Yes	Yes	Yes
Cross Bars	Slight			Slight			Yes			Yes	Yes	Yes
Manufacturing Characteristics												
Rough Cut / Ruptured Grain	No			No			Slight			Two 8 in. diameter areas or equivalent	5% of panel	10% of panel
Blended Repaired Tapering Hairline Splits	Two 1/32 in. x 3 in. on panel ends only			Two 1/16 in. x 6 in.			Four 1/8 in. x 8 in.			Four 3/16 in. x 8 in.	Six ¼ in. x 10 in.	Yes
Repairs	Very Small Blending			Small Blending			Blending			Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)												
Quartered	1 inch in 12 inches maximum grain slope, 2 ½ inches in 12 inches maximum grain sweep											

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching.

[b] American or European.

TABLE 3.2b – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Mahogany, Anegre, Makore, Sapele and other veneers with similar characteristics See paragraph 3.3 INCH-POUND

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut	**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns					
Grade Description	**AA**	**A**	**B**	**C**	**D**	**E**
Color and Matching						
Sapwood	No	No	No	Yes	Yes	Yes
Heartwood	Yes	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots	Slight	Slight	Occasional	Yes	Yes	Yes
Color Variation	Slight	Slight	Moderate	Yes	Yes	Yes
Sharp Color Contrasts at Joints	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched	 Yes Specify --	 Yes Specify --	 Specify Specify Yes	 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[a] Plain-S. Quarter Rotary	 6 in. 3 in. 6 in.	 5 in. 3 in. 5 in.	 3 in. 3 in. 4 in.	No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)						
Inconspicuous Burls & Pin Knots – Combined Avg. Number	1 per 5 sq ft 6 per 4ft x 8 ft panel	1 per 3 sq ft 10 per 4 ft x 8 ft panel	1 per 2 sq ft 16 per 4 ft x 8 ft panel	No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size	¼ in.	3/8 in.	½ in.	No Limit	No Limit	No Limit
Conspicuous Pin Knots Avg. Number Max. Size: Dark Part Total	 No	 1 per 8 sq ft 4 per 4 x 8 ft panel 1/8 in. ¼ in.	 1 per 4 sq ft 8 per 4 x 8 ft panel 1/8 in. ¼ in.	 No Limit	 No Limit	 No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired	 No	 No	 1 per 8 sq ft 4 per 4 x 8 ft panel 3/8 in. 1/8 in. 1 per 8 sq ft	 1 per 4 sq ft 8 per 4 x 8 ft panel ½ in. ½ in. 1 per 8 sq ft	 1 per 3 sq ft 10 per 4 x 8 ft panel 1 in. ¾ in. 1 per 6 sq ft	 No Limit 1 ½ in. 1 in. 1 per 2 sq ft
Mineral Streaks	No	Slight	Occasional	Yes	Yes	Yes
Bark Pockets	No	No	Few to 1/8 in. x 1 in.	Few to ¼ in. x 2 in.	¼ in. x 2 in.	Yes
Worm Tracks	No	No	Slight	Few	Yes	Yes
Vine Marks	Slight	Slight	Yes	Yes	Yes	Yes
Cross Bars	Occasional	Occasional	Yes	Yes	Yes	Yes
Manufacturing Characteristics						
Rough Cut / Ruptured Grain	No	No	Slight	Slight	Two 8 in. diameter areas or equivalent	5% of panel
Blended Repaired Tapering Hairline Splits	Two 1/32 in. x 3 in. on panel ends only	Two 1/16 in. x 6 in.	Two 1/8 in. x 8 in.	Four 3/16 in. x 8 in.	Six ¼ in. x 10 in.	Yes
Repairs	Very Small Blending	Small Blending	Blending	Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)						
Unfilled Wormholes	No	No	No	1/16 in. max. dia.	1/16 in. max. dia.	1/16 in. max. dia.
Quartered	1 inch in 12 inches maximum grain slope, 2 ½ inches in 12 inches maximum grain sweep					

Open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching.

TABLE 3.3b – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Red and White Oak

INCH-POUND

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut	**Plain-Sliced (Flat-Cut), Quarter-Cut, Rift and Comb Grain, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns								
Grade Description	**AA**		**A**		**B**		**C**	**D**	**E**
	Red Oak	White Oak	Red Oak	White Oak	Red Oak	White Oak			
Color and Matching									
Sapwood	No	No	5%[a]	Yes[a]	10-20%[b]	Yes	Yes	Yes	Yes
Heartwood	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots	Yes		Yes		Yes		Yes	Yes	Yes
Color Variation	Slight		Slight		Yes		Yes	Yes	Yes
Sharp Color Contrasts at Joints	Yes if Slip, Plank or Random matched		Yes if Slip, Plank or Random matched		Yes if Slip, Plank or Random matched		Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched	 Yes Specify --		 Yes Specify --		 Specify Specify Yes		 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[c] Plain-S. Quar/Rift Rotary	 6 in. 3 in. 6 in.		 5 in. 3 in. 5 in.		 3 in. 3 in. 4 in.		No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)									
Inconspicuous Burls & Pin Knots – Combined Avg. Number	1 per 4 sq ft 8 per 4 ft x 8 ft panel		Yes; blending		Yes; blending		No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size	¼ in.		3/8 in.		½ in.		No Limit	No Limit	No Limit
Conspicuous Pin Knots Avg. Number Max. Size: Dark Part Total	 No		 1 per 3 sq ft 10 per 4 x 8 ft panel 1/8 in. ¼ in.		 1 per 2 sq ft 16 per 4 x 8 ft panel 1/8 in. ¼ in.		No Limit	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired	 No		 No		 1 per 8 sq ft 4 per 4 x 8 ft panel 3/8 in. 1/8 in. 1 per 8 sq ft		 1 per 4 sq ft 8 per 4 x 8 ft panel ½ in. ½ in. 1 per 8 sq ft	 1 per 3 sq ft 10 per 4 x 8 ft panel 1 in. ¾ in. 1 per 6 sq ft	 No Limit 1 ½ in. 1 in. 1 per 2 sq ft
Mineral Streaks	No		Blending		1 row unlimited up to 12 in. long		Yes	Yes	Yes
Bark Pockets	No		No		Few to 1/8 in. x 1 in.		Few to ¼ in. x 2 in.	¼ in. x 2 in.	Yes
Worm Tracks	No		No		Slight		Few	Yes	Yes
Vine Marks	No		Slight		Yes		Yes	Yes	Yes
Cross Bars	Slight		Slight		Yes		Yes	Yes	Yes
Manufacturing Characteristics									
Rough Cut / Ruptured Grain	No		No		Slight		Slight	Two 8 in. diameter areas or equivalent	5% of panel
Blended Repaired Tapering Hairline Splits	Two 1/32 in. x 3 in. on panel ends only		Two 1/16 in. x 6 in.		Four 1/8 in. x 8 in.		Four 3/16 in. x 8 in.	Six ¼ in. x 10 in.	Yes
Repairs	Very Small Blending		Small Blending		Blending		Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)									
Ray Fleck[d]	Slight, Blending		Slight, Blending		Slight, Blending		Yes	Yes	Yes
Rift and Comb Grain	Rift permits 1 inch in 12 inches maximum grain slope, 2 ½ inches in 12 inches maximum grain sweep, fleck not to exceed 3/8 inch in width. Comb permits ½ inch in 12 inches maximum grain slope, ½ inch in 12 inches maximum grain sweep, fleck not to exceed 3/32 inch in width.								

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Sap allowed in rotary-cut only unless otherwise specified. [b] 10% Sap allowed in rift, comb, quarter-cut and plain-sliced; 20% sap allowed in rotary-cut.

[c] Outside components will be a different size to allow for edge trim loss and certain types of matching. [d] Unless otherwise specified, quartered permits unlimited fleck.

TABLE 3.4b – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Pecan and Hickory

INCH-POUND

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut		**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns				
Grade Description		**AA**	**A**	**B**	**C**	**1 (Back)**
Color and Matching						
Sapwood		Yes	Yes	Yes	Yes	Yes
Heartwood		Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots		Yes	Yes	Yes	Yes	Yes
Color Variation		Yes	Yes	Yes	Yes	Yes
Sharp Color Contrasts at Joints		Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched		 Yes Specify --	 Yes Specify --	 Specify Specify Yes	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[a]	Plain-S. Quarter Rotary	6 in. 3 in. 6 in.	5 in. 3 in. 5 in.	3 in. 3 in. 4 in.	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)						
Inconspicuous Burls & Pin Knots – Combined Avg. Number		1 per 1 sq ft 32 per 4 x 8 ft panel	2 per 1 sq ft 64 per 4 x 8 ft panel	No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size		1/4 in.	3/8 in.	1/2 in.	No Limit	No Limit
Conspicuous Pin Knots[b] Avg. Number Max. Size: Dark Part Total		1 per 2 sq ft 16 per 4 x 8 ft panel 1/8 in. 1/4 in.	2 per 1 sq ft 64 per 4 x 8 ft panel 1/8 in. 1/4 in.	 No Limit 1/8 in. 1/4 in.	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired		No	No	1 per 8 sq ft 4 per 4 x 8 ft panel 3/8 in. 1/8 in. 1 per 8 sq ft	1 per 3 sq ft 10 per 4 x 8 ft panel 1/2 in. 1/2 in. 1 per 6 sq ft	1 per 4 sq ft 8 per 4 x 8 ft panel 3/8 in. 1/8 in. 1 per 4 sq ft
Mineral Streaks		Slight	Slight	Yes	Yes	Yes
Bark Pockets		No	Small, Occasional	Few to 1/4 in. x 2 in.	Few to 3/8 in. x 4 in.	Few to 3/8 in. x 4 in.
Worm Tracks		No	Slight	Few	Yes	Yes
Vine Marks		Slight	Occasional	Yes	Yes	Yes
Cross Bars		Slight	Occasional	Yes	Yes	Yes
Manufacturing Characteristics						
Rough Cut / Ruptured Grain		No	No	Slight	Two 8 in. dia. areas or equivalent	Two 8 in. dia. areas or equivalent
Blended Repaired Tapering Hairline Splits		Two 1/32 in. x 3 in. on panel ends only	Two 1/16 in. x 6 in.	Four 1/8 in. x 8 in.	Four 3/16 in. x 8 in.	Four 3/16 in. x 8 in.
Repairs		Very Small Blending	Small Blending	Blending	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)						
Bird Peck[c]		No	Slight	Yes	Yes	Yes
Knife Marks		Knife marks may occur in these high-density species.				
Quartered		1 inch in 12 inches maximum grain slope, 2 1/2 inches in 12 inches maximum grain sweep				

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching. [b] For pecan and hickory, conspicuous pin knots means sound knots 1/4 inch or less in diameter with dark centers larger than 1/16 inch. Blending pin knots are sound knots 1/4 inch or less in diameter with dark centers 1/16 inch or less and are allowed in all grades of pecan and hickory.

[c] To achieve a more rustic appearance, bird peck shall be specified.

TABLE 3.5b – SUMMARY OF HARDWOOD FACE GRADE CHARACTERISTICS – Walnut and Cherry

INCH-POUND

NOTE: Because of the inherent individuality of trees, consideration should be given to the overall appearance of the veneer face to determine the appropriate grade for that veneer.

Cut		**Plain-Sliced (Flat-Cut), Quarter-Cut, Rotary-Cut** – See Table 2 for Common Face Veneer Patterns					
Grade Description		**AA**	**A**	**B**	**C**	**D**	**E**
Color and Matching							
Sapwood		No	No[a]	No[a]	Yes	Yes	Yes
Heartwood		Yes	Yes	Yes	Yes	Yes	Yes
Color Streaks or Spots		Slight	Slight	Yes	Yes	Yes	Yes
Color Variation		Slight	Slight	Yes	Yes	Yes	Yes
Sharp Color Contrasts at Joints		Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes if Slip, Plank or Random matched	Yes	Yes	Yes
Type of Matching Book Matched Slip Matched Pleasing Matched		 Yes Specify --	 Yes Specify --	 Specify Specify Yes	 -- -- --	 -- -- --	 -- -- --
Nominal Minimum Width of Face Components[b]	Plain-S. Quarter Rotary	6 in. 3 in. 6 in.	5 in. 3 in. 5 in.	3 in. 3 in. 4 in.	No Limit	No Limit	No Limit
Natural Characteristics (Except as limited below, natural characteristics are not restricted.)							
Inconspicuous Burls & Pin Knots – Combined Avg. Number		1 per 4 sq ft 8 per 4 x 8 ft panel	1 per 1 1/3 sq ft 24 per 4 x 8 ft panel	2 per 1 sq ft 64 per 4 x 8 ft panel	No Limit	No Limit	No Limit
Conspicuous Burls – Max. Size		1/4 in.	3/8 in.	1/2 in.	No Limit	No Limit	No Limit
Conspicuous Pin Knots[c] Avg. Number Max. Size: Dark Part Total		1 per 5 sq ft 6 per 4 x 8 ft panel 1/8 in. 1/4 in.	1 per 2 sq ft 16 per 4 x 8 ft panel 1/8 in. 1/4 in.	1 per 1 sq ft 32 per 4 x 8 ft panel 1/8 in. 1/4 in.	No Limit	No Limit	No Limit
Scattered Sound and Repaired Knots – Combined Avg. Number Max. Size – Sound Max. Size – Repaired Avg. No. – Repaired		No	No	1 per 8 sq ft 4 per 4 x 8 ft panel 3/8 in. 1/8 in. 1 per 8 sq ft	1 per 4 sq ft 8 per 4 x 8 ft panel 1/2 in. 1/2 in. 1 per 8 sq ft	1 per 3 sq ft 10 per 4 x 8 ft panel 1 in. 3/4 in. 1 per 6 sq ft	No Limit 1 1/2 in. 1 in. 1 per 2 sq ft
Mineral Streaks		Slight	Slight	Yes	Yes	Yes	Yes
Bark Pockets		No	No	Few to 1/8 in. x 1 in.	Few to 1/4 in. x 2 in.	1/4 in. x 2 in.	Yes
Worm Tracks		No	No	Slight	Few	Yes	Yes
Vine Marks		Slight	Occasional	Yes	Yes	Yes	Yes
Cross Bars		Slight	Occasional	Yes	Yes	Yes	Yes
Manufacturing Characteristics							
Rough Cut / Ruptured Grain		No	No	Slight	Slight	Two 8 in. dia. areas or equivalent	5% of panel
Blended Repaired Tapering Hairline Splits		Two 1/32 in. x 3 in. on panel ends only	Two 1/16 in. x 6 in.	Four 1/8 in. x 8 in.	Four 3/16 in. x 8 in.	Six 1/4 in. x 10 in.	Yes
Repairs		Very Small Blending	Small Blending	Blending	Yes	Yes	Yes
Special Characteristics (Except as limited below, special natural characteristics are not restricted.)							
Gum Spots		Occasional gum spots in cherry	Occasional gum spots in cherry	Gum spots and gum streaks in cherry	Gum spots and gum streaks in cherry		
Quartered		1 inch in 12 inches maximum grain slope, 2 1/2 inches in 12 inches maximum grain sweep					

Unfilled wormholes, open splits, open joints, open bark pockets, or doze not allowed in above grades.

[a] Sap is allowed in grades A and B; however, the percentage must be agreed upon between buyer and seller. [b] Outside components will be a different size to allow for edge trim loss and certain types of matching. [c] For walnut and cherry, conspicuous pin knots means sound knots 1/4 inch or less in diameter with dark centers larger than 1/16 inch. Blending pin knots are sound knots 1/4 inch or less in diameter with dark centers 1/16 inch or less and are allowed in all grades of walnut and cherry.

TABLE 4 – HARDWOOD DOOR FACE GRADE CHARACTERISTICS

Grade Description		AA	A	B
Nominal Minimum Width of Face Components[a]	Plain-Sliced Quartered / Rift Rotary-Cut	127 mm (5 in.) 76 mm (3 in.) 127 mm (5 in.)	102 mm (4 in.) 76 mm (3 in.) 102 mm (4 in.)	76 mm (3 in.) 76 mm (3 in.) 102 mm (4 in.)
Grade characteristics for color and matching, natural, manufacturing, & special characteristics are as specified in TABLES 3.1 – 3.5				

[a] Outside components will be a different size to allow for edge trim loss and certain types of matching.

TABLE 5 – SUMMARY OF HARDWOOD FACE AND BACK GRADE CHARACTERISTICS – Western Red Alder
METRIC AND INCH-POUND

Cut	Rotary and Sliced			
Grade Description	**A**	**B**	**C / Rustic**	**1 (Back)**
Color and Matching				
Sapwood	Yes	Yes	Yes	Yes
Heartwood	Yes	Yes	Yes	Yes
Color Streaks	Slight	Slight	Yes	Yes
Color Variation	Slight	Slight	Yes	Yes
Nominal Minimum Width of Face Components	76 mm (3 in.)	76 mm (3 in.)	76 mm (3 in.)	No minimum
Type of Matching Plank Matched for pleasing appearance Book Matched – Matched for color and grain at the joints	Yes[a] Specify	Yes[a] Specify[b]	Yes[a] Specify	Any matching type at the option of the mill
Natural Characteristics				
Conspicuous Burls – Max. Size	12.7 mm (1/2 in.)	Yes	Yes	Yes
Pin Knots	Yes	Yes	Yes	Yes
Bark Pockets	No	Few Maximum Size 6.4 mm x 50.8 mm (1/4 in. x 2 in.)	Unlimited in number Maximum size (6.4 mm x 102 mm) (1/4 in. x 4 in.)	Few Maximum size 6.4 mm x 50.8 mm (1/4 in. x 2 in.)
Sound Knots[b] – Max. Size (may contain dark centers) Repaired Knot Holes[b] – Number; Maximum Size	12.7 mm (1/2 in.) Two; 6.4 mm (1/4 in.) Max. Dia.	50.8 mm (2 in.) Six; 19 mm (3/4 in.) Max. Dia.	Yes Unlimited; 38 mm (1 1/2 in.) Max. Dia.	Yes Sixteen; 19 mm (3/4 in.) Max. Dia.
Manufacturing Characteristics				
Rough Cut	No	Small Areas Allowed	Small Areas Allowed	Small Areas Allowed
Stain	No	Slight	Yes	Yes
Blended Repaired Tapering Hairline Splits	Two 1.6 mm x 152 mm (1/16 in. x 6 in.) on panel ends	Three 3.2 mm x 254 mm (1/8 in. x 10 in.) on panel ends	3.2 mm x 305 mm (1/8 in. x 12 in.)	3.2 mm x 305 mm (1/8 in. x 12 in.)
Repairs	Blending	Blending	Yes	Yes
Special Characteristics	–	Open Knots[b]	–	–

[a] The general color of individual components shall not be significantly lighter or darker than that of other components in the face.

[b] Book Matched Grade B – One row of unlimited 3/4-inch open knots is allowed.

TABLE 6 – SUMMARY OF DECORATIVE SOFTWOOD GRADE CHARACTERISTICS **METRIC AND INCH-POUND**

	DECORATIVE KNOTTY SOFTWOOD FACE AND BACK GRADE CHARACTERISTICS WESTERN RED CEDAR AND WHITE PINE				VERTICAL GRAIN SOFTWOOD FACE GRADE CHARACTERISTICS DOUGLAS FIR AND REDWOOD	
Cut	**Rotary and Sliced Knotty Veneer**				**Sliced – Vertical Grain**	
Grade Description	**A (Face)**	**B (Face)**		**1 (Back)[a] / C (Face)**	**A (Face)[a]**	
		Red Cedar	**White Pine**		**Douglas fir**	**Redwood**
Color and Matching						
Sapwood	Yes	Yes		Yes	Blending	Yes
Heartwood	Yes	Yes		Yes	Yes[b]	
Color Streaks	Slight	Yes		Yes	Slight	
Color Variation	No	Slight		Yes	Slight	
Stain, Blue and Brown	No	Slight		Yes	No	
Type of Matching:						
Book Matched for color and grain at the joints	--	--		--	Yes[c]	
Plank Matched for pleasing appearance	Yes	Yes		Not Applicable	Yes[c]	
Natural Characteristics						
Burls	Yes	Yes		Yes	Small	
Pin Knots	Yes	Yes		Yes	Blending, 1 Row	Yes
Sound Knots; Max. Size	50.8 mm (2 in.)	89 mm (3 1/2 in.)		Yes	No	
Spike Knots; Max. Size	50.8 mm (2 in.)	89 mm (3 1/2 in.)		Yes	No	
Repaired Knot Holes; Max. Size	19 mm (3/4 in.)	38 mm (1 1/2 in.)		Unlimited	No	
Pitch Streaks	Small	Small		Yes	Blending	No
Pitch Pockets	Few to 3.2 mm x 25.4 mm (1/8 in. x 1 in.)	Few to 3.2 mm x 50.8 m (1/8 in. x 2 in.)		Yes	No	
Crows Foot	Slight	Occasional	Yes	Yes	No	
Manufacturing Characteristics						
Rough Cut	No	Slight		Yes	Slight	
Blended Repaired Tapering Hairline Splits	Yes	Yes		Yes[b]	Yes	
Repairs	Blending	Blending		Yes	Blending	
Special Characteristics						
Cross Bars	--	--		--	No	
	Unfilled wormholes, open splits, open joints, ruptured grain, or doze not allowed in grades A and B. [a] All knotty western red cedar and white pine complying with this Standard shall meet these back grade requirements unless otherwise specified. [b] Open hairline checks and splits up to 305 mm (12 in.) long and 3.2 mm (1/8 in.) wide allowed.				Unfilled wormholes, open splits, open joints, ruptured grain, or doze not allowed. [a] See Table 7 for description of back grades. [b] Heartwood must have 6 or more annual rings per 25.4 mm (1 inch). [c] Shall be provided book matched unless otherwise specified.	

3.3.6 GRADE D – Requirements for grade D faces appear in Tables 3.1a through 3.5b. This grade allows unlimited color streaks and spots, and color variation. An unlimited number of small burls and pin knots are allowed with no restrictions on the size of dark pin knot centers as long as the diameter of pin knots does not exceed 6.4 mm (1/4 inch) in diameter. The size of repaired and sound knotholes and similar shaped openings shall not exceed 19 mm (3/4 inch) for repaired and 25.4 mm (1 inch) for sound knots with a specified number based on individual species. Grade D faces shall provide a sound face, free of open defects. The size or percentage of rough grain on the panel surface depends on the species (see Tables 3.1a through 3.5b).

3.3.7 GRADE E – Requirements for grade E faces appear in Tables 3.1a through 3.5b. The grade allows unlimited color streaks and spots, color variation, and an unlimited number of small burls, pin knots, repaired openings, and sound knots. Repaired knotholes and similar shaped openings shall not exceed 25.4 mm (1 inch) in diameter and sound knot size is restricted to 38 mm (1 1/2 inches) in diameter. Grade E faces shall provide a sound face, free of open defects. The maximum amount of rough-cut veneer shall be in accordance with Tables 3.1a through 3.5b.

3.3.8 RUSTIC GRADE (R) – Rustic grade will include well scattered natural characteristics in both sliced and rotary-cut veneer faces as agreed upon between buyer and seller.

3.3.9 SPECIALTY GRADE (SP) – This grade shall be applicable instead of grades AA, A, B, C, D and E only to veneer in which the features of greatest significance are unusual characteristics, component widths that are not described by the above-mentioned grades, or proprietary to the manufacturer. Characteristics shall be as agreed upon between buyer and seller. This grade also refers to sound faces with large wood repairs such as boat patches. This category also includes wall panel face veneers and engineered veneer. Species such as wormy chestnut, birds-eye maple, and English brown oak which have unusual decorative features are considered as Specialty Grade.

3.3.10 SOFTWOOD GRADES – Tables 6 contain the face veneer grade requirements for specific knotty and vertical grain decorative softwoods. Requirements for unlisted softwoods for faces shall be selected by buyer and seller from among those listed in Tables 3.1a through 3.5b or Table 6. The type of matching for unlisted softwood faces shall be agreed to by buyer and seller. Softwoods for backs and inner plies shall meet the grading requirements of Table 7 and 8.

3.3.11 RECONSTITUTED VENEER – Hardwood Plywood may be produced using reconstituted veneers for the decorative face or back. Reconstituted veneers are typically produced using species such as obeche (ayous), poplar, basswood or other abundant and rapidly growing "white" hardwood species. These logs are typically rotary peeled into thin veneers, which are bleached and then dyed to a desired color. The resulting veneers are then glued and pressed to form solid blocks, which are then sliced across the glue lines to create veneers with consistent grain and color appearance. Color and grain appearance may be similar to some natural wood species, but these reconstituted veneers are not typically made from the species with which they may share visual similarities.

It is common industry practice to advertise the sale of decorative plywood made with a reconstituted veneer face based on its appearance in relation to a natural wood species (e.g. cherry, walnut, etc.). This is not intended to suggest that the reconstituted veneer is made from that species, or with any specific grade, cut, or grain characteristics as may be described for a natural wood veneer. To ensure clarity and avoid complications with U.S. federal law, such panels shall clearly indicate their use of reconstituted veneer by including a term such as "recon," "reconstituted," "engineered," or other similar descriptor before the "species" listed on product labeling and in marketing materials. For example, a reconstituted veneer made from obeche through the process described above may be described as "Recon Quartered Teak." This ensures that the end user understands the veneer is reconstituted, and that the description is not to imply it is a natural wood quarter sliced teak. To comply with U.S. federal law, it is also highly encouraged to communicate to customers the actual wood species used to produce the reconstituted veneer prior to purchase.

3.4 BACK GRADES – The summary of characteristics and allowable defects for four back grades are shown in Table 5 and Table 7. Back grades are designated by numbers: 1, 2, 3, and 4. Requirements of grade 1 are most restrictive, with grades 2, 3, and 4 being progressively less restrictive. Grades 1 and 2 provide sound surfaces with all openings in the veneer repaired except for vertical wormholes not larger than 1.6 mm (1/16 inch). Grades 3 and 4 permit some open defects; however, grade 3 is obtainable with repaired splits, joints, bark pockets, laps, and knotholes to achieve a sound surface if specified by the buyer. Grade 4 permits knotholes up to 102 mm (4 inches) in diameter and open splits and joints limited by width and length. Descriptions of the back grades for red alder and knotty softwoods appear in Tables 5 and 6, respectively. Method of cut and matching may be different from that of the panel face unless agreed to between buyer and seller.

3.5 INNER PLY GRADES – Inner plies are limited by the diameters and widths of openings listed in Table 8 and other provisions stated in Tables 9a and 9b. Four grades are described with the following designations: J, K, L, and M. Grade J is the most restrictive, allowing minimal size openings. Grades K, L, and M are progressively less restrictive. The least restrictive grade (M) is for plies not adjacent to faces and allows round and similar shaped openings not to exceed 63.5 mm (2 1/2 inches) and elongated openings up to 25.4 mm (1 inch) as visible on the edges or ends of panels.

3.6 THICKNESS OF VENEERS – Minimum acceptable thicknesses of veneers vary with the intended use and species and have no fixed limits except as agreed upon by the buyer and

seller. Decorative plywood face veneers are cut at different thicknesses, generally 0.65 mm (1/38", 0.026") and thinner.

Note: tolerance is measured prior to manufacturer's sanding.

3.7 LUMBER CORES – Lumber cores shall be of any listed species, except that mixing of species in a single core is prohibited. The maximum permissible width of core strips shall be 76 mm (3 inches) for Category A and B species (see Table 1), and 102 mm (4 inches) for Category C and D species. Core grades and core banding requirements shall be as described in 3.7.1 through 3.7.5. Finished hardwood plywood manufactured using lumber core shall have a flat smooth surface free of warpage.

3.7.1 CLEAR GRADE – The wood strips shall be full length or finger-jointed and shall be free of knots or other defects which will not properly shape or mold. Discolorations and wood repairs (patches, plugs and filler) are not prohibited.

3.7.2 SOUND GRADE – The wood strips shall be full length or finger-jointed and shall be free of defects, except discolorations and sound knots. Small open defects shall not be allowed unless securely repaired with wood or wood filler.

3.7.3 REGULAR GRADE – The wood strips shall be the same as sound grade, except that tightly butted ends are not prohibited.

3.7.4 CLEAR EDGE – The wood strips shall be "regular grade," except that the edge strips shall be a minimum of 38 mm (1 1/2 inches) "clear grade" to permit shaping or molding.

3.7.5 BANDED CORE – The bands shall be "clear grade." The species, width, number, and sequence of application of bands, and grade between bands shall be as agreed upon between buyer and seller. The types of banding shall be as follows:

1. Banded one end (B1E)
2. Banded two ends (B2E)
3. Banded one side (B1S)
4. Banded two sides (B2S)
5. Banded two ends and one side (B2E1S)
6. Banded two sides and one end (B2S1E)
7. Banded two sides and two ends (B4)

3.8 PARTICLEBOARD (PB), FIBERBOARD (MDF), ORIENTED STRAND BOARD (OSB) AND HARDBOARD CORES – Cores shall be in accordance with ANSI A208.l-2022 Particleboard, ANSI A208.2-2022 Medium Density Fiberboard, APA PS-2 Oriented Strand Board, and ANSI A135.4-2012 (R2020) Basic Hardboard.[5]

[5] Later issues of these publications may be used provided the requirements are applicable and consistent with the issue designated. Copies are available from the Composite Panel Association at www.compositepanel.org.

3.9 SPECIAL CORES – Cores made of other material shall be allowed if all other applicable requirements of this Standard are met.

3.10 CONSTRUCTION – Any combination of plies consistent with the definition of hardwood plywood shall be acceptable. Bonded assemblies are typically constructed utilizing combinations of species, thickness and moisture content to produce a balanced panel. Most plywood panels achieve balance by being constructed with an odd number of plies where all inner plies, except the innermost ply, occur in pairs. Some constructions utilize an even number of plies: constructions that contain layers of adjacent veneers with parallel grain; two-ply door skin constructions, in which the grain of veneer plies is perpendicular; or constructions in which decorative veneer is bonded to one side of particleboard, medium density fiberboard, or hardboard. A ply shall consist of a single veneer, particleboard, medium density fiberboard (MDF), hardboard, or lumber. Typical constructions are illustrated in Figure 2. The limiting criteria for hardwood plywood shall be as provided in Table 9a and 9b (see 3.17 for marking).

3.10.1 SPECIAL CONSTRUCTION – Because of special panel constructions and because of special face treatments, certain panels for specific applications, e.g. two-ply door skins, thin wall panels, etc., are not required to have a flat surface prior to their application. Such deviation shall not prevent their taking the shape of the surface to which they are applied without the development of defects attributable to this deviation.

TABLE 7 – SUMMARY OF ALLOWABLE NATURAL CHARACTERISTICS FOR BACK GRADES
METRIC AND INCH-POUND

Grade Description	1	2	3	4
Sapwood	Yes	Yes	Yes	Yes
Discoloration & Stain	Yes	Yes	Yes	Yes
Mineral Streaks	Yes	Yes	Yes	Yes
Sound Tight Burls	Yes	Yes	Yes	Yes
Sound Tight Knots	Max. dia. 9.5 mm (3/8 in.)	Max. dia. 19 mm (3/4 in.)	Max. dia. 38 mm (1 ½ in.)	Yes
Maximum Number of Tight Knots	16	16	Unlimited to 12.7 mm (½ in.); No more than 16 from 12.7 mm to 38 mm (½ to 1 ½ in.)	Unlimited
Knotholes	6 Max. dia. 3.2 mm (1/8”) repaired	12.7 mm (½ in.) repaired	25.4 mm[c] (1 in.)[c]	102 mm (4 in.)
Maximum Combined Number of Knotholes and Repaired Knots	None[a]	All repaired; Unlimited to 9.5 mm (3/8 in.); No more than 8 from 9.5 mm to 12.7 mm (3/8 in. to ½ in.)	Unlimited to 9.5 mm (3/8 in.); No more than 10 from 9.5 mm to 25.4 mm[c] (3/8 in. to 1 in.)[c]	Unlimited
Wormholes	Filled[b]	Filled[b]	Yes	Yes
Splits or Open Joints	Six 3.2 mm x 305 mm (1/8 in. to 12 in.) repaired	Six 4.8 mm x 305 mm (3/16 in. x 12 in.) repaired	Yes, 9.5 mm (3/8 in.) by 1/4 length of the panel[c]	25.4 mm (1 in.) for 1/4 length of the panel; 12.7 mm (1/2 in.) for ½ length of the panel; 6.4 mm (1/4 in.) for full length of panel
Doze and Decay	Firm areas of doze	Firm areas of doze	Firm areas of doze	Areas of doze and decay provided serviceability of panel is not impaired
Rough Cut/Ruptured Grain	Two 203 mm (8 in.) diameter areas	5% of panel	Yes	Yes
Bark Pockets	3.2 mm (1/8 in.) wide repaired[d]	6.4 mm (1/4 in.) wide repaired	Yes[c]	Yes
Laps	No	Repaired	Yes[c]	Yes

Back is the unexposed surface of a panel or the second (least important decoratively) surface when both surfaces are exposed. Ordering a back grade for both surfaces shall be permitted when agreed upon between buyer and seller.

[a] Repaired pin knots and pin knots allowed.

[b] Unfilled wormholes shall be a maximum of 1.6 mm in diameter.

[c] Available repaired, if specified.

[d] For pecan and hickory: 9.6mm (3/8 in.) wide repaired.

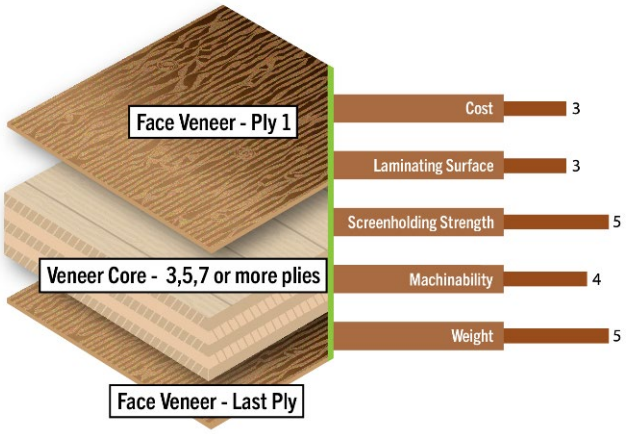
TABLE 8 – SUMMARY OF ALLOWABLE OPENINGS FOR INNER PLY GRADES OF CORE VENEER[a] **METRIC AND INCH-POUND**

Grade Description	Grade Designation				
	J	K		L	M
Thickness of Crossbands Adjacent to Faces	Any thickness	Thicker than 2.5 mm (1/10 in.)	2.5 mm (1/10 in.) and thinner	Any thickness	Not applicable
Knotholes and Other Round, Elliptical, or Similar Shape Openings (Max. Diameter)	None	9.5 mm (3/8 in.)	19 mm (3/4 in.)	25.4 mm (1 in.)	63.5 mm (2 1/2 in.)
Splits, Gaps, and Other Elongated End or Edge Openings – Each Opening is Visible on Only One End or Edge of Panel (Max. Width)	3.2 mm (1/8 in.)	6.4 mm (1/4 in.)		12.7 mm (1/2 in.)	25.4 mm (1 in.)

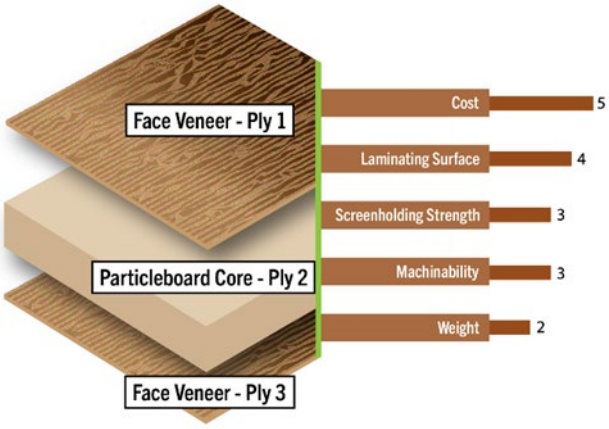
[a] Inner ply grades are also limited by characteristics listed in footnotes c and d of Table 9a depending on face grade and bond line type.

Figure 2 – Typical Plywood Constructions and Properties Comparison*

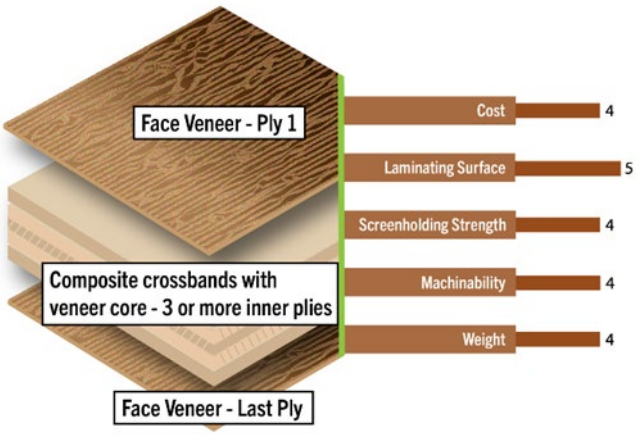
Veneer Core Plywood



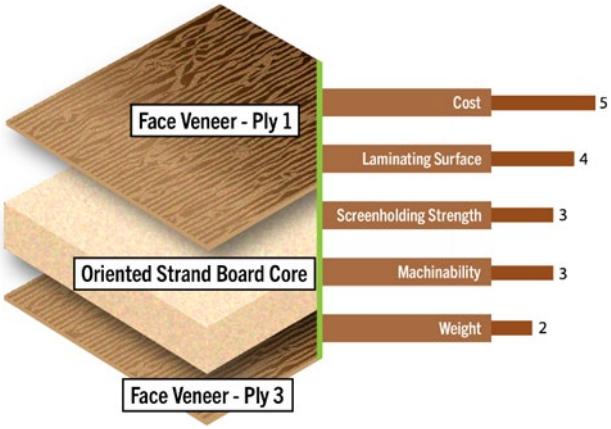
Particleboard Core Plywood



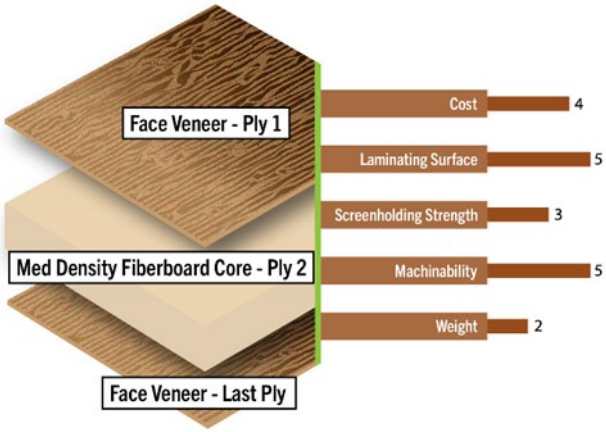
Combination Core Plywood with Composite Crossbands



Oriented Strand Board (OSB) Core Plywood



Medium Density Fiberboard Core Plywood



*Note: Not all possible constructions are represented.

Source: Timber Products Company

1 = POOR 2 = BELOW AVERAGE 3 = AVERAGE 4 = ABOVE AVERAGE 5 = EXCELLENT

TABLE 9a – LIMITING CRITERIA FOR PLYWOOD

Limiting Factors[a]	Technical (Exterior)	Type I[a] (Exterior)	Type II (Interior)
Species or Categories of Core Veneer (3.2)	Specify	Specify	Specify
Core Veneer Edge Joints (3.3)	No tape	No tape	Tape permitted
Grade of Face Veneers (3.3)	Specify among AA, A, or B	Specify	Specify
Grade of Back Veneers (3.4)	Specify	Specify	Specify
Grade and Limitations of Inner Plies Adjacent to Faces (3.5)[a]	J[b] under AA, A, and B	K[c]	K[d] under AA, A, or B L[d] under C, D, or E Specify under specialty and rustic grades
Grade of Other Inner Plies (3.5)[a]	K[c] or better	M or better	M or better
Grade of Lumber Core (3.7)	Not suitable	Specify	Specify
Particleboard, MDF, and Hardboard Cores (3.8)	Not suitable	Not suitable	Specify

[a] If the buyer requires a specific inner ply grade among those listed in Table 8, it must be specified. Shall not be used when continuously exposed to moisture in critical use applications such as for marine and aircraft.

[b] Patches and gum spots are not prohibited. Sound tight knots shall not exceed 19 mm (3/4 inch). No unfilled wormholes, cross breaks, ruptured grain, bark pockets, brashness, or laps permitted.

[c] No brashness permitted. Cross breaks, ruptured grain, doze, and other characteristics are allowed only as long as serviceability of panel is not impaired.

[d] For Type II plywood, inner ply grades limited only by allowable opening sizes in Table 8. Where 1.6 mm (1/16 inch) or thicker faces are used, Grade M inner plies are allowed.

TABLE 9b – PERFORMANCE CRITERIA FOR PLYWOOD **METRIC AND INCH-POUND**

Limiting Factors	Technical (Exterior)	Type I[a] (Exterior)	Type II (Interior)
Bond Line Requirements (See Section 3.11)	Fully waterproof	Fully waterproof	Water resistant
Bond Line (glue bond) Test Performance (See Section 3.11)	Dry and cyclic-boil shear	Dry and cyclic-boil shear	Three-cycle soak and dry
Softwood Core Other Core	Section 4.3 and PS 1-19 exterior plywood Sections 4.3,4.4,4.5	Section 4.3 and PS 1-19 exterior plywood Sections 4.3,4.4,4.5	All Type II require Section 4.6
Formaldehyde Emissions Requirements (See Section 3.12)	Maximum Large Scale Chamber Concentration (ASTM E 1333[6] or ASTM D6007[6]) mg/m^3 ppm Level 2 0.06 0.05 Level 2 NAF, ULEF Exempt 0.05/0.06 0.04/0.05		
Tolerances for Width and Length (See Section 3.13)	+/- 0.8 mm (1/32 in. or 0.031 in.)		
NOMINAL: Thickness Class Designations (See Section 3.13) Fractional Class Decimal Class Metric Class	Designations shall NOT be expressed in terms of actual units of measure 3/4, 5/8, 1/2, 3/8, 1/4, 3/16, or 1/8 Class .750, .625, .500, .375, .250, .185, or .125 Class 19.2, 15.9, 12.7, 9.5, 6.4, 4.8, or 3.2 Class		
ACTUAL: Thickness for Class Designations must be provided (See Section 3.13) Greater or equal to: 1/4, .250, 6.4 Less than: 1/4, .250, 6.4	Minimum Allowable Thickness of Stated Class - 3/64 in., .047 in., or 1.2 mm - 1/32 in., .031 in., or 0.8 mm		
Squareness (See Section 3.13.1)	Square within 2.4 mm (3/32 in. or 0.094 in.) for Panels > 1219 mm by 1219 mm (4 ft. by 4 ft.) Square within 1.6 mm (1/16 in. or 0.063 in.) for Panels ≤ 1219 mm by 1219 mm (4 ft. by 4 ft.)		
Straightness (See Section 3.13.2)	Straight within 1.6 mm (1/16 in. or 0.063 in.) for Panels ≤ 2438 mm (8 ft.) Straight within 2.4 mm (3/32 in. or 0.094 in.) for Panels > 2438 mm (8 ft.)		
Sanding (See Section 3.14)	Specify		
Moisture Content (See Section 3.15)	< 12% leaving Mill		

[a] Shall not be used when continuously exposed to moisture in critical use applications such as for marine and aircraft.

[6] The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. ASTM publications may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, www.astm.org.

TABLE 10 – WOOD FAILURE REQUIREMENTS FOR TECHNICAL AND TYPE I PLYWOOD BOND LINES

Average Failing Load		Minimum Wood Failure	
		Individual Specimen	Test Piece Average
Kilopascals (kPa)	(lb./ sq. inch)	Percent[a]	Percent[a]
Under 1724	(Under 250)	25	50
1724-2413	(250-350)	10	30
Over 2413	(Over 350)	10	15

[a] These values are the percentage of wood area remaining adhered to the fractured surface in the test area.

3.11 BOND LINE AND RELATED REQUIREMENTS

3.11.1 CONSTRUCTION REQUIREMENTS

Construction requirements specific to plywood types are specified in tables 9a and 9b.

3.11.2 TECHNICAL & TYPE I PLYWOOD – The bond line of Technical & Type I plywood panels shall meet the requirements given in Table 10 when tested in accordance with 4.2, 4.3, and 4.4.

3.11.3 TYPE II PLYWOOD – The bond line of Type II plywood shall be of such quality that specimens shall withstand the 3-cycle soak test and criteria described in 4.2.2 and 4.6.

3.12 FORMALDEHYDE EMISSIONS – Hardwood plywood shall be certified to or compliant with the California Air Resources Board Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products (CARB), EPA TSCA Title VI 40 CFR Part 770 Formaldehyde Emission Standards for Composite Wood Products (TSCA), and Canada's Formaldehyde Emissions from Composite Wood Products Regulations (CANFER). Panels or panel bundles shall be labeled in accordance with TSCA requirements, and may also be labeled in accordance with CARB and CANFER requirements at the manufacturer's discretion.

Hardwood plywood manufacturers that apply veneer to a substrate (e.g. hardwood plywood, PB, MDF) and subsequently process those panels into "component parts" or "finished goods" as defined in TSCA Title VI shall comply with the TSCA requirements for "laminated product producers" and "fabricators." Manufacturers that lay up their own hardwood plywood (e.g. line-by-line veneer core plywood construction) prior to subsequent processing into component parts or finished goods shall require third party certification of the plywood as a "panel manufacturer" per TSCA requirements.

Prior to fabrication into component parts or finished goods, all hardwood plywood products shall comply with the CARB and TSCA formaldehyde emissions limit for hardwood plywood (0.05 ppm) and shall be tested according to the ASTM E1333[7] Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products using a Large Chamber, or equivalent ASTM D6007[7] Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small Scale Chamber. ASTM D6007[7] small chamber equivalency must be demonstrated per CARB and TSCA requirements.

3.13 DIMENSIONS AND TOLERANCES – The actual dimensions of hardwood plywood panels shall be as agreed upon between the buyer and the seller. The tolerances for the stated dimensions shall be as follows:

Width: Stated actual plus or minus 0.8 mm (1/32 inch or 0.031 inch)

Length: Stated actual plus or minus 0.8 mm (1/32 inch or 0.031 inch)

Thickness: (sanded or unsanded)

Thickness may be referred to and labeled as the "Thickness Class" but is not required. The Thickness Class designation shall NOT be expressed in terms of actual units of measurement.

Thickness Class designation, if used, shall be expressed as follows:

Fractional Class designation:
(Examples: 3/4, 5/8, 1/2, 3/8, 1/4, 3/16, or 1/8 Class)

Decimal Class designation:
(Examples: .750, .625, .500, .375, .250, .185, or .125 Class)

Metric Class designation:
(Examples: 19.2, 15.9, 12.7, 9.5, 6.4, 4.8, or 3.2 Class)

The actual thickness shall at minimum be provided:

For Class designations equal to or greater than 1/4, .250 or 6.4 shall have a minimum thickness of stated Class designation with minus 3/64 inch, .047 inch, or 1.2 mm allowed.

For Class designations less than 1/4, .250 or 6.4 shall have a minimum thickness of stated Class designation minus 1/32 inch, .031 inch, or 0.8 mm allowed.

Actual thickness shall be measured to the nearest 0.025 mm (0.001 inch) using a dial thickness gauge or conventional micrometer. Sufficient pressure shall be applied to ensure that the anvils of the instrument are in firm and square contact with, but do not compress, the panel surface. One measurement shall be taken at approximate mid-width of one end of the panel. This

[7] The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. ASTM publications may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, www.astm.org.

measurement shall represent the panel thickness unless the measurement is below the minimum or above the maximum requirements. If the measurement is below or above the applicable requirements, three additional measurements shall be taken, one at approximate mid-width on the opposite end and one at approximate mid-length on each side of the panel, and the average of the four measurements shall be taken as the thickness of that panel.

3.13.1 SQUARENESS – Panels larger than 1219 mm by 1219 mm (4 feet by 4 feet) shall be square within 2.4 mm (3/32 inch). Panels 1219 mm by 1219 mm (4 feet by 4 feet) or less shall be square within 1.6 mm (1/16 inch). Squareness shall be determined by measuring the length of the diagonals of the panel.

3.13.2 STRAIGHTNESS – The edges of panels 2438 mm (8 ft) long or less shall be such that a straight line from one corner to the adjacent corner shall fall within 1.6 mm (1/16 inch) of the panel edge. A departure of 2.4 mm (3/32 inch) is allowed for panels longer than 2438 mm (8 ft).

3.14 SANDING – Plywood panels shall not be considered ready for finishing unless agreed to between buyer and seller. The types of sanding shall be as described below. The type of sanding and the number of surfaces of the panels to be sanded shall be as agreed upon between buyer and seller. Plywood panels shall not be considered ready for finishing when moisture has caused the grain to raise or when the panels have marks made during shipment or storage that require additional sanding. Panels shall have regular sanding unless otherwise specified.

No sanding – Faces need not be sanded nor tape removed.

Rough (Touch) sanding – Sanding hit-or-miss. Tape removal is not required.

Regular sanding – Surfaces shall be clean and free of tape. Sander streaks are not considered defects.

Polish sanding – Surfaces shall be clean and smoothly sanded.

3.15 MOISTURE CONTENT – The moisture content of plywood panels at the time of shipment from the producing mill shall not exceed 12 percent of the ovendry weight, as determined in accordance with section 4.7.

3.16 FINISHED PANELS

3.16.1 GENERAL – The grades of finished industrial panels produced under this Standard are the same as those for unfinished panels. Panels are graded after final sanding, prior to finishing. Various finishing methods affect the appearance of wood characteristics differently. Specific appearance requirements of finished panels shall be as agreed upon between buyer and seller.

3.16.2 FINISH PERFORMANCE – Factory finished industrial panels shall meet the following finish performance requirements:

ANSI/KCMA A161.1 – 2022, Section 9.2, 9.3, and 9.4 Finish Tests:

Tests for compliance of finished plywood with this provision shall be conducted with samples prepared as necessary to seal or otherwise prevent exposure of the panel edges to the test conditions.

3.17 PRODUCT MARKING AND DESIGNATION

3.17.1 GENERAL – All hardwood and decorative plywood represented as conforming to this Standard shall be identified as follows:

(a) Each industrial panel 12.7 mm or 1/2 inch or thicker shall be marked with "ANSI/HPVA HP-1-2024," the name or recognized identification of the producer, the species and grade of the face and back (if different species). Face and back grade identification is not required on panels designated only as SHOP. Such panels shall be identified as SHOP. Panel identification shall include both the HP-1 grade followed by SHOP when both designations are applicable. Panels identified as MILL RUN must include the HP-1 grade designation followed by MILL RUN. (See Section 5 for definitions of SHOP and MILL RUN.) The designation of the species of grade 4 backs is not required.

(b) Each unit or pallet of industrial panels less than 12.7 mm or 1/2 inch thick shall be marked with "ANSI/HPVA HP-1-2024," the name or recognized identification of the producer, and the species and grade of the face and back (if different species). The designation of species of grade 4 backs is not required.

(c) In addition to panel and unit labeling, a written statement containing the information in (a) and (b) above shall accompany the shipment.

(d) Wall panels shall be marked as described in 3.17.1(a) above except that the species of the back does not have to be designated.

3.17.1.1 TOLERANCES – The maximum allowable tolerance of non-conformance to this Standard for the shipment or order shall be 5 percent (see Appendix Al for more detailed description of industry practice).

3.17.2 IDENTIFICATION OF COMPLIANCE – For products produced, tested, and evaluated in accordance with the requirements of this Standard, manufacturers may include a statement of compliance in conjunction with their name and address on product labels, invoices, sales literature and the like (see example below). Self-compliance statements must be supported by manufacturers' records of satisfactory product testing and evaluations.

Sample Compliance Statement: *This hardwood plywood was produced and evaluated in accordance with the requirements established in American National Standard ANSI/HPVA HP-1-2024. Full responsibility for the conformance of this product to the Standard is assumed by: (name and address of manufacturer).*

3.17.3 IDENTIFICATION OF THIRD-PARTY CERTIFICATION – For purchasers to identify products third-party certified to meet all requirements of this Standard, manufacturers participating in a third-party certification program may include a statement of certification in conjunction with their name and address on product labels, invoices, sales literature and the like. All claims shall be supported by identification of an ISO/IEC 17065-accredited product certification agency.

Sample Certification Statement: *This hardwood plywood is certified by an ISO/IEC 17065-accredited certification agency to meet all of the requirements established in American National Standard ANSI/HPVA HP-1-2024.*

3.17.3.1 CERTIFIED MARK – The logo shown below is also available for use in demonstrating third-party certification to the Standard. Approval for use of the logo shall be granted by HPVA®, as the Standard developer (DBA DHA), upon successful demonstration of certification by an ISO/IEC 17065-accredited product certification agency.

ANSI/HPVA HP-1-2024 CERTIFIED

4. INSPECTION AND TEST PROCEDURES

4.1 GENERAL – The inspection and test procedures contained in this section are to be used to determine the conformance of products to the requirements of this Standard. Each producer or distributor who represents their products as conforming to this Standard shall keep such records as are necessary to substantiate his claim that all of the requirements of this Standard have been met. One method of establishing documentation is the use of statistically based sampling plans that are appropriate for each particular manufacturing process. Additional sampling and testing of the product, as agreed upon between purchaser and seller is not precluded by this section.

4.2 SPECIMENS FOR BOND LINE TESTS

4.2.1 TECHNICAL AND TYPE I PLYWOOD – Three test pieces shall be cut from each selected panel: one piece from each end of the panel and one piece near the center of the panel. Each test piece shall be of sufficient size to provide:

(a) for plywood produced with at least two adjacent plies of crossing grain bond lines, at least six specimens for the dry shear test and six specimens for the cyclic-boil shear test (see section 4.4 and Table 11),

(b) for plywood produced with at least two adjacent plies with parallel grain; four specimens for the two-cycle boil test (see section 4.5 and Table 11).

4.2.2 TYPE II PLYWOOD – One test piece shall be cut from each panel selected. A minimum of six test specimens for the three-cycle soak test (see section 4.6 and Table 11) shall be cut from each test piece. Test specimens shall not have common edges.

TABLE 11 – TEST SPECIMEN SIZES

Type of Plywood	Specimen Size	
	mm	(inches)
Technical and Type I	82.6[a] by 25.4	(3 1/4[a] by 1)
Technical and Type I containing parallel laminated veneers	76 by 76	(3 by 3)
Type II (3-Cycle)	127[b] by 50.8	(5[b] by 2)

[a] Specimens for testing inner plies shall be parallel to the grain of the outside veneers in 3-, 7-, and 11-ply construction and perpendicular to the grain of the outside veneers in 5- and 9-ply construction. Specimens for testing the outer plies shall always be parallel to the grain of the face veneer in the 82.6 mm (3 1/4 inches) dimension.

[b] Parallel to the grain of the face veneers.

4.3 DRY SHEAR TEST – Shear tests shall be conducted on specimens prepared as shown in Figure 3. In samples containing 3 or more plies, at least half of the specimens tested shall contain the innermost bond lines. The ends of each specimen shall be gripped in test machine retaining jaws, and the load shall be applied at the rate of 2669 to 4448 Newtons (600 to 1,000 pounds) per minute. Specimen notching shall be accomplished in such a way as to assure that when the specimens are subjected to loading, the lathe checks in the center ply of half of the specimens will be in tension, while in the other half the lathe checks will be in compression. An explanation of one method of notching specimens to ensure that half of the specimens are pulled with the lathe checks in tension and half are pulled in compression is described in ASTM D906-20[8], Standard Method of Test for Strength Properties of Adhesives in Plywood Type Construction in Shear by Tension Loading. If the number of plies exceed three, the outer pairs of bond lines and inner-most bond lines shall be tested with separate sets of test specimens. In plywood with face plies thicker than 1.6 mm (1/16 inch), the shear area shall be 645 square mm (1 square inch), as shown in Figure 3, specimen A. Specimens of plywood with face plies 1.6 mm (1/16 inch) or less in thickness shall be of the form shown in Figure 3, specimen B, in which the shear area shall be reduced to 323 square mm (1/2 square inch) without changing the width of the specimen. Test machine loads obtained from specimens of 323 square mm (1/2 square inch) shear area shall be multiplied by 2 to convert to kilo Pascals (pounds per square inch) and then reduced by 10 percent before comparing with the required values set forth in Table 10. For shear tests of lumber core plywood, the core shall be cut away to 2.5 mm (1/10 inch) in thickness.

4.4 CYCLIC-BOIL SHEAR TEST – The specimens prepared as shown in Figure 3 shall be boiled in water for 4 hours and then dried for 20 hours at a temperature of 63± 3˚C (145 ± 5˚F) with sufficient air circulation to lower the moisture content of the specimens to a maximum of 12 percent of the ovendry weight. They shall be boiled again for 4 hours, cooled in water, and then subjected while wet to the test described in 4.3. The values obtained from the six specimens shall meet the applicable requirements given in Table 10. If the number of plies exceeds three, the outer pairs of bond lines and innermost bond lines shall be tested with separate sets of test pieces. In samples containing 3 or more plies, at least half of the specimens tested shall contain the innermost bond lines.

4.5 TWO-CYCLE BOIL TEST – The 76 mm by 76 mm (3 inches by 3 inches) specimens shall be submerged in boiling water for 4 hours ± 10 minutes and then dried at a temperature of 63 ± 3˚C (145 ± 5˚F) for 20 hours ± 30 minutes with sufficient air circulation to lower the moisture content of the specimens to a maximum of 12 percent of the ovendry weight. They shall be boiled again for 4 hours ± 10 minutes, dried for three hours ± 10 minutes at a temperature of 63 ± 3˚C (145 ±5˚F), and then examined for delamination. Any observed delamination greater than 25.4 mm (1 inch) in continuous length constitutes failure of the specimen. Within any given lot of test samples, 90% of the individual specimens must pass. This method shall only be used for parallel grain testing as specified in 4.2.1(b).

4.6 THREE-CYCLE SOAK TEST – The 127 mm by 50.8 mm (5 inches by 2 inches) specimens from each test panel shall be submerged in water at 24 ± 3˚C (75 ± 5˚F) for 4 hours ± 10 minutes and then dried at a temperature between 49 and 52˚C (120 and 125˚F) for 19 hours ± 30 minutes with sufficient air circulation to lower the moisture content of specimens to 12 percent or below of the ovendry weight. This cycle shall be repeated until all specimens fail or until three cycles have been completed, whichever occurs first. A specimen shall be considered as failing when any single delamination between two plies is greater than 50.8 mm (2 inches) in continuous length, over 6.4 mm (1/4 inch) in depth at any point, and 0.08 mm (0.003 inch) in width, as determined by a feeler gauge 0.08 mm (0.003 inch) thick and 12.7 mm (1/2 inch) wide. Delamination due to tape at joints of inner plies or defects

[8] The latest issue of ASTM publications shall be used provided the requirements are applicable and consistent with the issues designated. ASTM publications may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959 USA, www.astm.org.

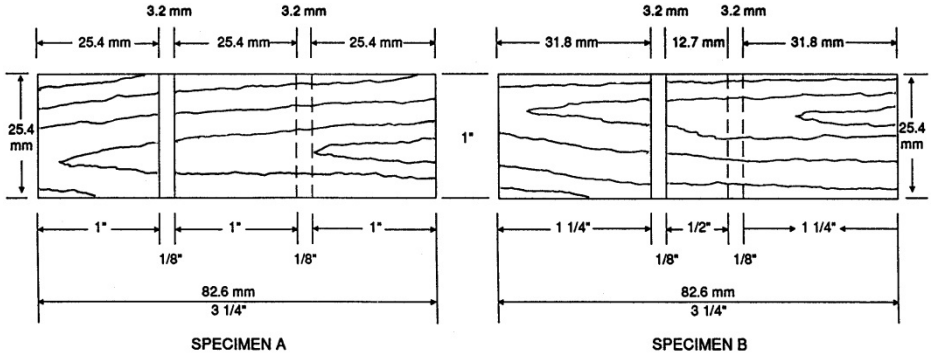
allowed by the grade shall be disregarded. Five of the 6 specimens shall pass the first cycle and 4 of the 6 specimens shall pass the third cycle in 90% of the panels tested. Within any given selection of test panels, 95% of the individual specimens shall pass the first cycle and 85% of the specimens shall pass the third cycle.

4.7 MOISTURE CONTENT TEST – The moisture content of plywood shall be determined as follows: a small test specimen shall be cut from the sample panel; the test specimen shall measure not less than 5806 square mm (9 square inches) in area and shall weigh not less than 20 grams. All loose splinters shall be removed from the specimen. The specimen shall be immediately weighed to the nearest 0.1 of a gram, and the weight shall be recorded as the original weight. The specimen shall then be dried in an oven at 100 to 105°C (212 to 221°F) until constant weight is attained. After drying, the specimen shall be reweighed immediately, and this weight shall be recorded as the ovendry weight. The moisture content shall be calculated as follows:

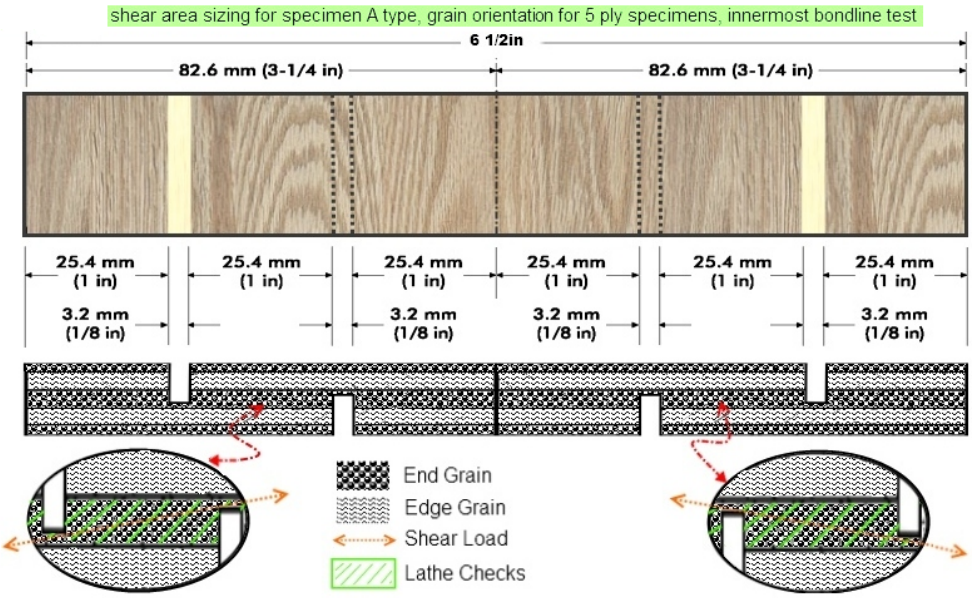
$$\frac{(\text{Original Weight} - \text{Ovendry Weight}) \times 100}{\text{Ovendry Weight}} = \text{Moisture Content (\%)}$$

Figure 3 – Plywood Bond Shear Specimens

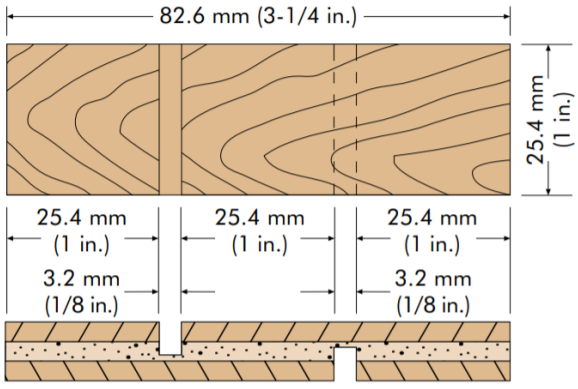
Shear Area Specimen Configurations:



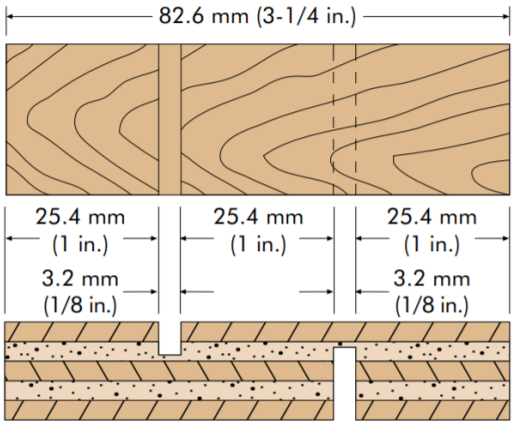
Specimen Notching (5-ply innermost bond line):



Specimen Notching (3-ply innermost bond line):*



Specimen Notching (5-ply outermost bond line):*



*Source: The Engineered Wood Association (APA), Voluntary Product Standard: PS 1 Structural Plywood

5. DEFINITIONS

The terms used in this Standard are defined as follows:

BACK – The side reverse to the face of a panel or the poorer side of a panel in any grade of plywood calling for a face and back.

BALANCED MATCH – Two or more veneer components or leaves of equal size to make up a single face.

BALANCED PANEL – For purposes of this Standard, a balanced panel is one which is free from warp that affects serviceability for its intended use

BANDING – Portion of wood extending around one or more sides of plywood panels.

BARK POCKET – Bark around which normal wood has grown.

BLENDING – Color change that is detectable at a distance of 1.8 m to 2.4 m (6 feet to 8 feet) but which does not detract from the overall appearance of the panel.

BOOK MATCH – Adjacent pieces of veneer from a flitch or log are opened like a book and spliced to make up the face with matching occurring at the spliced joints (see Figure 1 for illustration). The fibers of the wood, slanting in opposite directions in the adjacent sheets, create a characteristic light and dark effect when the surface is seen from an angle.

BRASHNESS – Condition of wood characterized by low resistance to shock and by abrupt failure across the grain without splintering.

BURL, CONSPICUOUS – A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch. A conspicuous burl is associated with abrupt color variation and/or a cluster of small dark piths caused by a cluster of adventitious buds.

BURL, BLENDING – A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch but does not contain a knot and does not contain abrupt color variation. A blending burl is detectable at 1.8 m to 2.4 m (6 feet to 8 feet) as a swirl or roundel.

CATHEDRAL – A grain appearance characterized by a series of stacked and inverted "V", or cathedral type of springwood (earlywood) summerwood (latewood) patterns common in plain-sliced (flat-cut) veneer (See **SPLIT HEART**).

CENTERS – Inner plies whose grain direction runs parallel to that of the outer plies. Included as centers are parallel laminated plies.

CENTER MATCH – An even number of veneer components or leaves of equal size matched with a joint in the center of the panel to achieve horizontal symmetry.

CHECKS – Small slits running parallel to grain of wood, caused chiefly by strains produced in seasoning.

COMBINATION CORE – A core which includes two or more different types of wood-based material, one of which is a reconstituted wood product (See **RECONSTITUTED WOOD**).

COMB GRAIN – A quality of rift cut veneer with exceptionally straight grain and closely spaced growth increments resembling the appearance of long strands of combed hair.

COMPONENT (OF FACE) – An individual piece of veneer that is jointed to other pieces to achieve a full length and width face. Terms used interchangeably with *component* in the context of the face are *piece* and *leaf*.

COMPRESSION FAILURE – See **CROSS BREAK**

CONSPICUOUS – See **BURL, CONSPICUOUS AND KNOTS, CONSPICUOUS PIN**.

COLOR VARIATION – The range of coloring across the entire surface of a face veneer. COLOR VARIATION is not to be confused with "sharp color contrasts at joints," a separate face grade criteria that applies only to the observation of sharp color contrast at joints between components in a full length and width face veneer.

CORE – The inner part of plywood between face and back, usually veneer. Sawn lumber, particleboard, MDF, hardboard, OSB or other material are also used as cores.

CORE, BANDED – Core that has been made with banding on one or more sides.

CROSSBANDING – Veneer used in the construction of plywood with five or more plies. Crossbands are placed at right angles to the grain of the faces and are typically placed adjacent to the face and back. Also refers to all inner layers of veneer whose grain direction runs perpendicular to that of the outer plies and includes parallel laminated plies.

CROSS BAR – Irregularity of grain resembling a dip in the grain running at right angles, or nearly so, to the length of the veneer.

CROSS BREAK – Separation of the wood cells, often appearing as barely distinct fine irregular lines across the grain. Such breaks are often due to internal strains resulting from unequal longitudinal shrinkage or to external forces (See **COMPRESSION FAILURE**).

CROWS FOOT – Open splits within a knot, fanning out from the center/eye of the knot.

CROSS FIGURE – A series of naturally occurring figure effects characterized by mild or dominant patterns across the grain in some faces. For example, a washboard effect occurs in fiddleback cross figure; and cross wrinkles occur in mottle figure.

DECAY – The decomposition of wood substance by fungi. The incipient stage is characterized by discoloration and sometimes accompanied by a softening of the wood substance. The final or ultimate stage is characterized by the partial or complete collapse of the wood structure and the destruction of the wood substance.

DEFECT, OPEN – Checks, splits, open joints, knotholes, cracks, loose knots, wormholes, gaps, voids, or other openings interrupting the smooth continuity of the wood surface.

DELAMINATION – Separation of plies or layers of wood or other material through failure of the adhesive bond.

DISCOLORATIONS – Stains in wood substances. Common veneer stains are sap stains, blue stains, stain produced by chemical action caused by the iron in the cutting knife coming in contact with the tannic acid of the wood, and those resulting from exposure of natural wood extractives to oxygen and light, to chemical action of vat treatments or the adhesive components, and/or to the surface finish.

DOZE – (SYNONYMOUS WITH DOTE) – A form of incipient decay characterized by a dull and lifeless appearance of the wood, accompanied by a loss of strength and softening of the wood substance.

EMISSION LEVEL – The formaldehyde concentration in testing wood panel products using ASTM E1333, *Standard Test Method for Determining Formaldehyde Levels From Wood Products Under Defined Test Conditions Using A Large Chamber* or equivalent ASTM D6007, *Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products using a Small Chamber*.

ENGINEERED VENEER – Veneers that are first peeled, normally from obeche or poplar logs. The peeled veneer leaves are dyed to a specified color, and then glued together in a mold to produce a large laminated block. The shape of the mold determines the final grain configuration. The block is then sliced into leaves of veneer with a designed appearance that is highly repeatable.

FACE – The better side of any plywood panel in which the outer plies are of different veneer grades. Also either side of a panel in which there is no difference in the veneer grade of the outer plies.

FEW – A small number of characteristics without regard to their arrangement in the panel.

FIGURE – The pattern produced in a wood surface by annual growth rings, rays, knots, deviations from natural grain such as interlocked, curly and wavy grain, and irregular coloration.

FINGER JOINT – A series of fingers machined on the ends of two pieces of wood to be joined, which mesh together and are held firmly in position with an adhesive.

FLAKE – See **FLECK, RAY**.

FLAT-CUT – See **PLAIN-SLICED**.

FLECK, RAY – Portion of a ray as it appears on the quartered or rift-cut surface. Fleck is often a dominant appearance feature in oak.

FLITCH – A complete bundle of veneer sheets laid together in sequence as they are cut from a given log or section of a log.

GAP – Open slits in the inner plies or improperly joined veneers.

GRAIN – The direction, size, arrangement, and appearance of the fibers in wood or veneer.

GRAIN SLOPE – Expression of the angle of the grain to the long edges of the veneer component.

GRAIN SWEEP – Expression of the angle of the grain to the long edges of the veneer component over the area extending one-eighth of the length of the piece from the ends.

GUM POCKETS – Well-defined openings between rings of annual growth, containing gum or evidence of prior gum accumulations.

GUM SPOTS AND STREAKS – Gum or resinous material or color spots and streaks caused by prior resin accumulations sometimes found on panel surfaces.

HAIRLINE – A thin, perceptible line showing at the joint of two pieces of wood.

HALF-ROUND – A method of veneer cutting similar to rotary cutting, except that the piece being cut is secured to a "stay log," a device that permits the cutting of the log on a wider sweep than when mounted with its center secured in the lathe to produce rotary sliced veneer. A type of half-round cutting is used to achieve plain-sliced or flat-cut veneer.

HARDBOARD – A panel manufactured primarily from inter-felted lignocellulosic fibers consolidated under heat and pressure in a hot press to a density of 500 kg/m^3 (31 lbs. /ft^3) or greater by: A) a wet process; or B) a dry process that uses a phenolic resin, or a resin system in which there is no added formaldehyde as part of the resin cross-linking structure; or C) a wet formed/dry pressed process. Other materials may be added to improve certain properties, such as stiffness, hardness, finishing properties, resistance to abrasion and moisture, as well as to increase strength, durability, and utility.

HARDWOOD – General term used to designate lumber or veneer produced from trees which are usually deciduous or tropical broad-leaved flowering trees which bear fruit, referred to as angiosperms. Contrast with softwood (See **SOFTWOOD**). The term "hardwood" does not infer hardness in the physical sense.

HEARTWOOD – The non-active or dormant center of a tree, generally distinguishable from the outer portion (sapwood) by its darker color, sometime referred to as heart.

HIGH DENSITY FIBERBOARD – See **HARDBOARD**.

INCONSPICUOUS – Barely detectable with the naked eye at a distance of 1.8 m to 2.4 m (6 feet to 8 feet) (See BLENDING).

INDUSTRIAL PANELS – Generally unfinished multi-ply products which consist of various combinations of hardwood or decorative veneer faces and inner ply materials (e.g., veneer, particleboard, MDF, and hardboard). These are generally cut-to-size and stock panels used in making

cabinets, furniture, laminated block flooring, and panels for other non-structural applications.

INNER PLIES – Plies other than face or back plies in a panel construction. Crossbands and centers are classed as inner plies (See **CORE**).

JOINT – The common edge between two adjacent materials in the same plane.

JOINT, EDGE – Joint running parallel to the grain of the wood.

JOINT, OPEN – Joint in which two adjacent pieces of veneer in the same plane do not fit tightly together.

KNIFE MARK – Caused by a nicked knife during process of slicing or peeling decorative veneer where a visibly apparent, linear, indented or raised strip of wood is deep or high enough to be felt with a fingernail.

KNOT – Cross section of tree branch or limb with grain usually running at right angles to that of the piece of wood in which it occurs.

KNOT, OPEN – Opening produced when a portion of the wood substance of a knot has dropped out or where cross checks have occurred to produce an opening.

KNOTHOLES – Openings produced when knots drop from the wood in which they were embedded.

KNOTS, BLENDING PIN – Sound knots 6.4 mm (1/4 inch) or less that generally do not contain dark centers. Blending pin knots are barely detectable at a distance of 1.8 m to 2.4 m (6 feet to 8 feet), do not detract from the overall appearance of the panel, and are not prohibited from appearing in all grades.

KNOTS, CONSPICUOUS PIN – Sound knots 6.4 mm (1/4 inch) or less in diameter containing dark centers.

KNOTS, SOUND, TIGHT – Knots that are solid across their face and fixed by growth to retain their place.

KNOTS, SPIKE – Knots cut from 0º to 45º to the long axis of limbs.

LAP – A condition where one piece of veneer in the same ply overlaps another piece.

LAYER – A single veneer ply or two or more plies laminated with grain direction parallel (See **PLY**). Two or more plies laminated with grain direction parallel is a parallel laminated layer.

LOOSE SIDE – In knife-cut veneer, the side of the sheet that was in contact with the knife as the veneer was being cut, and has cutting checks (lathe checks) because of the bending of the wood at the knife edge.

MANUFACTURER – A producer of hardwood and/or decorative plywood.

MEDIUM DENSITY FIBERBOARD (MDF) – A composite panel product composed primarily of cellulosic fibers and a bonding system cured under heat and pressure. MDF density is typically between 500 kg/m^3 (31 lbs./ft^3) and 1000 kg/m^3 (62 lbs./ft^3). For formaldehyde emission limits, thin MDF is defined as MDF with a thickness less than or equal to 8 mm (0.315 inches).

MILL RUN – A defined lot of panels which may include SHOP panels up to the amount agreed to between buyer and seller. Alternately referred to as BLENDED SHOP (see **SHOP**).

MINERAL – See **STREAKS, MINERAL**.

NATURAL – When referring to color and matching, veneers containing any amount of sapwood and/or heartwood.

NO ADDED FORMALDEHYDE (NAF) – A resin formulated with no added formaldehyde as part of the resin crosslinking structure in a composite wood product that meets the emission standards in Section 770.17(c) of the EPA TSCA Title VI regulation and Section 93120.3(d) of the CARB regulation.

NOMINAL – A term that designates a stated dimension as being approximate and subject to allowances for variation.

OCCASIONAL – A small number of characteristics that are arranged somewhat diversely within the panel face.

PARTICLEBOARD – A generic term for a composite panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers, bonded together with a bonding system, and which may contain additives.

PECKY – Pockets of disintegrated wood caused by localized decay or wood areas with abrupt color change related to localized injury such as bird peck. Peck is sometimes considered as a decorative effect, such as bird peck in pecan and hickory or pecky in cypress.

PLAIN-SLICED (FLAT-CUT) – Veneer sliced parallel to the pith of the log and approximately tangent to the growth rings to achieve flat-cut veneer. Plain-sliced veneer is cut using either a horizontal or vertical slicing machine or by the half-round method on a lathe.

PLANK MATCHED – A panel having the face made up of specially selected and assembled dissimilar (in color, or grain, or width) veneer strips of the same species, and sometimes grooved at the joints between strips to simulate lumber planking.

PLEASING MATCHED – A face containing components which provides a pleasing overall appearance. The grain of the various components need not be matched at the joints. Sharp color contrasts at the joints of the components are not permitted.

PLY – A single sheet of veneer or several strips laid with adjoining edges that may or may not be glued, which forms one veneer lamina in a glued panel (see **LAYER**). In some constructions, a ply is used to refer to other wood components such as particleboard or MDF.

PLYWOOD, HARDWOOD or DECORATIVE – A bonded assembly intended for interior use with at least one

decorative veneer surface with a core consisting of an assembly of layers or plies of veneer, or veneers in combination with lumber, particleboard, MDF, hardboard, or special core in which the adjacent layers or plies are at approximately right angles.

QUARTER-SLICED (QUARTER-CUT) – A straight grain appearance achieved through the process of quarter-slicing or through the use of veneer cut in any fashion that produces a straight grain effect. Cut is radial to the pith to the extent that ray fleck is produced, and the amount of fleck is not limited.

RANDOM MATCHED (MISMATCHED) – A panel having a face made up of veneer strips of the same species which are selected and assembled without regard to color or grain, resulting in variations, contrasts and patterns of color and grain. Pleasing appearance is not required.

RAY FLECK – See **FLECK**.

RECONSTITUTED WOOD – A generic term for panel products made with strands, wafers, particles, or fibers of wood. Individual products include hardboard, insulation board, particleboard, MDF, and oriented strand board (OSB) or waferboard. Particleboard and MDF normally use urea-formaldehyde resin as the binding agent. OSB/waferboard normally use phenol-formaldehyde as the binding agent. Most hardboard and insulation board use the lignin from the processed wood as the binding agent. Most dry-process hardboards contain phenol-formaldehyde to increase bonding strength.

RECONSTITUTED BLOCK – A generic term for cellulosic biomaterials re-assembled into a resource for veneer production.

RED/BROWN – When referring to color and matching, veneers containing all heartwood, ranging in color from light to dark.

REPAIRS – A patch, shim, or filler material inserted and/or glued into veneer or a panel to achieve a sound surface.

REPAIRS, BLENDING – Wood or filler insertions similar in color to adjacent wood so as to blend well.

RIFT-CUT – A straight grain appearance achieved through the process of cutting at a slight angle to the radial on the half-round stay log or through the use of veneer cut in any fashion that produces a straight grain with minimal ray fleck.

ROTARY-CUT – Veneer produced by centering the log in a lathe and turning it against a broad cutting knife which is set into the log at a slight angle.

ROUGH CUT – Irregular shaped areas of generally uneven corrugation on the surface of veneer, differing from the surrounding smooth veneer and occurring as the veneer is cut by the lathe or slicer.

RUNNING MATCH – The panel face is made from components running through the flitch consecutively. Any portion of a component left over from a face is used as the beginning component or leaf in starting the next panel.

RUPTURED GRAIN – A break or breaks in the grain or between springwood and summerwood caused or aggravated by excessive pressure on the wood by seasoning, manufacturing or natural processes. Ruptured grain appears as a single or series of distinct separations in the wood such as when springwood is crushed, leaving the summerwood to separate in one or more growth increments.

SAPWOOD – The living wood of lighter color occurring in the outer portion of a tree, sometimes referred to as sap.

SHAKE – A separation or rupture along the grain of wood in which the greater part occurs between the rings of annual growth (see **RUPTURED GRAIN**).

SHARP CONTRASTS – For purposes of this Standard, this term means that face veneer of lighter than average color shall not be joined at the edges with veneer of darker than average color and that two adjacent pieces of veneer shall not be widely dissimilar in grain, figure, and other natural character markings.

SHOP – A common industry term defined as a panel which has marks, characteristics and manufacturing defects not described in applicable requirements for a designated HP-1 outer ply grade, or a panel which is not designated as any specific HP-1 outer ply grade. Specific characteristics as agreed to between buyer and seller.

SLICED – Veneer produced by thrusting a log or sawed flitch into a slicing machine which shears off the veneer in sheets.

SLIGHT – Visible on observation, but does not interfere with the overall aesthetic appearance with consideration of the applicable grade and common species characteristics of the panel.

SLIP MATCHED – A sheet from a flitch is slid across the sheet beneath and, without turning, spliced at the joints (see Figure 1 for illustration).

SMOOTH, TIGHT CUT – Veneer cut to minimize lathe checks.

SOFTWOOD – General term used to designate lumber or veneer produced from trees which are usually non-deciduous and needle-bearing with naked seeds (cones), referred to as gymnosperms. Contrast with hardwood (See **HARDWOOD**). The term “softwood” does not infer softness in the physical sense.

SOLID CORE – Plywood panels in which all inner plies are grade J or better. Splits up to 3.2 mm (1/8 inch) are allowed.

SPECIES (COMMERCIAL SPECIES GROUPS) – Species generally grouped for marketing convenience and identified with a single commercial name (See ASTM D 1165, Standard Nomenclature of Domestic Hardwoods and Softwoods, for commercial practice in the United States and Canada).

SPECIES (TREES) – An internationally established Latin botanical classification of trees.

SPECIFIC GRAVITY – The ratio of the weight of a certain volume of a substance to the weight of an equal volume of water, the temperature of which is 4ºC (39.2ºF).

SPLIT HEART – A method of achieving an inverted "V" or cathedral type of springwood (earlywood)/summerwood (latewood), plain-sliced (flat-cut) figure by joining two face components of similar color and grain. A cathedral type figure must be achieved by a single component in "AA" grade; the split heart method is allowed in grades "A" through "E." Each half of a split heart shall be subject to the minimum component width requirements for grade "A" and "B" faces.

SPLITS – Separations of wood fiber running parallel to the grain.

STREAKS, MINERAL – Sharply contrasting elongated discolorations of the wood substance.

SUGAR – See **WORM TRACKS**.

ULTRA LOW EMITTING FORMALDEHYDE (ULEF) – A resin in a composite wood product that meets the emission standards in Section 770.18(c) of the EPA TSCA Title VI regulation and Section 93120.3(c) of the CARB regulation.

TAPE – Strips of gummed paper or cloth sometimes placed across the grain of large veneer sheets to facilitate handling and sometimes used to hold the edges of veneer together at the joint prior to gluing.

TIGHT SIDE – In knife-cut veneer, that side of the sheet that was farthest from the knife as the sheet was being cut and contains no cutting checks (lathe checks).

VENEER, CORE – A layer of softwood, hardwood, or woody grass which is rotary cut, sliced, or sawed from a log, cant, or block, used below the face or back in the construction of hardwood plywood.

VENEER, DECORATIVE – A layer of softwood, hardwood, reconstituted block, or woody grass which is rotary cut, sliced, or sawed from a log, cant, or block, used as the face or back in hardwood plywood.

VINE MARK – Bands of irregular grain running across or diagonally to the grain which are caused by the growth of climbing vines around the tree.

WALL PANELS – Generally up to 5-ply grooved or ungrooved plywood or reconstituted wood panels, generally in thicknesses of 12.7mm (1/2 inch) or less, with at least one surface decorated and protected with a liquid applied or film overlay finish.

WHITE – When referring to color and matching, veneers containing all sapwood, ranging in color from pink to yellow.

WOOD FAILURE (PERCENTAGE) – The area of wood fiber adhering at the glue line following completion of the specified shear test. Determination is by visual examination. The value is expressed as an estimated percentage of the wood area remaining adhered to the fractured surface in the test area.

WOOD FILLER – An aggregate of resin and strands, shreds, or flour of wood which is used to fill openings in wood and provide a smooth, durable surface.

WOODY GRASS – A fast growing member of the grass family utilized with commercial applications as a wood substitute due to its rapidly renewable properties.

WORMHOLES – Holes resulting from infestation of worms.

WORM TRACKS – Marks caused by various types of wood attacking larvae. Often appear as sound discolorations running with or across the grain in straight to wavy streaks. Sometimes referred to as "pith flecks" in certain species of maple, birch and other hardwoods because of a resemblance to the color of pith.

6. IDENTIFICATION

In order that purchasers are able to identify products conforming to all requirements of this Standard, producers and distributors shall be permitted to include a statement of compliance in conjunction with their name and address on invoices, sales literature, and the like. When space is available the following statement shall appear:

This plywood conforms to all of the requirements established in ANSI/HPVA HP-1-2024 developed cooperatively with the industry and published by the Hardwood Plywood and Veneer Association® DBA the Decorative Hardwoods Association. Full responsibility for the conformance of this product to the Standard is assumed by (name and address of producer or distributor).

When space is not available for the full statement, the following abbreviated statement shall appear:

Conforms to ANSI/HPVA HP-1-2024 (name and address of producer or distributor).

These Appendices are not a part of ANSI/HPVA HP-1-2024 but are included for information purposes only.

APPENDIX A

RE-INSPECTION PRACTICES, METHOD OF ORDERING, PRODUCT MARKING FORMAT

A.1. RE-INSPECTION PRACTICES – The following, based on general industry practices, is offered only for the information of purchasers of hardwood and decorative plywood. This information does not affect the requirements of this Standard or take precedence over purchasing agreements.

Because the provisions of this Standard apply to each and every panel represented as conforming to the Standard, and because some tests for determining conformance destroy the panel, provisions for sampling during re-inspection to determine conformance of shipments with purchase agreements should be included in the original purchase agreement.

All complaints regarding the quality of any shipment should be made within 15 days from receipt thereof. The buyer should report any defects to the seller after receipt of the panels at the stage of further processing at which detection of the defects is first possible. The seller should not be responsible for any of the cost of processing done by buyer on defective panels. The responsibility of the seller should be limited to the replacement of, or the cost of, defective material as specified in the original purchase agreement.

If the grade, bond line integrity, or other attribute of this Standard of any shipment is in dispute, the buyer and seller may select a qualified agency to re-inspect the shipment or an agreed upon sample from the shipment. A qualified agency is defined as one that has the facilities and trained technical personnel to perform the re-inspection, has developed procedures to be followed in performing the re-inspection, is not financially dependent upon any single company manufacturing the product, and is not owned, operated, or controlled by any such company. The cost of such a re-inspection should be borne by the seller if the shipment exceeds a 5% tolerance. The buyer need not accept those panels established as a result of the re-inspection as being below grade, failing to exhibit good bond line integrity, and not complying with other attributes of this Standard, but should accept the balance of the shipment as invoiced.

If the re-inspection establishes that the shipment is within the 5% tolerance, the buyer should pay for the shipment as invoiced as well as the cost of the re-inspection.

A.2. METHOD OF ORDERING – The recommended procedure for ordering decorative plywood is to list the following:

1	Quantity
2	Construction Type: (face, back, core specifications, bond line durability)
3	Face and back species, grade, aesthetics, color, etc.
4	Dimensions: thickness, width, length
6	Grade of face and back ply, pattern or type of cut, and matching requirements
7	Species of back ply and, if applicable, whether light, medium, or dark color
8	Species and grade of lumber core and type of banding (if required)
9	Type and grade of composite core (if required) (i.e., MDF, Hardboard, Particleboard, Combination Core, Special Core)
10	Sanding requirements
11	Certification Requirements (HP-1, CARB/TSCA Title VI, CANFER, LTDD, FSC, SFI, etc.)
12	Inner-ply grade (beneath Specialty and Rustic Grade only)

A.3. PRODUCT MARKING FORMAT – The following is the recommended format for marking decorative plywood panels.

ANSI/HPVA HP-1 Markings: Markings for product specification items covered by ANSI/HPVA HP-1, such as the following, are grouped together. For certain items listed below, product marking is a mandatory requirement under HP-1. Other items are optional, or may not be applicable. Refer to HP-1 section 3.17 regarding mandatory marking requirements pertaining to the manufacturer, species, grade, formaldehyde emissions, and dimensions.

(1) Panel Thickness Class designation (do not include reference to any unit of measure)

(2) Nominal length and width

(3) Face grade

(4) Back grade

(5) Face pattern or type of cut, e.g., RC (rotary cut), PS (plain sliced), Q (quartered), WP (whole piece)

(6) Face species, and color if applicable under HP-1, e.g., Sap or Heart. Proprietary color designation markings should not be included here.

(7) Back pattern or type of cut

(8) Back species

(9) Core type or total plies in veneer core, e.g., LC (lumber core), PB (particleboard core), 2+5 PLY (two-step veneer core panel with 5-ply platform)

(10) Bond line type, e.g., TYPE II

(11) ANSI/HPVA HP-1-2024

(12) Producer's name or recognized identification

(13) Production date or lot number

(14) Product category, e.g., WP (wall panel), IP (industrial panel)

(15) Other markings – Panel markings for proprietary specifications or other information not related to the HP-1 Standard are located separate from HP-1 related markings. Proprietary product names and color designations should be included here.

Panel Marking Examples:

Example 1:

(1)	(2)	(3)	(4)	(5)	(6)	(9)	(10)	(11)	(12)	(13)	(14)
¾ Class	48 X 96	A	2	RC	OAK	7 PLY	TYPE II	ANSI/HPVA HP-1-2024	HWPW INC.	01-01-00	IP

Example 2:

(1)	(2)	(3)	(4)	(5)	(6)	(11)	(12)	(13)	(14)	(15)
.500 Class	48 X 48	A	2	RC	OAK	ANSI/HPVA HP-1-2024	HWPW, INC	01-01-00	IP	HONEY OAK

Example 3:

(1)	(2)	(3)	(4)	(5)	(6)	(11)	(12)	(13)	(14)
12.7 Class	48 X 96	A	2	RC	OAK	ANSI/HPVA HP-1-2024	HWPW, INC.	01-01-00	IP

Example 4:

(1)	(2)	(3)	(4)	(5)	(6)	(11)	(12)	(13)	(14)	(15)
0.375 Class	48 X 96	A	2	RC	OAK	ANSI/HPVA HP-1-2024	HWPW, INC.	01-01-00	IP	ANTIQUE WHITE

Example 5:

(1)	(2)	(3)	(4)	(5)	(6)	(11)	(12)	(13)	(14)	(15)
½ Class	48 X 96	R	2	RC	OAK	ANSI/HPVA HP-1-2024	HWPW, INC.	01-01-00	IP	CO. DESIGNATION

APPENDIX B

EUROPEAN STANDARDS FOR HARDWOOD PLYWOOD

SAMPLE PERFORMANCE CHARACTERISTIC EVALUATIONS FOR CE MARKING

The summary table below is provided for information purposes only and may be subject to revisions and interpretations. Contact the competent authorities for the most recent requirements.

Performance characteristics of hardwood-plywood panels to be shown for CE marking[a]		European standards to evaluate such performances on panels according to types			CE marking requirement	Entity that shall show "Initial trial form" to EEC as marking procedure
		Veneer core	Particleboard	MDF		
1	Bending resistance	EN 789	EN 310	EN 310	Required for CE marking as "initial trial properties verifications"	Hardwood/plywood manufacturer/laminator from information obtained from its core manufacturer
2	Bond quality (plies gluing)	CEN/TS 13354 EN 314-1,2	N/A	N/A		
3	Internal cohesion/traction resistance	N/A	EN 319	EN 319		
4	Thickness swelling	N/A	EN 317	EN 317		
5	Moisture resistance (durability)	CEN/TS 13354 EN 314-1,2	EN 321 determined under EN 310	EN 321, EN 319 EN 317		
6	Formaldehyde emission E1 and E2	EN 717-1				Hardwood/plywood manufacturer/laminator and core manufacturer
7	Fire resistance	EN 636 and EN 13501-1	EN 312 and EN 13501-1	EN 622-5 and EN 13501-1	Not required for CE marking but required by EEC Building Code	If required by the building code, both hardwood plywood manufacturer/laminator and core manufacturer
8	Permeability to water vapor	EN ISO 12572 or Section 5.9 of EN 13986:2004+A1:2015			Not required for CE marking but subject to customer's requirement	If decorative species is recognized to modify initial properties, this is the responsibility of hardwood/plywood manufacturer/laminator
9	Airborne sound insulation	EN 13986:2004+A1:2015 Section 5.10				
10	Acoustic absorption	EN ISO 354 or Section 5.11 of EN 13986:2004+A1:2015				
11	Thermal conductivity	EN 12664 or Section 5.12 of EN 13986:2004+A1:2015				
12	Biological durability	CEN/TS 1099	EN 335	EN 335		
13	Pentachlorophenol (PCP) content	Follow Section 5.18 of EN 13986:2004+A1:2015				

[a] Since characteristic No. 2 is a requirement from the plywood platform manufacturer, for CE marking, production control requires a delamination test be conducted under EN 311 method and under EN 13986:2004 sections 6 and 6.2. For characteristic No. 6, CARB and TSCA Title VI protocol should comply with EEC standards. ISO 9001 is recognized by EEC as an acceptable mill operation control system.

HP-1 CERTIFICATION

Certify with Capital Testing℠ to Differentiate Your Product!

Capital Testing℠ is proud to offer an accredited third-party certification program designed to demonstrate full conformance to the ANSI/HPVA HP-1-2024 American National Standard for Hardwood and Decorative Plywood. Manufacturers who display the certification mark demonstrate their ongoing commitment to producing a high-quality product through ongoing independent testing, inspections, and certification of their quality system.

Where is HP-1 Specified?

Conformance to all or parts of HP-1 is required by:

- International Code Council (ICC) International Building Code (IBC)
- International Code Council (ICC) International Residential Code (IRC)
- HUD 24 CFR 3280 Manufactured Home Construction and Safety Standards
- HUD Guide Specifications for Residential Cabinets - Section 12370
- Architectural Woodwork Institute (AWI) Architectural Woodwork Standards (AWS)
- ICC/ASHRAE 700 National Green Building Standard™ (NGBS)

HP-1 Certified Plywood is Third-Party Verified

HP-1 certified manufacturers are subject to third-party inspections and testing to verify compliance with every specification in the standard. This includes:

- Annual Audits of Quality Control Systems
- Manufacturing Facility Inspections
- Review of Face/Back/Inner Ply Grading Policies & Procedures
- Third-Party Product Evaluations:
  - Evaluation of Dimensions & Tolerances
  - Formaldehyde Emissions Testing
  - Type I and II Glue Bond Testing
  - Moisture Content Testing
  - Finish Performance

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- Specialized Product Testing
- Legal Timber Lacey Act Certification
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- ISO/IEC Standard 17065 Certification Agency
- ISO/IEC Standard 17020 Inspection Agency
- ISO/IEC Standard 17025 Testing Laboratory
- California EPA CARB Third-Party Certifier
- EPA TSCA Title VI Third-Party Certifier

> "As AHF's third-party CARB/TSCA certifier and testing lab, the quality and reliability of Capital Testing not only provides value to our customers, it allows us to maintain our focus on additional product development work knowing our testing is in good hands."

MATT MYERS,
MANAGER, RESEARCH & DEVELOPMENT
AHF PRODUCTS

IAS ACCREDITED Product Certification Agency

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