HARDWOOD PLYWOOD

Grading Guide

2015 EDITION

A GUIDE TO UNDERSTANDING POPULAR HARDWOOD PLYWOOD FACE VENEER GRADES

BROUGHT TO YOU BY

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WE KNOW OUR WAY AROUND A LOG ...AND THE CONTINENT

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800.760.3341

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800.637.1609

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Founded in 1957, Columbia Forest Products is North America's largest manufacturer of hardwood plywood and hardwood veneer, a leader in sustainable forestry, and innovator of soy-based formaldehyde-free PureBond® technology. Columbia's decorative veneers and plywood panels are used to build cabinets, furniture, fixtures and millwork in homes and commercial settings.

Employee-owned and based in Greensboro, North Carolina, Columbia employs more than 1,800 people, operates facilities throughout the United States and Canada and maintains an operational network which spans the globe.

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From the tree to works of art: A guide to understanding the hardwood plywood standard

An introduction from Ang Schramm

HARDWOOD PLYWOOD **Grading Guide**

Trees are amazing. They provide us with shelter, warm our hearths, and shade us from the heat of the summer sun. But they also give us far more as they offer up their inner distinctiveness to serve us as one of the most functional and attractive of all materials for quality kitchen and bath cabinetry, fine furniture, architectural millwork, store fixtures, and wall furnishings, to name just a few.

Wood is a unique material for decorative applications in that by its very nature no two pieces can ever be exactly alike. Its appearance may be consistent for a given species within a broad and generalized range, but even wood from the same tree can vary in aesthetics and physical properties. Growth conditions such as geography and climate, availability of water and nutrients, adverse weather, genetics, pestilence, injury, competition for space, bacterial or viral infection, the presence of extraneous compounds contributing to the color of heartwood, the lighter color of sapwood, and the presence of limbs and their relationship to figure and knots, are but a few of the factors contributing to this phenomenon.

It is the purpose of this publication to help us give some order to this assortment of characteristics in a practical manner with an overview of the industry standard grading tables and other content, including veneer production, core options, and plywood manufacture. With a sound understanding of the inherent individuality of trees, we have the rare opportunity to make every project or job a signature work of art!

Our goal is to provide this information in a way that is easy to understand and that will give us a valuable tool to help enhance communication and ensure that all your expectations are met when you choose Columbia Forest Products' PureBond® Hardwood Plywood.

Ang Schramm
Director of Technical Services

Author of
A Complete Guide to Hardwood Plywood and Face Veneer

Past Panel Products Director HPVA

Past Chair HPVA Technical Committee

Director and Instructor
Columbia Forest Products University

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For more photos of veneer grades, or to view our digital version, visit our Grading Guide online: columbiaforestproducts.com/library/reference-guides/grading-guide

Special thanks to **Veneer Tech, Inc.** for the sliced veneers shown in this book.

Veneer Tech
Veneer Technologies Incorporated

Important Disclaimer:
The photographs in this publication are presented as examples only, and are not intended to represent or predict in any form the actual appearance of any grade or species. No range of color, grain, or other natural characteristics can be fully depicted in any single photograph or collection of photographs, and no representation or guarantee of appearance of any grade or species is made with respect to any such photograph contained herein.

VENEER CUTS AND MATCHING

ROTARY PEELED▶

An entire log is placed into a lathe and rotated in uninterrupted contact with the lathe knife, resulting in a cut that roughly parallels the growth rings to produce a bold and often variegated grain pattern. The resulting ribbon of veneer is subsequently clipped to usable widths, including sheets called whole piece or one-piece face that will cover an entire 4x8' sheet of plywood, as well as narrower leaves that will later be spliced together in order to cover a 4x8, 4x6, 8x4, or any number of sizes as may be specified by a customer. Rotary cutting is the only method of producing veneer that will produce whole piece faces.

Rotary Red Oak
Whole Piece Face

SLICED▶

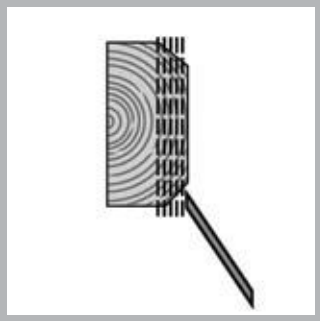
A half or quarter log is placed on the slicer which forces it laterally against a knife to produce narrow veneer sheets with somewhat more predictable grain patterns. These sheets will later be joined together through one of the various matching methods to produce 4x8', 4x6, 8x4, or any number of sheet sizes as may be specified by a customer. Generally, slicing veneer produces more of a solid lumber appearance associated with the manner in which the half or quarter log is positioned in the slicer. Veneer leaves are kept in order as they are cut from the log to ensure a consistent appearance, making sliced veneer generally more prized than rotary cut veneer.

Plain Sliced Red Oak

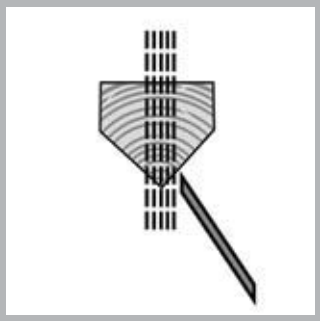
Rotary Cut Veneers
Entire log is peeled producing a continuous ribbon of veneer.

VARIOUS METHODS OF CUTTING AND MATCHING FACE VENEERS ALLOW FOR A VARIETY OF EXCEPTIONAL OPTIONS TO MAKE ANY PROJECT A SIGNATURE WORK OF ART

SLICING METHODS



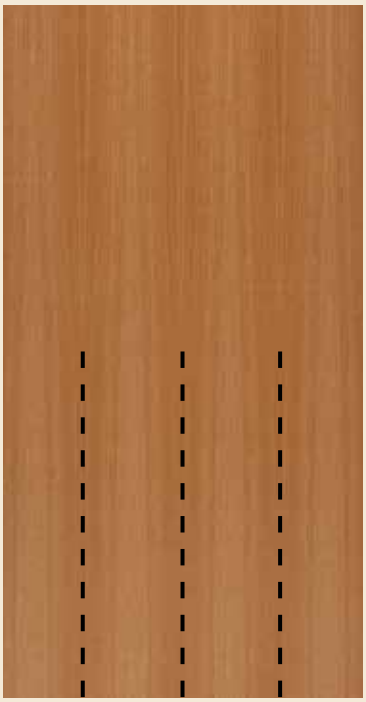
Plain Slicing
The half log is mounted with the knife parallel to the center or “back” of the log, then forced across the knife to produce a flat sawn lumber look, often developing a repeating grain pattern called a cathedral.



Quarter Slicing
The quarter log is mounted in the slicer so that the knife cuts across the growth rings at approximately a right angle and parallel to the rays, resulting in a highly three dimensional ray flake appearance in red and white oak.

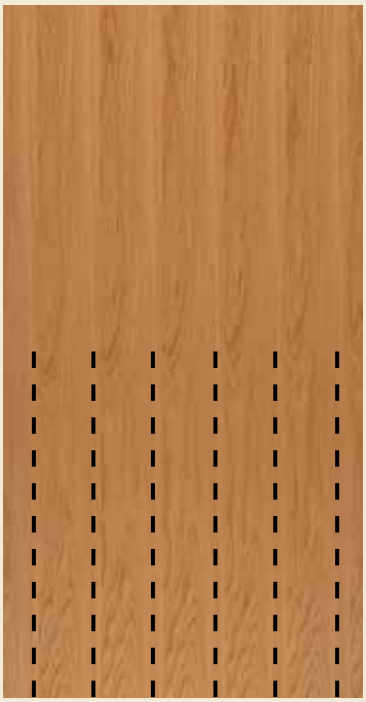
VENEER CUTS AND MATCHING

Once the veneer is cut, it can be laid up on a panel face in different sorts of "matching." The appearance of the panel can be formal or casual, simple or busy based on the matching choice. Matching selections may be more obvious in some species than in others depending on the natural grain characteristic of that wood species.



Plain Sliced Red Oak
Book Matched

Book Matching
Every other leaf or component of veneer from a given log is turned over to produce a mirror image at the splice joint, much like turning the pages of a book, to produce a very aesthetically appealing look across the face.



Plain Sliced Red Oak
Slip Matched

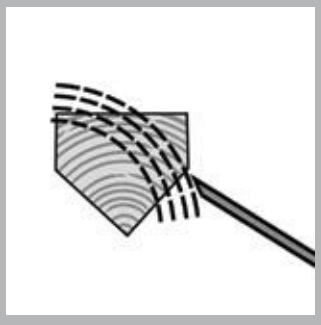
Slip Matching
All components from a given log are spliced together in their respective order without turning over any component, thereby producing a somewhat staggered image across the face. This allows for the panel face to be applied with the tight side of the veneer facing outward in order to minimize the potential for a barber pole effect occasionally observed with book matched veneer.

Plain Sliced Red Oak
Plank Matched

Plank Matching
Components from various logs of the same species are arranged in a deliberate mismatched manner to achieve a natural lumber effect as offered in Columbia Forest Products' Appalachian Traditions® product line. This is often used to produce a rustic effect.

Plain Sliced Red Oak
Random Matched Back

Random Matching
Components are arranged in the order they come from a given stack of veneer that may have come from a number of logs with no consideration given to matching for color or grain. This is process often used to produce backs from remnant material.



Rift Cutting

The quarter log is mounted on a modified lathe to produce a cut that crosses both the growth rings and the rays at a slight angle, resulting in a relatively straight grain effect that minimizes the bold ray flake appearance found in quarter sliced wood.

Note: *Both quarter sliced and rift cut veneer are more often than not pulled from the straight grain portion of plain sliced veneer from the region of the log closest to its center. The resulting veneer is called quarter sliced if heavy flake is visible and rift cut when the flake is minimal. Veneers thus developed are often called false rift or quarters, but they are held to the same standard as "true" rift and quarters, reducing cost while preserving aesthetic appeal.*

ALDER *(Alnus rubra)*

Common names: Alder, Red Alder

Sources: North American west coast

Description: Pink to red to reddish brown with large rays widely scattered and readily visible with the unaided eye. Prone to having numerous knots and burls with all clear wood the exception rather than the rule.

Common cuts: Plain sliced, quarter sliced

Uses: Decorative veneer for kitchen and bath cabinets and millwork. Highly suited to rustic applications due to tendency to have numerous and scattered open and sound knots.

Availability: Readily available

Price: $$-$$$

Alder Plain Sliced A

Alder Plain Sliced A

Alder Plain Sliced B

ANIGRE *(Aningeria spp.)*

Common names: Anegre, Anigre, Aningeria

Sources: Tropical East and West Africa

Description: Light tan, sometimes creamy, occasionally light pink. Grain texture smooth, with occasional light silica inclusions. Figure ranges from unfigured to highly figured, often with a pronounced fiddleback.

Common cuts: Plain sliced, Quarter sliced - Ribbon striped

Uses: Decorative veneer and lumber for architectural millwork and occasional cabinetry.

Availability: Abundant

Price: $$-$$$, depending on level of specification

Anigre Plain Sliced A

Anigre Plain Sliced A

Anigre Quarter Sawn, Figured A

ASH *(Fraxinus americana, F. pennsylvanica, F. nigra)*

Common names: White Ash, Green or Red Ash, Black or Brown Ash

Sources: USA and Canada

Description: Generally creamy sapwood with light tan to relatively brown heart wood. Typical grain pattern for ring porous wood with coarse early wood and smooth late wood. Figure may be present and can be intense.

Common cuts: Rotary, Plain sliced, Quarter sliced

Uses: Cabinetry, millwork, and molding.

Availability: Abundant

Price: $$

Ash Sap Plain Sliced A

Ash Sap Plain Sliced B

Ash Quarter Sawn A

Ash Natural
Rotary Spliced B

Ash Natural
Rotary Spliced C

Ash Natural
Whole Piece B

Ash Sap
Whole Piece B

BIRCH *(Betula spp.)*

Common names: White Birch, Yellow Birch, Red Birch

Sources: USA and Canada

Description: Light tan to pale yellow sapwood with red to ruddy heart wood. Grain is tight and smooth with normal amounts of figure and other characteristics.

Common cuts: Rotary (primarily), Plain sliced (available)

Uses: Decorative veneer and lumber primarily for kitchen cabinetry and furniture. Excellent surface for painting.

Availability: Abundant

Price: $

Birch Sap
Rotary Whole Piece A

Birch Sap
Rotary Whole Piece B

Birch Sap
Rotary Whole Piece C

Birch Sap Plain Sliced A

Birch Sap Plain Sliced A

Birch Sap
Rotary Back 1

Birch Sap
Rotary Spliced A

BIRCH *(Betula spp.)*

Birch Natural
Rotary Whole Piece A

Birch Natural
Rotary Whole Piece B

Birch Natural
Rotary Whole Piece C

Birch Natural
Rotary Whole Piece C

CHERRY *(Prunus serotina)*

Common name: American Black Cherry

Sources: USA and Canada

Description: Pink to reddish brown heart wood, blonde sap wood. Tight grain minimum early wood. Gum, pin knots, and burls are prevalent. Figure is common and may include heavy patterns such as ropey, mottled, chevron, and flare.

Common cuts: Plain sliced, Quarter sliced (usually as false quarters)

Uses: Kitchen and bath cabinetry, fine furniture, architectural millwork, molding.

Availability: Readily available

Price: $$

Cherry Plain Sliced A

Cherry Plain Sliced B

Cherry Quarter Sawn A

HICKORY *(Carya spp.)*

Common names: Various common names, such as Pignut Hickory, Mockernut Hickory, Shellbark Hickory, Shagbark Hickory

Sources: USA and Canada

Characteristics: Pale yellow sapwood with light brown to reddish brown to gray brown heartwood. Some moderately coarse early wood, but otherwise hard and smooth. Some may contain color variation, color streaks, and rustic marks like worm track and bird peck. Same genus as Pecan.

Common cuts: Plain sliced, Rotary cut

Uses: Cabinetry, millwork, paneling, fine furniture, flooring, and molding.

Availability: Abundant

Price: $$

Hickory
Plain Sliced A

Hickory
Plain Sliced A

Hickory
Plain Sliced B

MAHOGANY, AFRICAN *(Khaya Ivorensis)*

Common names: African Mahogany, Khaya

Sources: Central Africa East to West

Characteristics: Only one of two species considered to be genuine mahogany, this species has light to dark red to reddish brown heartwood, medium coarse texture, and interlocked grain which appears as striped (frequently generically called Ribbon stripe). Where interlocked grain is absent, surface is relatively uneventful other than well defined cathedrals in crown cut veneer.

Common cuts: Plain sliced, Quarter sliced, Rotary cut

Uses: Architectural millwork, molding, judges panels, flat wall panels, some cabinetry, fine furniture, inlay, and accent trim.

Availability: Reasonable. Often used in place of Honduras Mahogany which is restricted by CITES (Convention on International Trade in Endangered Species).

Price: $$-$$$ depending on specifications

Mahogany / Khaya
Plain Sliced A

Mahogany / Khaya
Plain Sliced B

Mahogany / Khaya
Quarter Sawn A

MAPLE NATURAL *(Acer saccharum, A. nigrum)*

Common names: Rock Maple, Sugar Maple, White Maple

Sources: USA and Canada

Characteristics: Sapwood varies from soft pinkish white to light yellow to light khaki in color. Surface is smooth, tight, and dense. Heartwood ranges from dark brown to green to black. Typically sold as white maple due to its broadly defined uniform light color. Growth rings are light and at times imperceptible. Susceptible to insect assault resulting in brown streaks called worm track and sometimes incorrectly sugar streaks.

Common cuts: Rotary cut, Plain sliced, Half round, Quarter sliced and Rift cut usually pulled from sliced quarters

Uses: Decorative veneer and lumber primarily for kitchen cabinetry and furniture. Excellent surface for painting.

Availability: Readily available

Price: $-$$ depending on specifications

Maple Natural
Plain Sliced A

Maple Natural
Plain Sliced B

Maple Natural
Plain Sliced Back 1

Maple Natural
Rotary Whole Piece A

Maple Natural
Rotary Whole Piece B

Maple Natural
Rotary Whole Piece C

Maple Natural
Rotary Back 2

MAPLE SAP *(Acer saccharum, A. nigrum)*

Common names: Rock Maple, Sugar Maple, White Maple

Sources: USA and Canada

Characteristics: Sapwood varies from soft pinkish white to light yellow to light khaki in color. Surface is smooth, tight, and dense. Heartwood ranges from dark brown to green to black. Typically sold as white maple due to its broadly defined uniform light color. Growth rings are light and at times imperceptible. Susceptible to insect assault resulting in brown streaks called worm track and sometimes incorrectly sugar streaks.

Common cuts: Rotary cut, Plain sliced, Half round, Quarter sliced and Rift cut usually pulled from sliced quarters

Uses: Decorative veneer and lumber primarily for kitchen cabinetry and furniture. Excellent surface for painting.

Availability: Readily available

Price: $-$$ depending on specifications

Maple Sap
Plain Sliced A

Maple Sap
Plain Sliced B

Maple Sap
Plain Sliced Back 1

Maple Heavy Bird's Eye
Rotary Spliced A

Maple Sap
Rotary Whole Piece A

Maple Sap
Rotary Whole Piece B

Maple Sap
Rotary Whole Piece C

Maple Bird's Eye Detail

RED OAK *(Quercus rubra and related species)*

Red Oak
Plain Sliced A

Red Oak
Plain Sliced B

Red Oak
Plain Sliced Back 1

Common names: Red Oak, Northern Red Oak, Southern Red Oak; more than 10 other names

Sources: North America

Characteristics: Sharp contrast between coarse early wood and smooth late wood. Early wood vessels are typically open and not occluded. Heartwood color is light tan to pinkish to reddish brown to dark tan or khaki. Large rays produce pronounced flake appearance across the grain when the wood is quarter sliced. Rift cutting minimizes the flake appearance.

Common cuts: Plain sliced, Quarter sliced, Rift cut

Uses: Kitchen and bath cabinetry, fine furniture, architectural millwork, molding, flooring, architectural as wall paneling, casework, office furniture.

Availability: Plentiful

Price: $-$$ depending on specifications

Red Oak
Rotary Whole Piece A

Red Oak
Rotary Whole Piece B

Red Oak
Rotary Whole Piece C

Red Oak
Rotary Back 1

SAPELE *(Entandrophragma cylindricum)*

Common names: Sapeli, Sapele Mahogany, Aboudikro

Sources: Africa - widespread

Characteristics: Heartwood seasons to reddish or purplish brown. Grain is typically interlocked, resulting in pronounced striped effect when quarter sliced. When interlocked grain is absent, appearance can be quite plain. Pommele figure from rotary cut veneer appears as diagonal waves of varying intensity.

Common cuts: Plain sliced, Quarter sliced, Rotary (for Pommele figure)

Uses: Decorative veneer and lumber for architectural millwork and occasional cabinetry and boat interiors.

Availability: Reasonable to very good availability depending on level of specification

Price: $$-$$$ depending on specifications

Sapele
Plain Sliced A

Sapele
Quarter Sawn A

Sapele
Quarter Sawn B

WALNUT, AMERICAN BLACK *(Juglans nigra)*

Common names: Walnut, Black Walnut

Sources: Eastern USA and Southeastern Canada

Characteristics: Heartwood varies from dark tan to deep chocolate depending on amount of exposure to air prior to drying. Grain varies from very straight to interlocked which produces pronounced figure that may or may not be desireable. Pin knots with small dark centers may be prevalent.

Common cuts: Plain sliced, Quarter sliced (usually pulled from sliced)

Uses: Architectural millwork, judges panels, parquetry, musical instruments, fine furniture, high end office furniture, accent walls, occasional cabinetry.

Availability: Readily available

Price: $$-$$$ depending on specifications

Walnut
Plain Sliced A

Walnut
Plain Sliced B

Walnut
Quarter Sawn A

WHITE OAK *(Quercus alba and related species)*

White Oak
Plain Sliced A

White Oak
Plain Sliced B

White Oak
Plain Sliced B

Common names: White Oak, with at least 10 commercially harvested members in this group

Sources: North America

Characteristics: Sharp contrast between coarse early wood and smooth late wood. Early wood vessels are typically occluded with a substance called tyloses. Heartwood color is light brown to light gray to medium brown. Large rays produce pronounced flake appearance across the grain when the wood is quarter sliced. Rift cutting minimizes the flake appearance.

Common cuts: Plain sliced, Quarter sliced, Rift cut

Uses: Kitchen and bath cabinetry, fine furniture, architectural millwork, molding, flooring, architectural as wall paneling, casework, office furniture.

Availability: Common

Price: $$-$$$

White Oak
Quarter Sawn A

White Oak
Quarter Sawn A

White Oak
Rift Cut A

White Oak
Rift Cut A

NATURAL CHARACTERISTICS

It is common for wood to have naturally occurring anomalies that will show in the wood once peeled or sliced. Many of these natural characteristics add to the appeal of wood and can even enhance its value.

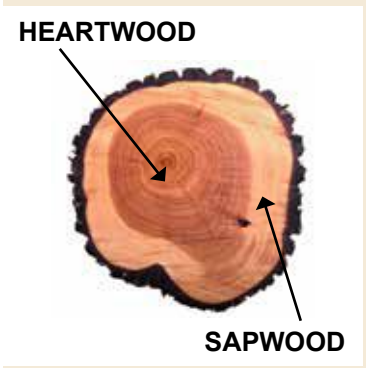
Bark pockets are openings surrounded by bark on a veneer surface, usually associated with a loose or cracked knot. They may have an elliptical shape like those in the photos shown here, or they may have a more rounded shape, depending on the angle of cut.

A **burl** is a cross section of an abnormal growth that occurs on the side of a tree. It may be a cluster of pin knots from adventitious limbs that develop when a limb dies off, or it may be from an injury to a tree. It may occur over a large area, or in a small area as shown here. Burls are limited in the higher grades in the standard.

Gum is a feature of cherry that does not occur to any great extent in any other domestic species. Gum is a deposit of an amorphous material that is thought to result from the tree attempting to heal an injury. It is dark red in color, and very soft compared to surrounding wood.

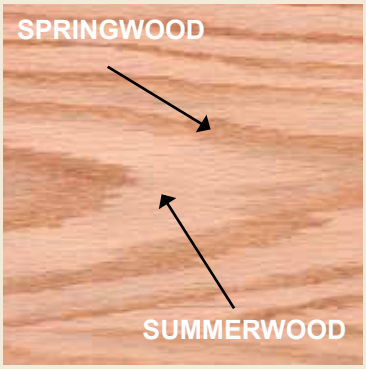
The dark part in the center of the cross section of a log is referred to as **heartwood**. The lighter part that surrounds the heartwood and forms a band of lighter color wood all the way out to the inner bark of the tree is referred to as **sapwood**.

Mineral streaks are generally blue-gray to black elongated discoloration on the surface of solid lumber or decorative veneer that may be caused by any number of events including injury, disease, growth conditions, nutrients, or even genetics.



▼ This plywood ceiling of natural Birch panels is a great example of heartwood and sapwood together in a veneer face.

▼ Mineral streak in hard maple caused by the presence of syrup tap holes, clearly visible in the photo below.



Ring porous woods such as red oak produce two-tiered growth rings consisting of coarse-textured, darker appearing early wood (**springwood**) and smooth textured, lighter colored late wood (**summerwood**).

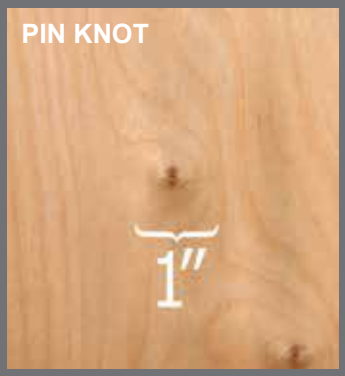
Vine marks are typically isolated, tightly compacted figure features typically resulting when an outside force such as a winding vine compresses the normal growth pattern in that region of the tree.

Worm track results when certain types of wood cells called parenchyma cells multiply to fill voids left in the cambium as a result of insect larval activity.

Wind shake or ring shake is a traumatic failure of the bonds between adjacent growth rings caused by an outside force such as strong wind, ice, even felling the tree, appearing as a ruptured, feathered, or very rough texture on a veneer surface.

NOTE: The American National Standard for Hardwood and Decorative Plywood, ANSI/HPVA HP-1-Current Year is the voluntary product standard to which most hardwood and decorative softwood plywood is manufactured in North America. Throughout this publication, any use of the word "standard" is a direct reference to this particular standard. Please see the introduction to the section on the ANSI/HPVA HP-1-2009 Standard Grading Tables on page 22 for further clarification.

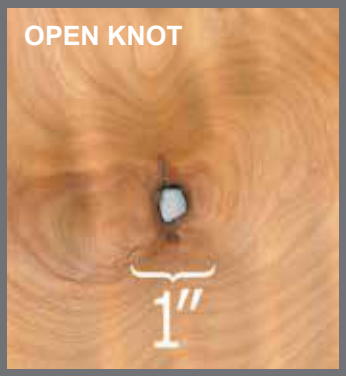
KNOTS



A **pin knot** with a dark center up to 1/8" in diameter (in most grades) is called a conspicuous pin knot, and is limited by the product standard in grades "AA." "A," and "B."

Inconspicuous pin knots have no dark center and are not considered when determining the grade of a sheet of veneer, as long as they do not interfere with the overall appearance of the face.

A **solid knot** is a cross section of a limb that was dead when the log was harvested, usually appearing as dark in color, likely containing cracks and bark that are subject to falling away during manufacturing.



Open knots are permitted on #2 backs and lower, and on "C" grade faces and lower, with some restrictions as outlined in the product standard.

A **sound knot** usually results when a live limb existed on the log. It will contain growth rings like a smaller version of the tree itself. The knot material is, as the name suggests, sound, and will most likely remain in place throughout the manufacturing process.

FIGURE

Figure is a general term used to describe any deviation from the normal growth of the wood grain, known technically as wavy or curly grain. Figure is so common as to occur in all species to the extent that wood completely lacking in figure is the exception rather than the rule. Slicing or peeling veneer from a log with wavy grain often creates distinctive figure patterns that reflect light differently from the surrounding wood. Some of these patterns are common to the extent they bear familiar colloquial names as shown here.

Tightly compacted, densely populated figure patterns are often called "**fiddle back**," and, as the name infers, it is commonly used in musical instruments.

Occasionally, the grain will be compressed into what may be referred to as a **waterfall** or **quilted** look.

Figure that is clearly visible but relatively isolated on a given veneer surface is defined in the HP-1 ANSI Standard glossary as a **cross bar**. Cross bar figure is permitted at some level in all face grades.

Flake, also called "**ray flake**" is not actually figure in the same sense as the other types shown here, but rather a result of a radial cut veneer that parallels one or more rays that naturally occur in all species. Here we see flake that is common in quarter sliced red and white oak as the rays in these species are quite large in comparison to other species.

Occasionally, for reasons not fully understood, conical indentations, will occur within a developing growth ring in many species of hardwoods, most notably hard maple (*Acer saccharum*). The indentations are repeated in successive growth rings in a nested fashion that, when the log in which they occur are sliced or peeled as veneer, the resulting figure pattern displayed on the veneer surface resembles, as the name infers, **birds' eyes.**

DID YOU KNOW?

- Columbia Forest Products p**eels about a billion square feet of decorative hardwood veneer a ye**ar at our 3 veneer mills. Columbia can source sustainable veneers from around the country or around the globe.

- Columbia Forest Products presses about **50,000 panels a day** at its 7 plywood facilities in the US and Canada. The majority of our products are made with veneer core substrates. Any decorative face and back species can be applied to this core to make it a beautiful and useful plywood panel.

- In 1998 Columbia was the first decorative hardwood plywood manufacturer to attain **Forest Stewardship Council™**, or FSC® certification for our US mills.

FSC
www.fsc.org
FSC® C017500
The mark of responsible foresty

FSC-certified wood is available upon request.

- The **PureBond®** system received the attention of the EPA, when in 2007 it was awarded The Presidential Green Chemistry Challenge - Greener Synthetic Pathways Award. Columbia's commitment to no-added formaldehyde manufacturing is better for our employees or customers and the indoor air we all breathe.

ASK FOR PureBond® HARDWOOD PLYWOOD

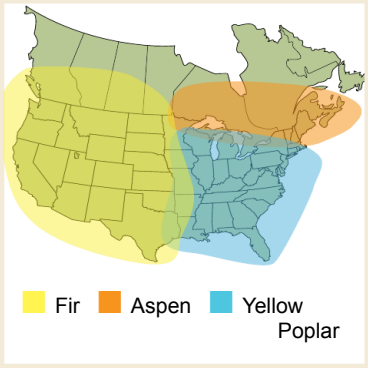
Columbia specializes in making all-wood veneer core hardwood plywood, but we can also apply our faces and backs to a variety of other cores and core types we purchase from outside sources.

Veneer Core is produced by placing the "lines" of core veneers into the panel "sandwich" so that adjacent plies having a grain direction oriented at approximate right angles to each other. Veneer core panels are relatively light in comparison with composite core panels, typically weighing about 70 pounds per 3/4" panel.

Veneer core offers superior physical properties than either PBC and MDF, but they may exhibit a bit more thickness variation.

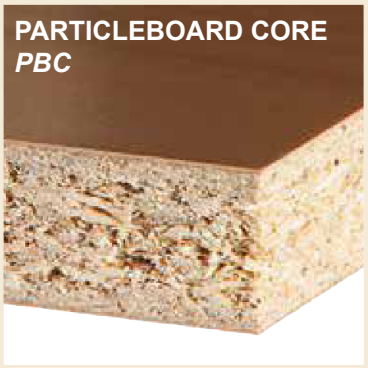
Due to ever decreasing face veneer thicknesses, slight imperfections on a veneer core surface may show through or "telegraph."

Veneer core may be manufactured with fir, aspen or yellow poplar, or a combination of these.



MPX core is Columbia's newest core innovation using extremely smooth poplar hardwood cross bands under the face and back. These poplar crossbands are peeled on state-of-the-art Meinan® lathes producing the smoothest domestic all-wood core in North America.

This is a specialty all hardwood "European style," high ply-count birch veneer core blank. This core is often used for decorative applications where the panel edge is revealed. Europly PLUS® is a NAUF panel. A 3/4" EuroplyPLUS panel weighs about 85 lbs.



PBC is composed of wood particles bonded together with adhesive. It's the least expensive core option, with a smooth, void-free surface. PBC is very uniform in thickness and density, but is heavy weighing about 100 lbs per 3/4" panel.

Medium Density Fiberboard is composed of wood fiber bundles bonded with adhesive. It offers a very smooth, void-free surface. MDF has greater strength and screw holding properties than particleboard and weighs around 100 lbs per 3/4" panel. MDF is a good choice for very thin panel applications.

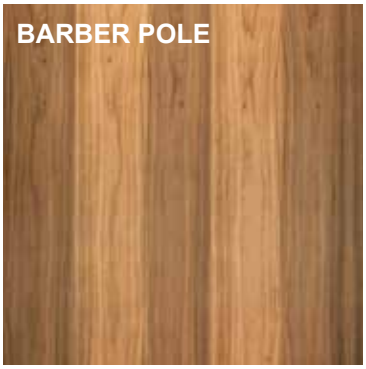
Constructed of veneer core inner plies with particleboard or MDF cross bands next to the face and back. Offers similar strength and stability to veneer core but has the void-free surface quality of PBC or MDF. Combination core (combi) panels like Classic Core replace veneer crossbands with a thin layers of MDF which visibly reduce core veneer telegraphing.

GLOSSARY OF HARDWOOD PLYWOOD TERMS

Annual ring (Annular Ring): See Growth Ring

Back: Generally a lower grade veneer than that of the opposing side of the same panel when a higher grade face is specified.

Barber pole: A phenomenon in a book matched face wherein adjacent components appear alternately dark and light due to the presence of lathe checks on the loose side of the veneer refracting light and absorbing slightly more finishing material.



Bark Pocket: An area of bark surrounded by wood of normal growth and color.

Blending: Color change that is detectable at a distance of 6 to 8 feet but which does not detract from the overall appearance of the panel.

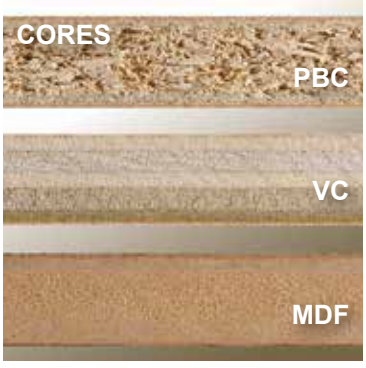
Book match: Veneer sheets consisting of individual components that are spliced side by side with every other side turned over, creating a mirror image at the joint due to the orientation of the grain coming together at the joints. The more common method of splicing face veneers.

Burl: A swirl or twist in the grain of wood, usually occurring near a knot, but which itself does not contain a knot. Clusters of small pin knots resulting from the development of adventitious buds or branches may or may not be present.

Check: Any fracture of a veneer surface along the grain generally resulting from stresses due to un-even shrinkage during seasoning or acclimatization, often exacerbated when extreme conditions of exterior cold and interior heat and relative humidity occur simultaneously.

Checking: The appearance of checks as described above anywhere on a veneer face. Concentration may be isolated to small areas or widely dispersed over the entire panel surface. Often associated with maple due to the stresses inherent in that genus.

Core: Any substrate upon which a decorative wood veneer face and or back may be applied by some means of adhesion. A core may be fabricated from hardwood or softwood veneers of various thicknesses (VC), or as engineered wood produced utilizing wood fibers (Medium Density Fiberboard – MDF) or wood chips and smaller particles (Particle Board Core – PBC)



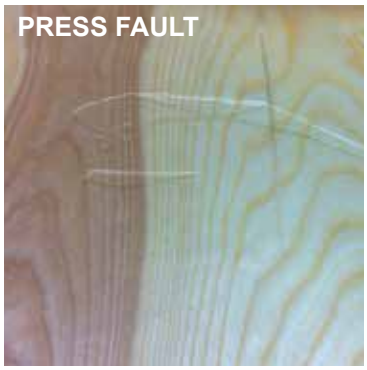
Core void: The absence of core material in any component in an inner ply of a veneer core panel as a result of a split, knot hole, damage, or gap between components within a given ply. Generally of more concern when the void occurs directly under the decorative face veneer. Limited in the product standard in Table 7, Summary Of Allowable Openings For Inner Ply Grades For Veneer Core Hardwood Plywood.

Cross bar: Any isolated deviation or concentration of normal grain direction on the surface of a hardwood or decorative softwood face or back veneer usually occurring at approximate right angles to the normal grain direction.

Cross band: A component ply in a veneer core hardwood plywood panel with a grain orientation at an approximate right angle to that of the face, back, and any other inner plies within the core of the panel. Also used to infer the inner ply in a veneer core panel occurring directly adjacent to the face and back of a given panel.

Cross checking: A phenomenon primarily associated with red oak but occasionally with other ring porous hardwoods wherein the early growth regions exhibit small fractures across the grain as a result of expansion or contraction of the substrate in reaction to moisture movement.

Defect: Any manufacturing mark or damage that interferes with the aesthetic appearance or usability of a given panel. Types of defects include delamination, machine or handling damage, dents or impressions (press fault) in a face or back, face or back visible due to excessive sanding (sand-through), core show through, and the like. A natural characteristic



such as a knot, split, bark pocket, mineral streak, other color marks or streaks, worm holes, or worm tracks are not considered defects, but rather are limited in occurrence by one of the applicable grades. Allowable but unrepaired or poorly repaired natural characteristics may be considered as defects.

Delamination: A separation of two or more plies in a hardwood plywood panel due to adhesion failure that can result from a number of causes.

Equilibrium moisture content: The moisture content eventually attained in wood exposed to a given environment. Also, the moisture content a given wood component would need to attain to be in balance with its environment.

Face: The better side of a decorative panel intended to be exposed in service.

False quarters: Sheets of veneer consisting of individual components from near the center of the tree and having straight grain produced by conventional slicing of a half log rather than by quarter slicing the log.

Few: A small number of characteristics without regard to their arrangement on a given face.

Figure: Any acute deviation of the normal grain direction in a given tree. Depending on intensity and population in the log, figure may be identified by several esoteric names such as cross bar, swirl, burl, tiger stripe, fiddle back, mottled, ropey, birds' eye, among others. Note: figure is common in wood to the extent that wood without figure is the exception, not the rule.

Fire rating (fire rated): A standard classification relative to the rate of flame spread over time in a tunnel test environment. Most wood products meet the classification of "C" in accordance with the National Fire Protection Association, Life Safety Code, NFPA 101.

Fire retardant treated: In this context, any wood panel or solid wood component that has been chemically treated in order to retard the rate of flame spread. Such treated products usually meet the requirements for Class "A" in accordance with the National Fire Protection Association, Life Safety Code, NFPA 101. Generally available with a particle board or medium density fiber core that has been treated as described above. Face and backs are not treated, but any veneer having a thickness less than 1/28" does not affect the rating of the panel. As of this printing, fire retardant treated veneer core is unavailable and impractical.

Formaldehyde: A pungent, irritating gaseous chemical commonly used in many consumer products, that when off-gassed causes many acute conditions including itchy watery eyes, sore throat, and runny nose. It was once used in large volume to produce decorative and engineered wood components destined for residential or commercial applications, but because it is now considered a carcinogen in the scientific and environmental community, its use in such products has largely been replaced by lower emitting products, or formaldehyde free panels such as Columbia Forest Products Purebond®.

FSC®: Forest Stewardship Council™. An open member-led nonprofit organization that sets independent standards by which forests are audited, protecting them for future generations. FSC uses the power of the marketplace to promote responsible forest management, creating an ecolabel that helps consumers identify products from such forests.

Grade: A designation set forth by the Hardwood Plywood and Veneer Association and its membership in the ANSI/HPVA HP-1 American National Standard for Hardwood and Decorative Plywood, including 6 face grades, AA-E, and 4 back grades, 1-4, with each descending grade having more frequent and larger characteristics than the higher grades.

NATIONAL STANDARD

Grain: The pattern, size and direction of the fibers in wood or veneer.


GRAIN

Growth ring: Any of the number of layers of wood added to the stem of a tree during a given growth period, generally annually for temperate species, but not necessarily for all tropical or arboreal species.


GROWTH RINGS

Gum spots or streaks: Accumulations of dark, amorphous, water soluble material often found embedded between adjacent growth rings of certain species of hardwoods, most notably American black cherry *(Prunus serotina)*. Source is unknown but thought to be a response by the tree to heal itself from injury.

Half round slicing: An adaptation of rotary cutting, utilizing a stay log that replaces the spindles so that the log half or quarter may be mounted offset from the center. The resulting cut is oriented tangentially to the growth rings to produce a plain sliced appearance, or across the grain and rays, usually in the oaks *(Quercus spp.)*, to produce a rift cut appearance.


HALF ROUND SLICNG

Hardwood: General term referring to solid wood or wood veneer originating from one of the broad leaved trees belonging to the class angiosperm. Does not relate to the hardness or fragility of the wood.


HARDWOOD TREES

Heartwood: The central core of the tree consisting of wood that was once active sapwood but that has been transformed to a neutral state due to the accumulation of extraneous materials and the depletion of oxygen, causing it to take on a generally darker color than that of the outer bands of sapwood.

Knot: Cross section of a limb that transfers to the surface of lumber or veneer as a round or elliptical form having the general appearance of growth rings. The condition of the knot will depend on whether it was alive, dead, or decayed at the time of harvest.

Knot (open): Opening pronounced when a portion of a knot has dropped out or separated due to seasoning.

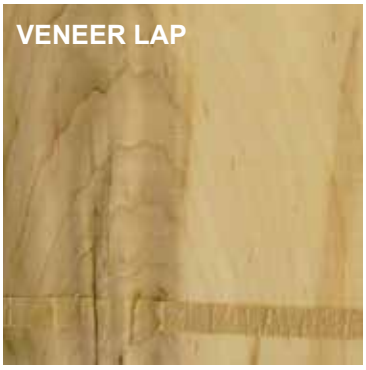
GLOSSARY OF HARDWOOD PLYWOOD TERMS

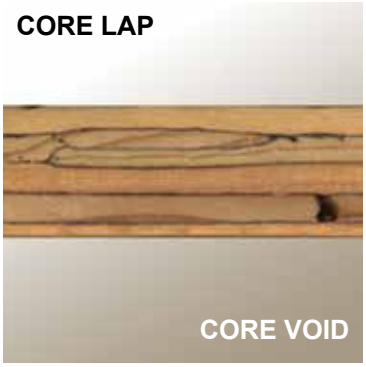
Knot (pin): A knot ¼" or less in diameter, with no missing knot material. The center of a pin knot may be dark up to 1/8" (conspicuous), or natural in color with no dark center (blending or inconspicuous).

Knot (sound): Knots that are solidly fixed by growth and that retain their place in lumber or veneer.

Knothole: Opening produced when knots drop from the wood in which they were once embedded.

Lap: A manufacturing defect that occurs when a portion of a sheet of veneer splits and subsequently overlaps itself due to uneven moisture movement. A lap may occur in a face and back where it may resemble a split if the errant portion is still intact in the lap or a press dent if the errant portion is missing.





It may also occur in a core component wherein it will create a localized thickness difference in the panel that will result in the face or back veneer being sanded off or in the core itself showing through the face or back.

Medium Density Fiberboard (MDF): Engineered wood panel product consisting of wood reduced to basic lignocellulosic fiber bundles integrated with adhesive and compressed under heat for use as a substrate for decorative hardwood plywood face veneers, paper and plastic laminates, and high pressure laminate (HPL), among others.

Mill run: A production lot of panels produced with the understanding and agreement between buyer and seller that all panels in that particular lot will be shipped by the seller and accepted by the buyer, without regard to usability of any particular panel or portion of any panel due to any manufacturing defect or natural characteristic.

Mineral streak: A generally blue-gray to black elongated discoloration on the surface of solid lumber or decorative veneer.

Moisture content: The percentage by weight of water in wood relative to the weight of the wood with all the moisture removed.

Occasional : Occurring on some, but not all face veneers. Refers to characteristics such as vine caused figure (also called vine mark) that may be present sporadically within a given run of veneer, but not to the extent it creates an objectionable condition.

Particleboard (PBC): Engineered wood panel product consisting of small wood particles and fiber bundles integrated with adhesive and compressed under heat for use as a substrate for decorative hardwood plywood face veneers, paper and plastic laminates, and high pressure laminate (HPL), among others.

Patch: Any repair to a decorative wood veneer, consisting of synthetic filler or wood veneer inserts.

Plain sliced: Wood veneer cut roughly parallel to the pith of the tree on a tangent to the growth rings, generally

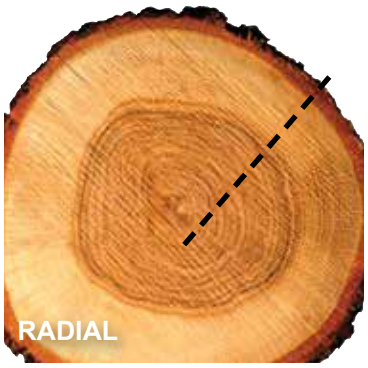
having a relatively consistent appearance from piece to piece, and usually producing at least some semblance of a cathedral grain pattern at some point during the slicing process.

Ply: A single sheet of veneer forming one layer in a multi-layered piece of plywood.

Plywood, hardwood: A panel composed of layers of one or more inner plies of wood veneer, MDF, PBC, or other core material joined with an adhesive to a face and back veneer of hardwood or decorative softwood veneer.

Quarter sliced: Decorative face veneer cut on a radial angle to the growth rings of the tree by slicing a quarter log, or a half log as it is reduced to a point near the pith of the tree. Typically, quarter sliced oak *(Quercus spp.)* veneer will have relatively straight grain with pronounced flake across the growth rings due to the fact that the cut is roughly parallel to the oak rays which are wider than in most other species.

Radial: A line projecting from or converging upon a center of a round object. In wood, the radial plane constitutes a line across the growth rings and parallel to the rays.



Ray: Flattened band of parenchyma cells projecting from the center of the tree to the cambium. Present in all species, but pronounced in some species, particularly red and white oak and alder.

Repair: A patch, shim, or natural or synthetic filler material inserted

and/or glued into a face or back veneer so as to achieve a sound surface.

Rift cut (or sliced): Decorative face veneer cut on a radial angle to the growth rings of the tree by slicing a quarter log, or a half log as it is reduced to a point near the pith of the tree. Typically, rift cut oak *(Quercus spp.)* veneer will have relatively straight grain with minimal flake across the growth rings due to the fact that the cut is roughly across rather than parallel to the rays.

Rotary cut: Veneer peeled from a whole log set in a lathe and turned against a special knife.

Sapwood: The light colored, active portion of a tree located between the generally darker heartwood and the bark.

Scattered: Relatively uniformly distributed within a given face veneer.

Shake (Ring shake, Wind shake): A separation of wood structure parallel to one or more growth rings generally associated with traumatic shear stress that may result from wind storms, ice storms, or felling.

Shop grade (Developed shop): A common, non-standard industry term broadly defined in the glossary of the HPVA HP-1 standard, but not included as a part of the standard. Generally interpreted and accepted as a panel that is deemed by the final inspector at the producing mill to be less than 100% usable due to a manufacturing defect such as a dent, scratch, or damage, but having at least 85% of the surface area of the panel that is unblemished and assumed to be usable. Shop developed from a normal production run of panels.

SHOP

Shop, manufactured: A panel manufactured utilizing one or more component(s) that have been previously determined to be damaged to the point they would almost assuredly result in a panel being downgraded to shop in a normal production run. Panels thusly produced are usually provided as "mill run" as agreed upon between buyer and seller.

Slight: Visible on observation but does not interfere with the overall appearance of a given face veneer in consideration of the applicable grade for that particular face veneer.

Slip matched: Veneer sheets that consist of individual components spliced side by side without turning any of them over to form staggered but repetitive grain appearance with all components oriented so that the tight side of each veneer is on the same side of the sheet. Often specified as "Slip Match – Tight Side Out (SMTSO)."

Species: An internationally established and recognized Latin binomial nomenclature used to identify every living plant or animal. As with all such classifications, trees are identified by both genus and species, e.g.: *Acer rubrum.* Acer is the genus and rubrum is the species, in this case it refers to red or soft maple. Species with the "s" on the end is used for both singular and plural applications.
It is always "species."

Split: Same as check. Separation of wood fiber along the longitudinal direction of the grain, this term is usually associated with such failure isolated to panel ends, although splits may occasionally develop within the field of the panel face.


SPLIT

Split, splice line: A separation occurring between adjacent components in a hardwood plywood panel face, generally resulting from stresses that cause the actual joint to fail, but not the wood fiber within the adjacent components.

Sugar streaks: (See worm track)

Veneer: Peeled or sliced thin sheets of wood used as decorative faces or inner plies in a hardwood plywood panel.


VENEER

White: A highly generalized term frequently inappropriately used in reference to the lighter color of sapwood in a tree as opposed to the darker color of the heartwood of the same tree. Also used to describe wood of any color, whether heart or sap, that has no added finish material such as stains or paint.


WHITE

Worm track: Accumulations of light brown parenchyma cells arranged within the tunnels left in the cambium by the larvae of certain species of flies, leaving the image of the trails (tracks) created by these larvae as they continuously consume cambial tissue. Common in maple *(Acer spp.)* where it is often erroneously called "sugar streak," and in birch *(Betula spp.)* where it is sometimes erroneously called "pith fleck."

NOTE: There are a host of terms used to reference the appearances or processes used in the production of faces, backs, and inner ply veneers or other core components. Many of these terms are colloquial or esoteric, and often misused or at the very least are confusing. The purpose of this glossary is to accurately define these and other often used terms in hopes of making some sense of them.

ANSI/HPVA HP-1-2009 STANDARDS©

The Hardwood Plywood and Veneer Association (HPVA) is an ANSI-accredited standards developer that works through its participating membership and other interested outside parties to develop a voluntary standard for hardwood and decorative plywood under due process guidelines set forth by the American National Standards Institute (ANSI). The resulting national consensus standard bears the name, "American National Standard for Hardwood and Decorative Plywood, ANSI/HPVA HP-1- Current Year," often shortened to ANSI/HPVA HP-1. Any other reference is not appropriate. It is often erroneously called the ANSI Standard, but there are hundreds of ANSI standards, only one of which covers our industry. ANSI does not write the standard or bear any responsibility for its content. The sole involvement by ANSI is to provide a protocol for the development of a standard that includes participation and sign-off by all interested parties in the process, and a format to use so that the resulting standard conforms to due process requirements to qualify for the ANSI designation.

The history of the standard is rich, beginning in 1931 as Commercial Standard CS 35-31, evolving through the National Bureau of Standards as PS 51-71, to its final version today. As mentioned above, it is a voluntary consensus standard, meaning compliance is voluntary, and the contents are a result of a consensus of those involved in its development. While this may seem to be a simple process, today's version of the standard is the result of an arduous and tumultuous process. It is intended to provide a baseline by which a panel or lot of panels may be judged to ensure what is delivered is what is specified. Once a panel provider agrees to or professes to conform to the standard, it becomes mandatory.

It is important to understand that because of the natural differences in how the look of wood will vary from piece to piece, even from the same tree, every grade will include a range of appearance from the low end of the grade to the high end. The tables in the ANSI/HPVA HP-1 standard and abbreviated here for simplification purposes establish a minimum appearance for each grade. In other words, the tables essentially say that if a given attribute such as a small burl is present, it can't exceed the size and quantity restrictions listed in the table. What the tables do not say and should not be interpreted to say is that for any grade, every face in that particular grade must have every attribute listed in the amount and size listed in the applicable table. The truth is that not every panel will have every characteristic. Some will have virtually none, but others will have a combination of them, often making the final determination of the grade status of a given piece of veneer quite perplexing. Sometimes a panel face with a faint characteristic that objectively is outside the permitted size for a given grade will look much more desirable than another that has several characteristics that are within the permitted limit, but which are actually quite ugly, yet objectively meet the grade. The resulting inclination is to select the better looking face and reject the ugly one. In fact, quoting from the current industry standard, ANSI/HPVA HP-1-2009, Section 3.3.1, "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."

Regardless of the fact that every effort has been invested to ensure that the standard is as objective as possible, there will always be some level of subjectivity involved when making the final decision as to the grade of a given sheet of veneer. For this reason, there is almost always some degree of overlap in appearance between the bottom end of one grade and the top end of the next grade down, as illustrated in **Diagram 1** below.

As can be seen in this diagram, as we go from one grade to the next, not only does the variation in appearance get wider for each, but the amount of overlap between the low end of one grade and the high end of the next grade down gets wider as well.

While the standard consists of numerous sections and complete tables for every grade of face and back by species category, it also includes sections and tables relating to core requirements, glue performance, formaldehyde emissions, dimensions and tolerances, and testing methodology. The following tables are offered as a condensed version of the grade tables in the ANSI/HPVA HP-1 standard for a few select species categories showing a small number of limiting criteria for illustration purposes only. Please check the current ANSI/HPVA HP-1 standard for the full tables and narrative for more complete information.

Note: Some exotic species such as Amaranth/Purpleheart *(Peltogyne paniculata)* or Zebrano *(Microberlinia brazzavillensis)*, or unusual matchings such as diamond or sunburst do not fit into the grading tables described here or in the industry standard. These and even certain domestic woods such as bird's eye maple *(Acer saccharum)* or wormy chestnut *(Castanea dentata)* must be carefully specified to include expected appearance. They will not be applicable to any particular grade, and therefore should be considered as agreed upon between buyer and seller for appearance purposes. Even so, other requirements of ANSI/HPVA HP-1, including dimensional tolerances, glue performance, and formaldehyde emissions, among others, shall apply.

DIAGRAM 1

ASH, BIRCH, MAPLE AND POPLAR: ROTARY-CUT, QUARTER CUT, PLAIN SLICED *(From Table 3.1 ©)*

Natural Characteristics	A Grade	B Grade	C Grade
Small Conspicuous Burls & Pin Knots — Comb. Avg. Number	10 per 4 x 8' panel	16 per 4 x 8' panel	No limit
Conspicuous Burls — Max. Size	3/8"	1/2"	No limit
Conspicuous Pin Knots Average Number Max. Size: Dark Part Max. Size: Total	1 per 8 sq ft 4 per 4 x 8' panel 1/8" 1/4"	1 per 4 sq ft 8 per 4 x 8' panel 1/8" 1/4"	No limit
Scattered Sound and Repaired Knots Comb. Average Number Max. Size — Sound Max. Size — Repaired Avg. Number — Repaired	No	1 per 8 sq ft 4 per 4 x 8' panel 3/8" 1/8" 1 per 8 sq ft	1 per 4 sq ft 8 per 4 x 8' panel 1/2" 1/2" 1 per 8 sq ft
Mineral Streaks	Slight	Slight	Yes
Bark Pockets	No	Few to 1/8" x 1"	Few to 1/4" x 2"
Worm Tracks	Slight	Slight; Ash Yes	Yes
Vine Marks	Slight	Slight	Yes
Cross Bars	Slight	Yes	Yes

MAHOGANY, ANIGRE AND SAPELE: ROTARY-CUT, QUARTER CUT, PLAIN SLICED *(From Table 3.2 ©)*

Natural Characteristics	AA Grade	A Grade	B Grade
Small Conspicuous Burls & Pin Knots — Comb. Avg. Number	6 per 4 x 8' panel	10 per 4 x 8' panel	16 per 4 x 8' panel
Conspicuous Burls — Max. Size	1/4"	3/8"	1/2"
Conspicuous Pin Knots Average Number Max. Size: Dark Part Max. Size: Total	No	1 per 8 sq ft 4 per 4 x 8' panel 1/8" 1/4"	1 per 4 sq ft 8 per 4 x 8' panel 1/8" 1/4"
Scattered Sound and Repaired Knots Comb. Average Number Max. Size — Sound Max. Size — Repaired Avg. Number — Repaired	No	No	1 per 8 sq ft 4 per 4 x 8' panel 3/8" 1/8" 1 per 8 sq ft
Mineral Streaks	No	Slight	Occasional
Bark Pockets	No	No	Few to 1/8" x 1"
Worm Tracks	No	No	Slight
Vine Marks	Slight	Slight	Yes
Cross Bars	Occasional	Occasional	Yes

RED AND WHTE OAK: ROTARY-CUT, QUARTER CUT, PLAIN SLICED *(From Table 3.3 ©)*

Natural Characteristics	A Grade	B Grade	C Grade
Small Conspicuous Burls & Pin Knots — Comb. Avg. Number	12 per 4 x 8' panel	24 per 4 x 8' panel	No limit
Conspicuous Burls — Max. Size	3/8"	1/2"	No limit
Conspicuous Pin Knots Average Number Max. Size: Dark Part Max Size: Total	1 per 3 sq ft 10 per 4 x 8' panel 1/8" 1/4"	1 per 2 sq ft 16 per 4 x 8' panel 1/8" 1/4"	No limit
Scattered Sound and Repaired Knots Comb. Average Number Max. Size — Sound Max. Size — Repaired Avg. Number — Repaired	No	1 per 8 sq ft 4 per 4 x 8' panel 3/8" 1/8" 1 per 8 sq ft	1 per 4 sq ft 8 per 4 x 8' panel 1/2" 1/2" 1 per 8 sq ft
Mineral Streaks	Slight, Blending	Few to 12"	Yes
Bark Pockets	No	Few to 1/8" x 1"	Few to 1/4" x 2"
Worm Tracks	No	Slight	Few
Vine Marks	Slight	Yes	Yes
Cross Bars	Slight	Yes	Yes

HICKORY: ROTARY-CUT, QUARTER CUT, PLAIN SLICED *(From Table 3.4 ©)*

Natural Characteristics	A Grade	B Grade	Rustic
Small Conspicuous Burls & Pin Knots — Comb. Avg. Number	64 per 4 x 8' panel	No Limit	As agreed upon between buyer and seller
Conspicuous Burls — Max. Size	3/8"	1/2"	
Conspicuous Pin Knots Average Number Max. Size: Dark Part Max. Size: Total	2 per 1 sq ft 64 per 4 x 8' panel 1/8" 1/4"	No Limit 1/8" 1/4"	
Scattered Sound and Repaired Knots Comb. Average Number Max. Size — Sound Max. Size — Repaired Avg. Number — Repaired	No	1 per 8 sq ft 4 per 4 x 8' panel 3/8" 1/8" 1 per 8 sq ft	
Mineral Streaks	Slight	Yes	
Bark Pockets	Small, Occasional	Few to 1/4" x 2"	
Worm Tracks	Slight	Few	
Vine Marks	Occasional	Yes	
Cross Bars	Occasional	Yes	
Bird Peck	Slight	Yes	
Knife Marks	Knife marks may occur in these high density species		

WALNUT AND CHERRY: PLAIN SLICED, QUARTER CUT, ROTARY CUT *(From Table 3.5 ©)*

Natural Characteristics	A Grade	B Grade	C Grade
Small Conspicuous Burls & Pin Knots — Comb. Avg. Number	24 per 4 x 8' panel	64 per 4 x 8' panel	No Limit
Conspicuous Burls, Max. Size	3/8"	1/2"	No Limit
Conspicuous Pin Knots Average Number Max. Size: Dark Part Max. Size: Total	1 per 2 sq ft 16 per 4 x 8' panel 1/8" 1/4"	1 per 1 sq ft 32 per 4 x 8' panel 1/8" 1/4"	No Limit
Scattered Sound and Repaired Knots Comb. Average Number Max. Size — Sound Max. Size — Repaired Avg. Number — Repaired	No	1 per 8 sq ft 4 per 4 x 8' panel 3/8" 1/8" 1 per 8 sq ft	1 per 4 sq ft 8 per 4 x 8' panel 1/2" 1/2" 1 per 8 sq ft
Mineral Streaks	Slight	Yes	Yes
Bark Pockets	No	Few to 1/8" x 1"	Few to 1/4" x 2"
Worm Tracks	No	Slight	Few
Vine Marks	Occasional	Yes	Yes
Cross Bars	Occasional	Yes	Yes
Gum Spots	Occasional gum spots in Cherry	Gum spots and gum streaks in Cherry	Gum spots and gum streaks in Cherry

BACK GRADES *(From Table 6 ©)*

Grade Description	1 Back	2 Back	3 Back	4 Back
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. diameter 3/8"	Max. diameter 3/4"	Max. diameter 1 1/2"	Yes
Max. Number of Tight Knots	16	16	Unlimited to 1/2"; No more than 16 from 1/2" to 1 1/2"	Unlimited
Knotholes	No	1/2" Repaired	1"	4"
Max. Combined Number of Knotholes and Repaired Knots	None	All repaired; Unlimited to 3/8"; No more than 8 from 3/8" to 1/2"	Unlimited to 3/8"; No more than 10 from 3/8" to 1"	Unlimited
Wormholes	Filled	Filled	Yes	Yes
Splits or Open Joints	Six 1/8" x 12" repaired	Six 3/16" x 12" repaired	Yes, 3/8" x 1/4" Length of Panel (LOP)	1" to 1/4 LOP, 1/2" to 1/2 LOP, 1/4" to Full LOP
Doze & 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 8" diameter areas	5% of panel	Yes	Yes
Bark Pockets	1/8" wide repaired	1/4" wide repaired	Yes	Yes
Laps	No	Repaired	Yes	Yes

CORE GRADES *(From Table 7 ©)*

Grade Description	J Grade	K Grade		L Grade	M Grade
Thickness of Crossband Adjacent to Faces	Any thickness	Thicker than 1/10"	1/10" and thinner	Any thickness	Any thickness
Knotholes and Other Round Elliptical Openings (Max. Diameter)	None	3/8"	3/4"	1"	2 1/2"
Splits, Gaps and Other Elongated End or Edge Openings — Visible on only one end or edge of panel (Max. Width)	1/8"	1/4"		1/2"	1"

LIMITING CRITERIA FOR PLYWOOD *(From Table 8 ©)*

Limiting Factors	TYPE 1 (EXTERIOR)	TYPE 2 (INTERIOR)
Bond Line Requirements	Fully waterproof	Water resistant
Bond Line (glue bond) Test Performance	Dry and cyclic-boil shear	Three-cycle soak and dry
Grade and Limitations of Inner Plies Adjacent to Faces*	K	K under AA, A or B L under C, D or E
Grade of Other Inner Plies	M or better	M or better

NOTE: If the buyer requires a specific inner ply grade among those as listed in Table 7, it must be specified.

HARDWOOD PLYWOOD

Grading Guide

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