Hardwood Plywood Handbook

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Editor: Curt Alt

This book is published by the Hardwood Plywood & Veneer Association (HPVA), formerly the Hardwood Plywood Manufacturers Association, an international trade association representing wood industry companies in the United States, Canada, and abroad. Association members include manufacturers of hardwood plywood, veneer, and engineered hardwood flooring, hardwood plywood prefinishers, distributors of hardwood plywood products, and suppliers to the industry. HPVA's mission is "to promote and support the long-term growth and prosperity of our industry, our members, and the natural resources upon which we depend." The Association offers numerous services to members, including: industry promotion, communication services, government representation, and technical, laboratory, and testing services.

The processes and procedures shown in this publication represent the industrial manufacture of hardwood plywood and veneer and should not be attempted by unqualified individuals.

Comments or questions regarding this publication are welcome and should be directed to the following address:

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INTRODUCTION

This Hardwood Plywood Handbook has been designed as a visual companion to the Voluntary Standard for Hardwood and Decorative Plywood. It is a reference for sales representatives, specifiers, distributors, purchasing personnel, woodworkers, and end users.

Because this publication is a companion to the HP-1 Standard, it assumes some reader familiarity with the plywood grades and terms defined in the Standard. This handbook and the Standard together provide a superior knowledgebase from which the reader can understand and specify the correct hardwood species, grade, thickness, and core combination for specific applications.

This handbook and the grading information in the Standard are only a part of a much larger store of information available to you online at the Hardwood Plywood and Veneer Association's website, www.hpva.org. Online, you may purchase fine veneer sample sets, the intensely graphic Hardwood Veneer Selectorama, the hardwood plywood production video "Human Nature," which shows every step of the hardwood plywood production process from veneer slicing to final sanding, and much more. There is also information on hardwood plywood and veneer producers and links to other related websites. We encourage readers to use this online resource to develop a master's understanding of the characteristics and applications for hardwood plywood products.

As you will see from this handbook, there are many combinations of thicknesses, lengths, widths, cores, face species, and grades of hardwood plywood available. For specific information on availability and a list of mills that can meet your product needs, we suggest you get a complimentary copy of HPVA's in-depth "Where to Buy Hardwood Plywood, Veneer, and Engineered Flooring" membership directory and product guide, available on HPVA's website.

This handbook is not a substitute for the Standard, but is a companion piece that explains the product characteristics in greater detail. This publication does not provide the detail necessary to properly specify hardwood plywood. When specifying hardwood plywood products, the current version of the HP-1 Standard should be used and referenced. Visit www.hpva.org to order a copy of the current Standard.

Helpful Hint

The choices made between different cores, faces, and backs will affect the cost, structural properties, and finished appearance of the panel. It is your responsibility to understand the impacts of your selections on the finished product.

GREEN BY DESIGN: RENEWABLE, DURABLE, SUSTAINABLE WOOD

Never before have consumers cared so deeply about the environmental impacts of the products they use. In these environmentally conscious times, wood products offer concerned consumers a breath of fresh air by giving them the peace of mind of knowing that they are using an environmentally friendly building material.

Wood is renewable, reusable, recyclable, and completely biodegradable. The well-managed forests from which our wood is derived are natural air filters, absorbing carbon dioxide and releasing oxygen. Forests also provide us with clean water and scenic beauty and provide habitat for wildlife and plants.

Wood—The Environmentally Conscious Choice

Life cycle assessment, or LCA, is an internationally recognized analytical method that quantifies energy and material usage, emissions to the air and water, and the solid waste generated at each stage of a product's life cycle. The LCA process asks some basic questions—the same questions that more and more architects, designers, and consumers are asking of building products:

- How is the environment affected at each stage of the building product's life cycle—resource extraction through manufacturing, transportation, installation, and eventual disposal?
- How can the impacts on the environment be compared for one material choice over another?

LCA is becoming the world standard for dealing with these complex environmental issues and objectively improving environmentally based decision making. When examined under the LCA framework, wood is clearly superior to alternate building materials. Metal, masonry, and plastics are originally extracted from fixed, non-renewable sources and, in all cases, take more fossil fuel energy to process and manufacture (see chart). Wood can be easily reused or recycled throughout its life cycle and, when no longer needed, is completely biodegradable. Try saying that about metal, concrete, or plastics!

Life Cycle Assessment of the Environmental Impacts of a House Built from Wood, Sheet Metal, and Concrete

	Wood	Sheet Metal	Concrete
Global Warming Potential (CO_2 equivalent kg)	62,183	76,453	93,573
Air Toxicity (critical volume measurement)	3,236	5,628	6,971
Water Toxicity (critical volume measurement)	407,787	1,413,784	876,189
Weighted Resource Use (kg)	121,804	138,501	234,996

Source: Canadian Wood Council, Technical Bulletin No. 5, *Life Cycle Analysis for Residential Buildings,* www.cwc.ca

Responsibly Meeting a Growing Demand

HPVA members are committed to the integration of the science of sustainable harvest and production with the conservation of soil, air, and water quality that preserves wildlife and fish habitat and promotes healthy forests. Our policy statement on Sound Forestry and Utilization Practices is available online at www.hpva.org.

Worldwide, there are a number of forest certification programs that strive to meet consumer and manufacturer demands for greater environmental accountability by documenting and improving forestry practices. HPVA members fully support the fundamental concepts of forest certification and actively participate in the two major certification initiatives in the US: the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI). Information on those and other forest certification programs and the companies that manufacture to certification standards is available on our website, www.hpva.org, and in our "Where to Buy" membership directory.

Internationally, recent attention has focused on the problem of illegal logging and the subsequent trade in illegal wood products. HPVA members support international efforts to ensure that all countries have the resources necessary to monitor and sustainably manage their forest resource. Individually, our member companies encourage the proper stewardship of our international forest resource by supporting community activities that promote natural resource education and policies that enhance forest health and vigor.

Forest Facts:

- There are 737 million acres of forest land in the U.S.
- The U.S. hardwood resource has grown by 91% since 1952.
- Tree growth exceeds harvest in all areas of the U.S.
- 5.4 million trees are planted *every day* in the U.S.

Stewardship in Action

A great example of that stewardship in action is the hardwood tree planting initiatives coordinated and sponsored each year by the Hardwood Forestry Fund. The Fund, created by the HPVA membership in 1990 to educate the public about the importance of active forest management, works closely with natural resource professionals to fund the planting of hardwood trees on public sites.

The Hardwood Forestry Fund's proactive mission has received broad-based support from the forest products industry, conservation-focused foundations, and environmentally concerned individuals. Since 1990, the Fund has planted more than 2.5 million trees through 140 planting projects in 22 states and 4 foreign countries.

The Hardwood Forestry Fund is a growing program that helps companies and individuals that do not own forestland have a hand in the establishment and management of future forests. The Fund and its members replace the trees used today and create healthy hardwood forests for future generations. You could say our future is growing every day. We invite you to learn more about how you can help by visiting our website at www.hardwoodforestryfund.org.

CHARACTERISTICS OF SPECIES COMMONLY USED IN HARDWOOD PLYWOOD FACES

Ash, White *(Fraxinus americana)*

Tree: When mature, usually 70'–80' tall. Trunk diameter may reach 3'. Deeply ridged, thick gray to brown bark with diamond furrows.

Leaf: Compound leaf consisting of 5–9 smooth or finely toothed leaflets on opposite side of stem; 8"–12" long.

Fruit: Sumara or winged seed, 1"–2" long, in crowded clusters 6"–8" long.

Wood: *Color:* Somewhat lustrous; sapwood nearly white, wide; heartwood grayish brown to light brown to pale yellow streaked with brown. *Pattern:* Straight grain; coarse, even texture.

Working Properties: Heavy in weight, hard, strong, stiff, high shock resistance, excellent bending qualities. Good machining and excellent finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.60	42	1,320	1.74	15,000

Birch, Yellow *(Betula alleghaniensis)*

Tree: 60'–70' tall when mature. Trunk diameter may reach 2½'. Gold-gray to bronze bark, flaky with curly, papery ends.

Leaf: Alternating simple leaves of slim ovals, 2 ½"–6" long, sharply toothed. Leaf stems and vein axils are hairy.

Fruit: Scaly cone, 1"–1½" long, bearing small winged seeds.

Wood: *Color:* White sapwood; heartwood cream or light brown tinged with red. *Pattern:* Straight, close-grained; fine textured and even.

Working Properties: Heavy, hard, and strong with good shock-resisting abilities. Good machining and excellent finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.62	43	1,260	2.01	16,600

[1] Values are given for wood at 12% moisture content.

[2] Hardness represents the relative toughness of the wood and its ability to withstand marks and wear. The numerical value represents the force needed to embed a 0.444-inch ball to one-half its diameter in the wood.

Sources: *Your Wood Fact Book,* Appalachian Hardwood Manufacturers, Inc.; *Temperate Hardwoods of the USA,* American Hardwood Export Council; *The Hardwood Handbook,* Southeastern Lumber Manufacturers Association, *Fine Hardwoods Selectorama,* Hardwood Plywood & Veneer Association.

Cherry, Black *(Prunus serotina)*

Tree: 60' or taller when mature. Trunk diameter may reach 3'. Bark changes from smooth reddish brown in young trees to scaly black upraised plates in crisscrossing ridges in older trees.

Leaf: Alternating simple ovals, pointed with fine incurving teeth, 2"–6" long.

Fruit: Edible berries, ⅓"–½" in diameter, dark red to purple when ripe. Grouped along a central stem.

Wood: Color: Sapwood nearly white; heartwood light pinkish-brown to dark reddish-brown. Pattern: Fine, straight, close-grained.

Working Properties: Light, strong, hard, and stiff with moderately large shrinkage. Excellent machining and finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.50	35	950	1.49	12,300

Maple, Hard *(Acer spp.)*

Tree: 75'–100' tall when mature. Trunk may reach 3'–4' in diameter. Thick dark gray bark, furrowed and irregular.

Leaf: Simple leaf with 5 pointed lobes, 3"–5" across, large pointed teeth. Occur opposite on stem. Colorful in autumn.

Fruit: U-shaped pair of winged seeds, 1"–1½" long, borne in pairs.

Wood: *Color:* Sapwood white to creamy-white; heartwood creamy-white with pinkish tinge to light reddish-brown. *Pattern:* Straight, close grained; sometimes wavy or curly; fine textured; can be highly figured.

Working Properties: Heavy, hard, and tough with high resistance to shock and abrasive wear. Good machining and excellent finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.63	43	1,450	1.83	15,800

[1] Values are given for wood at 12% moisture content.

[2] Hardness represents the relative toughness of the wood and its ability to withstand marks and wear. The numerical value represents the force needed to embed a 0.444-inch ball to one-half its diameter in the wood.

Sources: *Your Wood Fact Book,* Appalachian Hardwood Manufacturers, Inc.; *Temperate Hardwoods of the USA,* American Hardwood Export Council; *The Hardwood Handbook,* Southeastern Lumber Manufacturers Association, *Fine Hardwoods Selectorama,* Hardwood Plywood & Veneer Association.

Oak, Red *(Quercus spp.)*

Tree: 60'–80' tall when mature. Trunk may reach 3' or more in diameter. Brown to black bark, deeply fissured with vertical lines and cross breaks.

Leaf: Simple toothed and sharply pointed leaf, 5"–8" long with bristly ends, alternating on stem.

Fruit: 1" acorns that require two growing seasons. Pointed cap with a shallow cup.

Wood: *Color:* Sapwood grayish-white to pale reddish-brown; heartwood flesh-colored to pinkish to light reddish-brown. *Pattern:* Straight grained; coarse textured.

Working Properties: Heavy, hard, and strong with high wear and shock resistance. Excellent machining and finishing properties

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.63	43	1,290	1.82	14,300

Oak, White *(Quercus spp.)*

Tree: 80'–100' tall when mature. Trunk may reach 3'–4' in diameter. Flaky, light gray bark.

Leaf: Simple pinnately lobed leaf with smooth rounded tips, 5"–9" long, alternating on stem.

Fruit: Acorn ¾" long, light brown with oval pointed top and a scaly cup.

Wood: *Color:* Sapwood whitish to light-brown; heartwood rich light-brown to dark brown. *Pattern:* Straight grained; coarse textured.

Working Properties: Heavy, hard, and strong with high wear and shock resistance. Excellent machining and finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.68	47	1,360	1.78	15,200

[1] Values are given for wood at 12% moisture content.

[2] Hardness represents the relative toughness of the wood and its ability to withstand marks and wear. The numerical value represents the force needed to embed a 0.444-inch ball to one-half its diameter in the wood.

Sources: *Your Wood Fact Book,* Appalachian Hardwood Manufacturers, Inc.; *Temperate Hardwoods of the USA,* American Hardwood Export Council; *The Hardwood Handbook,* Southeastern Lumber Manufacturers Association, *Fine Hardwoods Selectorama,* Hardwood Plywood & Veneer Association.

Pine, Western White *(Pinus monticola)*

Tree: 150'–180' tall when mature. Trunk may reach 2½'–3½' in diameter. Bark is smooth, gray-green to light green on young trees, breaking up into square or rectangular dark or purplish gray blocks separated by deep fissures on older trees.

Leaf: Thin blue-green needles, 2"–4" long, in groups of 5.

Fruit: Narrowly cylindrical, often curved, cones 5"–11" long.

Wood: *Color:* Wide ring of pale-white sapwood; heartwood, smaller portion, slightly darker. *Pattern:* Straight grained, not contrasty; fine textured.

Working Properties: Light; moderately strong, and easily worked. Excellent machining and finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.35	22	380	1.24	8,600

Walnut, Black *(Juglans nigra)*

Tree: Reaches 100' tall. Trunk may be 2'–3' in diameter. Thick dark brown bark, deeply furrowed in diamond patterns

Leaf: Small pointed ovals, pinnately compound, 15"–30" long with 11–17 leaflets opposite on stem.

Fruit: Edible nut, 1"–1½" in diameter, with yellowish-green fibrous husk, often occurring in pairs.

Wood: *Color:* Sapwood whitish to yellowish-brown, will darken when steamed; heartwood light gray-brown to rich chocolate-brown to deep purplish-brown. *Pattern:* Straight to interlocked or curly, wavy grained; medium to coarse textured

Working Properties: Moderately heavy, hard, and strong with good shock resistance. Excellent machining and finishing properties.

Physical Properties[1]:

Specific Gravity	Weight (lbs/ft³)	Hardness[2] (psi)	MOE (million psi)	MOR (psi)
.55	38	1,010	1.68	14,600

[1] Values are given for wood at 12% moisture content.

[2] Hardness represents the relative toughness of the wood and its ability to withstand marks and wear. The numerical value represents the force needed to embed a 0.444-inch ball to one-half its diameter in the wood.

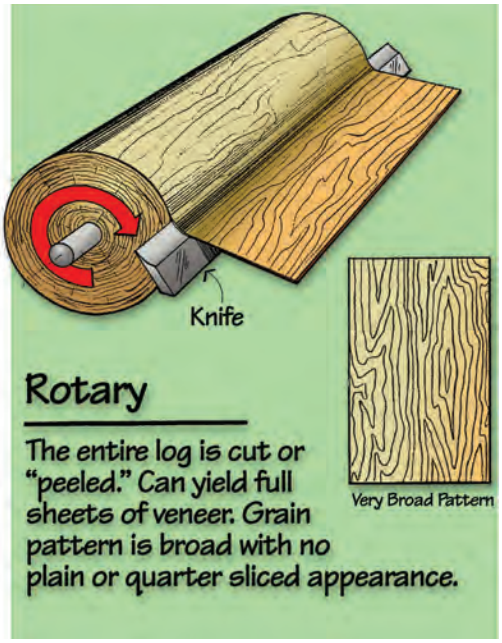
Sources: *Your Wood Fact Book,* Appalachian Hardwood Manufacturers, Inc.; *Temperate Hardwoods of the USA,* American Hardwood Export Council; *The Hardwood Handbook,* Southeastern Lumber Manufacturers Association, *Fine Hardwoods Selectorama,* Hardwood Plywood & Veneer Association.

VENEER CUTTING METHODS

Helpful Hint

Rotary is the only cutting method that is capable of producing whole piece faces.

Rotary

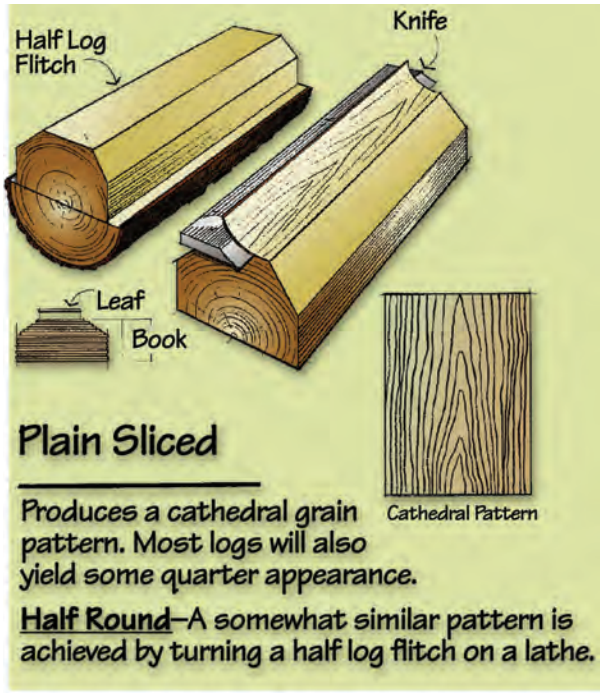


- Used in the majority of stock panels produced in North America
- Produces a broad, variegated pattern
- Yields the most veneer per log
- Can produce a limited amount of full-sized whole piece faces
- Generally, rotary cut veneer is less expensive than sliced veneer

Birch, Rotary, Whole Piece Face, C

Maple, Rotary, Book Match, Balance Match, A

Plain Sliced

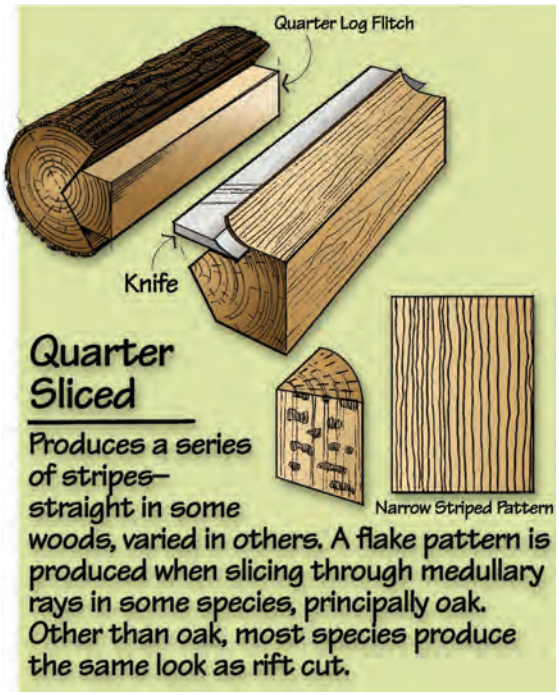


- Most common slicing method
- Veneer cut along the growth rings
- Frequently results in a combination of familiar "cathedral" pattern and straight grain patterns
- Because plain slicing offers the highest yield of the slicing methods, it is generally the least expensive

Red Oak, Plain Sliced, Book Match, Running Match, A

Red Oak, Plain Sliced, Slip Match, Running Match, A

Quarter Sliced

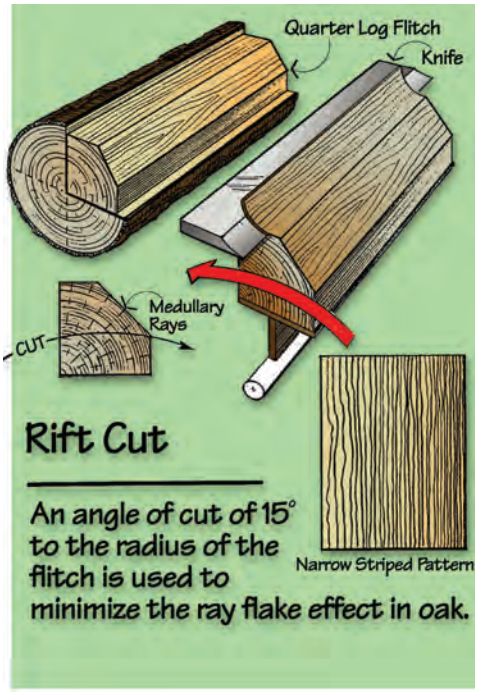


- Cut is perpendicular to the growth rings
- Produces a straight grain appearance
- May produce ray flake in red and white oak
- Produces narrower components than plain slicing
- Because quarter slicing yields less veneer per log than plain slicing, it is generally more expensive than plain slicing

Red Oak, Quarter Sliced, Book Match, Running Match, A

Red Oak, Quarter Sliced, Book Match, Running Match, A

Rift Cut



- Red and white oak are generally the only species that are rift cut
- Produces straight grain appearance in oak with minimal flake
- Produces the narrowest components of the slicing methods
- Because rift cutting yields the least veneer per log, it is generally the most expensive slicing method

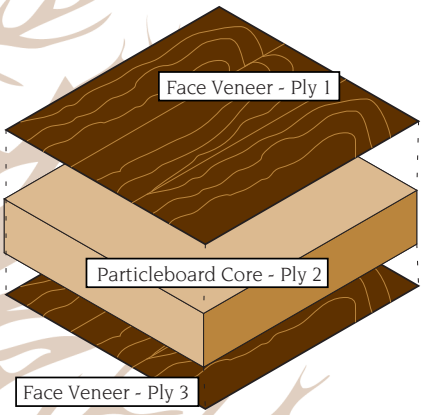
Red Oak, Rift Cut, Book Match, Running Match, A

Red Oak, Rift Cut, Book Match, Running Match, A

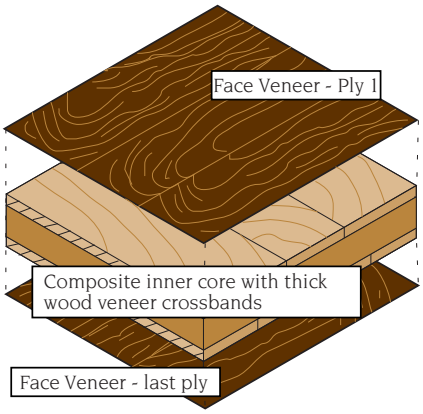
CORE TYPES

Although most people think only of a veneer core product when hardwood plywood is mentioned, hardwood plywood actually refers to any multi-ply panel product in which the face of the panel is hardwood or decorative softwood veneer. The illustrations on this page show the most common hardwood plywood constructions.

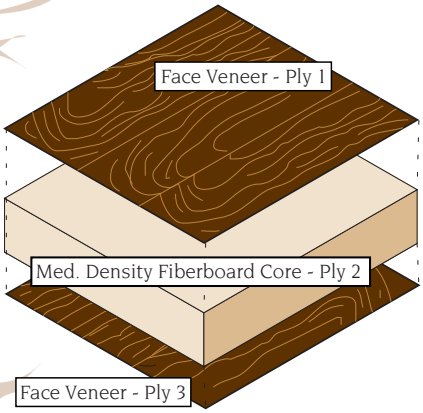
Types of Plywood



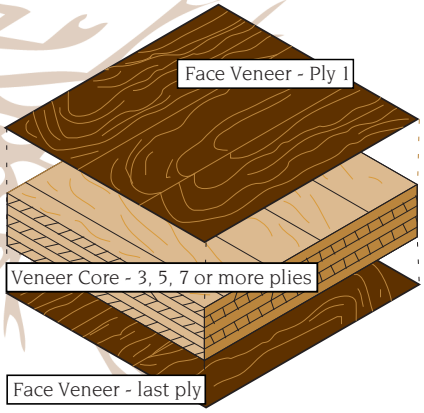
Particleboard Core Plywood



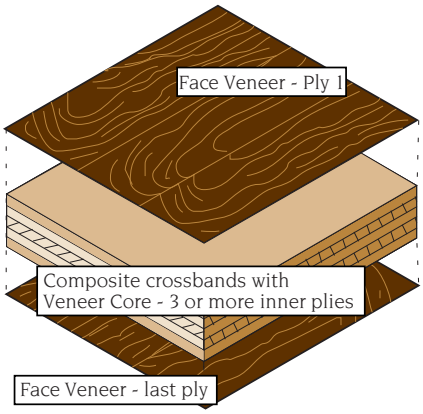
Combination Core Plywood with Composite Inner Ply



Medium Density Fiberboard Core Plywood



Veneer Core Plywood



Combination Core Plywood with Composite Crossbands

Panels made with different cores will have different properties. The following table provides a comparison of the properties for the different core types. The relative importance of specific properties can help you determine which core type should be used in a particular application.

Characteristics of Hardwood Plywood Core Materials

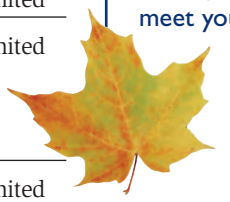
Panel Core Type	Flatness	Visual Edge Quality	Surface Uniformity	Dimensional Stability	Screw-holding	Bending Strength	Availability
Industrial Particleboard (Medium)	Excellent	Good	Excellent	Fair	Fair	Good	Readily
Medium Density Fiberboard (MDF)	Excellent	Excellent	Excellent	Fair	Good	Good	Readily
Veneer	Fair	Good	Fair	Excellent	Excellent	Excellent	Readily
Lumber	Good	Good	Good	Good	Excellent	Excellent	Limited
Combination Core with Composite Crossbands	Excellent	Good	Excellent	Good	Excellent	Excellent	Limited
Combination Core with Composite Inner Ply	Good	Fair	Good	Good	Good	Good	Limited
Moisture Resistant Particleboard	Excellent	Good	Good	Fair	Fair	Good	Limited
Moisture Resistant MDF	Excellent	Excellent	Excellent	Fair	Good	Good	Limited
Fire Rated Particleboard	Excellent	Fair	Good	Fair	Fair	Good	Limited

NOTES: Various characteristics above are influenced by the grade and thickness of the core and specific gravity of the core species. Visual Edge Quality is rated before treatment with edge bands or fillers, and Visual Edge Quality for lumber core assumes the use of "clear edge" grade. Surface Uniformity has a direct relationship to the performance of the fine veneers placed over the surface. Dimensional Stability is usually related to exposure to wide swings in relative humidity. Screwholding and Bending Strength are influenced by proper design and engineering.

Table Developed in Cooperation with the Architectural Woodwork Institute

Helpful Hint

Resource pressures have resulted in thinner face veneer that is less tolerant of core variations. When high quality finishes are required, talk to your supplier about which core option would best meet your needs.



MATCHING BETWEEN TWO ADJACENT VENEER LEAVES (MATCHING TYPE)

All spliced plywood faces are created by splicing multiple leaves of veneer together to form the plywood face. The most commonly used matching types are book, slip, random (or mismatch), pleasing, and plank match. Each type of matching produces a specific pattern, visual effect, and finished appearance. In some cases, the Standard specifies the match for a particular species and grade. **If another type of matching is required, it must be specified at the time the order is placed.**

Helpful Hint

The barber pole effect: The alternating leaves in book matched faces may reflect light and accept stain differently, creating a noticeable color variation. This effect can be minimized through the use of proper finishing techniques.

Book Match – The most common matching type. Alternating leaves of veneer are turned over, so that adjacent leaves are opened like the pages of a book.

- Visual effect: Veneer joints match, creating a symmetrical pattern. Yields maximum continuity of grain. Prominent characteristics will ascend or descend across the face.

Helpful Hint

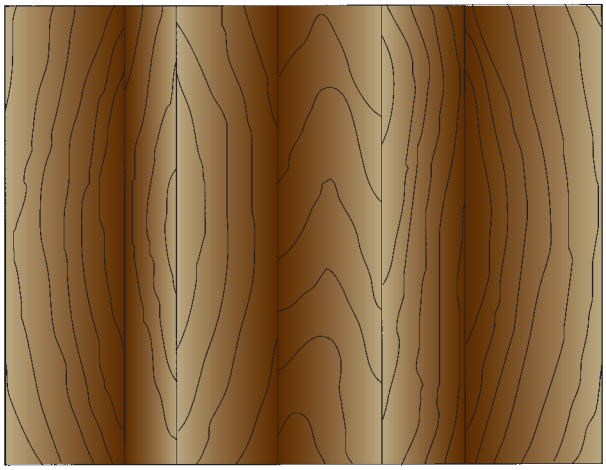
Slip matching eliminates the barber pole effect, but may reduce yield and increase cost.

Slip Match – Adjoining veneer leaves are fed out in sequence (without being turned) so that the same side of the veneer leaves is exposed.

- Visual effect: Figure repeats but grain does not match at joints. Enhances color uniformity because all faces have a similar light reflection. Joints may not be noticeable if grain is straight; vertical slant may occur if grain is not exactly vertical.

Helpful Hint

Availability of slip matched faces may be limited due to the general preference for book matched faces.

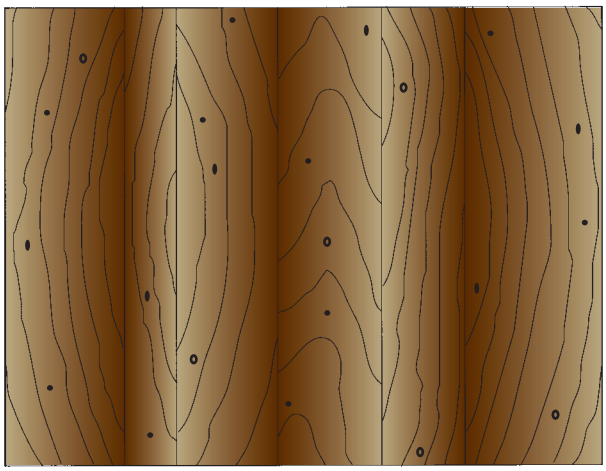


Random Match (Mismatch) – Veneer leaves of the same species are selected and assembled without regard to color or grain, resulting in variations, contrasts, and patterns of color and grain. Pleasing appearance is not required.

- Visual effect: No visual continuity across the face should be expected.

Pleasing Match – Veneer leaves are matched by color similarity.

- Visual effect: Provides an overall pleasing appearance. No sharp color contrasts are allowed at the joints. Grain characteristics may not match



Plank Match – Dissimilar (in color, grain, or width) veneer leaves of the same species are specially selected and assembled in a specific order to create a particular look. Plank matched faces are sometimes grooved at the joints between veneer leaves to simulate lumber planking.

- Visual effect: Casual or rustic effect. The components may be of different widths within the panel face.

Helpful Hint

As a flitch is sliced into veneer, the individual veneer leaves may increase or decrease in width. As a result, the number of veneer leaves per face may change as you move through the flitch.

ORGANIZATION OF THE INDIVIDUAL LEAVES WITHIN THE PANEL FACE (MATCHING ARRANGEMENT)

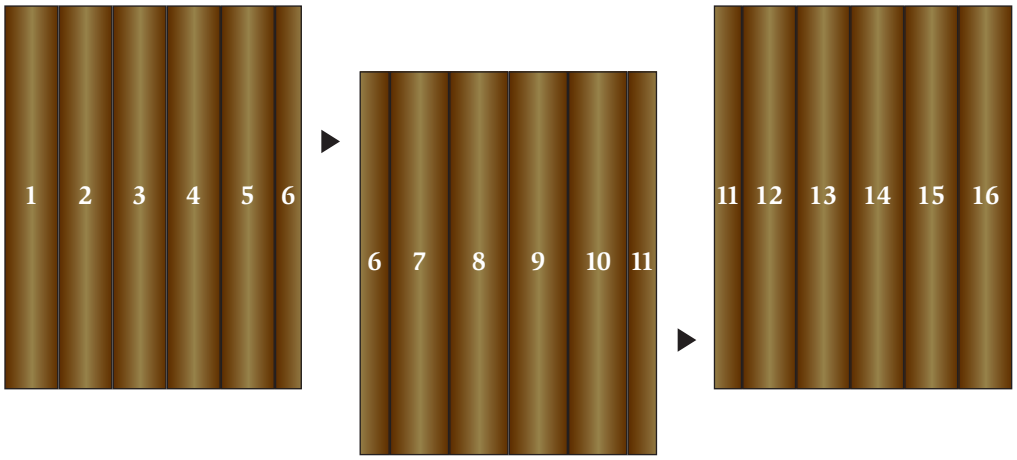
The most common methods of arranging book and slip matched leaves within a face are running, balance, and center matching (there is no matching arrangement associated with random, pleasing, plank, or whole piece faces). Unless otherwise specified, the matching arrangement will be selected by the manufacturer.

Running Match – The veneer leaves are fed continuously into the splicing machine, and the machine forms the individual faces by cutting the continuous ribbon of veneer at a pre-specified width without regard to the number of components in any one face or the width of those components. As a result, a veneer leaf may be split to form the end of one face and the beginning of the next. The trimmed leaves are known as "remainders."

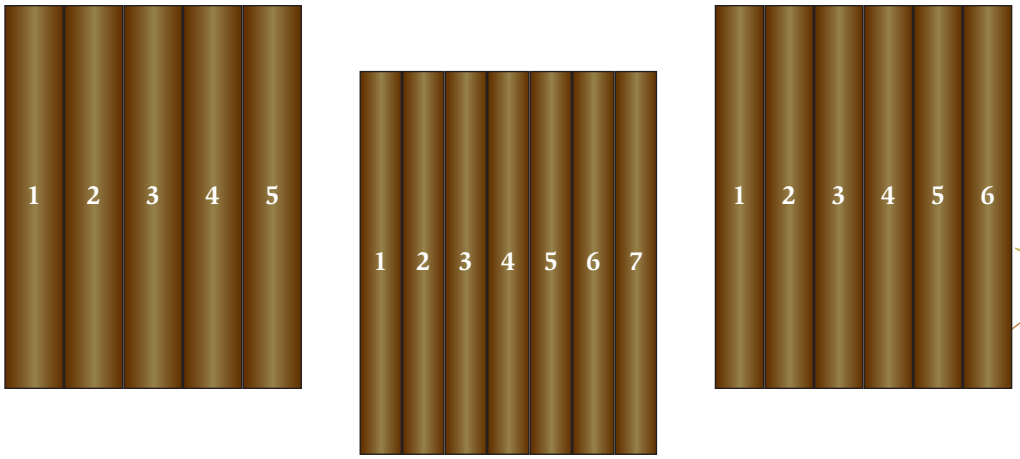
Balance Match – Each panel face is assembled from leaves of uniform width before edge trimming. This construction eliminates remainders and is usually more aesthetically pleasing than running match but comes at a higher cost.

Center Match – A special case of balance matching in which each panel is made from an even number of veneer leaves. The use of an even number of leaves results in a veneer joint in the center of the panel. This construction is more expensive than balance matching.

RUNNING MATCH



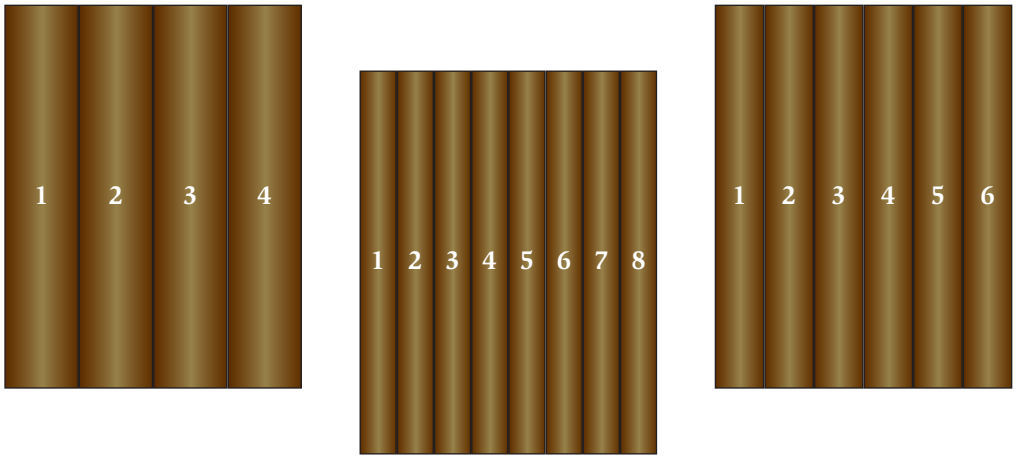
BALANCE MATCH



Helpful Hint

Final panel edge trimming may alter the dimensions of the outside two face components in balance and center matched panels.

CENTER MATCH



SPECIFYING HARDWOOD PLYWOOD

Grade, simply put, is a position in a scale of qualities. In the case of hardwood plywood, the appearance of the product is the primary determinant of the grade.

But how does one rate an infinitely variable product based upon an individual's perception of what it should look like? The answer is to use a published standard which defines the type and quantity of natural and other characteristics allowed in each grade. The *Voluntary Standard for Hardwood and Decorative Plywood,* maintained by HPVA, describes the appearance and performance characteristics of hardwood plywood. The use of the Voluntary Standard, recognized by manufacturers, distributors, and end users, improves the communications process when placing orders.

Helpful Hint

Periodically, the Standard is revised to meet the changing needs of the industry. Always make sure you are using the most recent version of the Voluntary Standard.

The current Standard defines six face grades (grades AA, A, B, C, D, and E), each of which is a range of appearances. Tables in the Standard, organized according to species, describe the allowable characteristics in each grade. Additionally, a comprehensive glossary defines the terms used throughout the Standard and the industry. As you move through the alphabetical grade order, more and progressively larger natural characteristics are allowed, with grade E allowing the largest and greatest number of natural characteristics and repairs. Back and inner ply grade tables in the Voluntary Standard also describe a similar progressive pattern. Because the grades describe an allowable range of a naturally variable product, there will always be some variance in the appearance of panels, even within the same grade.

HP-1: Your Assurance of Quality

Although the Standard is often thought of as *only* an appearance standard, it is actually much broader in scope. In addition to the appearance grade, the Standard also governs the construction, core and back grades, glue bond performance, formaldehyde emissions, moisture content, dimensions, and finish of the panel. A panel manufactured to the HP-1 Standard must meet or exceed the requirements for all of those critical performance indicators. Therefore, specifying an HP-1 panel is the best way to ensure you get a quality panel.

Helpful Hint

As the product specifications become more restrictive, the yield from the log decreases and the cost of the panel increases.

A statement such as: **"Manufactured according to HPVA HP-1"** on the purchase order along with additional information regarding the face, back, core type, quantity, etc. will give the manufacturer the information needed to provide the product you want. **Your role in obtaining the product you want cannot be overemphasized. Use the current Voluntary Standard to clearly communicate to the manufacturer exactly what you want!** To facilitate effective communication, a Hardwood Plywood Order Form has been provided at the end of this publication for your use.

HARDWOOD PLYWOOD FACE AND BACK GRADES

The following tables provide a general description of the hardwood plywood face and back grades as defined in the current Standard. For a complete understanding of the features and characteristics of each grade, please consult a copy of the current Voluntary Standard.

Face Grade Applications

AA	A premium face grade for exclusive uses such as architectural paneling and interiors, case goods, and quality furniture.
A	Where AA is not required but excellent appearance is still important.
B	Where the natural characteristics and appearance of the species are desirable.
C	Allows for unlimited color and increased natural characteristics. Perfect for applications where an economical panel is needed.
D and E	Provide sound surfaces but allow unlimited color variation; allow repairs in increasing size ranges. Applications: where surface will be hidden or a more rustic character is desired.

Back Grade Descriptions

1, 2, 3, and 4	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 worm holes not larger than 1.6 mm (1/16"). Grades 3 and 4 permit some open defects; however, grade 3 can be obtained 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") in diameter and open splits and joints limited by width and length.

Helpful Hint

Higher grade hardwood veneers should be considered when high gloss paint finishes will be used.

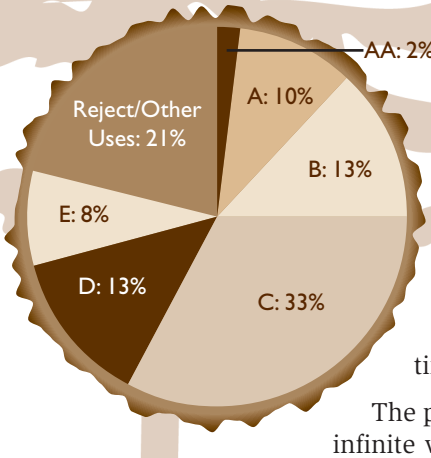
EXAMPLES OF COMMON GRADES AND SPECIES

The photographs on the following pages offer a visual interpretation of the hardwood plywood grades defined in the Voluntary Standard. Representative samples of the more common grades and species are shown. For each panel, the species, veneer cut, matching type, matching arrangement, and grade are given.

Because every log is different and the Standard provides for a range of appearances within each grade, there is no way that any set of photographs could ever capture all of the different appearances that one can expect to see in a grade. Therefore, these photographs are not to be used in place of the grade tables in the current Standard when ordering hardwood plywood, but are rather provided to give the reader a basic introduction to the different kinds of looks one can expect to see in the various grades and species.

It is important to remember that, because the grades define an acceptable range of a number of different characteristics, there is no absolute point that delineates where one grade ends and the next grade begins. As a result, the overall appearance of a panel that falls at the bottom of the AA range may be less aesthetically pleasing than the overall appearance of a panel at the top of the A range. As the following graphic shows, both the amount of overlap between grades and the range of acceptable appearances within a grade increase as you move through the grade order.

Another important grade consideration is the amount of material in each grade that is available for use. As the pressures on our hardwood resource continue to grow, it becomes increasingly important that we use that valuable resource as efficiently as possible. By their very nature, veneered hardwood plywood panels make exceptional use of this resource, but it is still important to consider what kinds of panels we use. As the accompanying graphic shows, the typical rotary hardwood log produces a large amount of B and C grade material but only a small percentage of AA grade material. Customers that automatically request an A or AA panel (without consideration of other grades) simply because they perceive it to be "the best" may in fact be doing themselves a disservice. When selecting panels for a job, take the time to determine whether or not a B or C grade panel might work for you. By considering a lower grade panel, you may be getting a significant value on a panel that will work just as well, while at the same time helping to maintain and preserve our treasured hardwood resource.



The panel photographs that follow are, again, only a brief pictorial representation of the infinite variety of appearances that one can expect to see in hardwood plywood. To prevent any potential misunderstanding when placing an order, it is imperative that you, the customer, select the appropriate grade for your needs from the current Standard and clearly communicate your choice to your supplier.

A NOTE ABOUT SAPWOOD AND HEARTWOOD

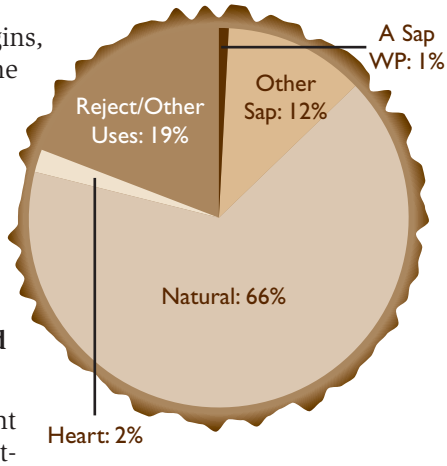
Every tree is sheathed in a thin layer of living cells that continually expand outward and grow the tree. The wood immediately inside this living ring is known as the **sapwood** of the tree and consists of cells that are still physiologically active and provide for the conduction of water and nutrients, the respiration and digestion functions of the tree, and mechanical support. As you move further in towards the center of the tree, however, the physiological activity of the cells slows until you reach a region of the tree called the **heartwood.** Heartwood cells are physiologically dead and serve only as mechanical support for the tree and as a repository for the tannins, oils, resins, gums, and other by-products of the tree's existence.

Helpful Hint

Be sure to clearly communicate your color preference to your supplier when placing an order.

In many hardwoods, the heartwood is much darker than the sapwood due to the resins and other extractives stored in the cells, and the veneer cut from these different regions will exhibit a marked difference in color.

Although it is often easy to see where the sapwood ends and the heartwood begins, the transition rarely forms a perfect cylinder within the tree (see photo). The veneer cut from this transitional region that contains both sapwood and heartwood is referred to as natural veneer. Quite often, the amount of veneer that can be cut from only the sapwood or heartwood of the tree is limited, while significant amounts of **natural** veneer may be produced (see chart).



The Voluntary Standard allows for natural color in any grade of ash, birch, maple, poplar, pecan, and hickory, and varying amounts of sapwood in grade A and lower panels of walnut, cherry, and oak. **Therefore, when specifying a panel, you should very clearly specify your color preference so that you and the seller agree on the color selection from the beginning.**

It is also important to note that the color of sapwood may naturally vary from a light white to a dark yellow within a single tree, and the darker color shades in the heartwood of a tree may also vary. Therefore, even when specifying only sapwood or heartwood you should expect some color variation within your panels.


Sapwood Panel


Natural Panel


Heartwood Panel

CHERRY

Cherry, Plain Sliced, Book Match, Center Match, AA

Cherry, Plain Sliced, Book Match, Running Match, A

Cherry, Plain Sliced, Book Match, Running Match, B

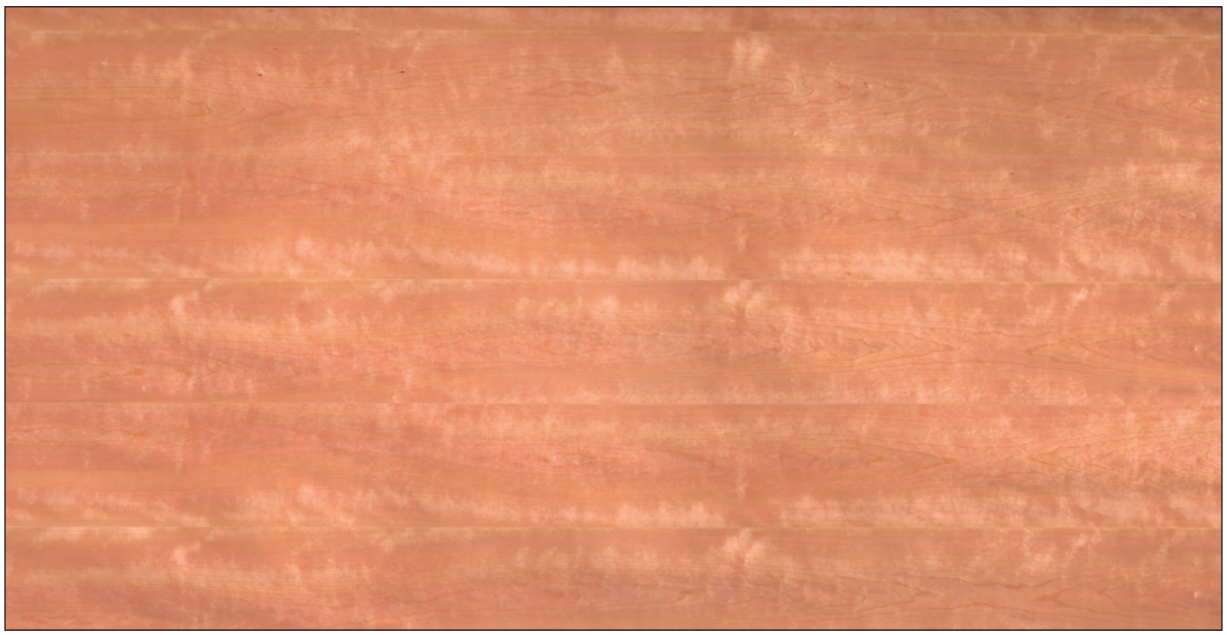
Cherry, Plain Sliced, Book Match, Running Match, C

Cherry, Plain Sliced, 1 Back

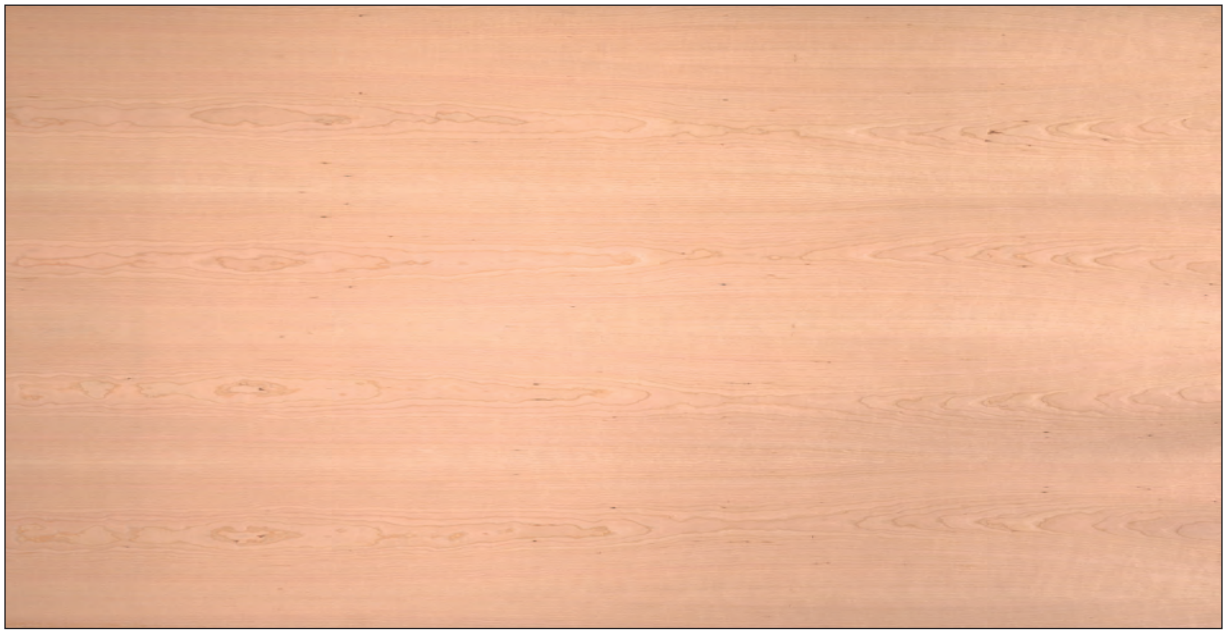
Cherry, Plain Sliced, 1 Back

Cherry, Plain Sliced, 1 Back

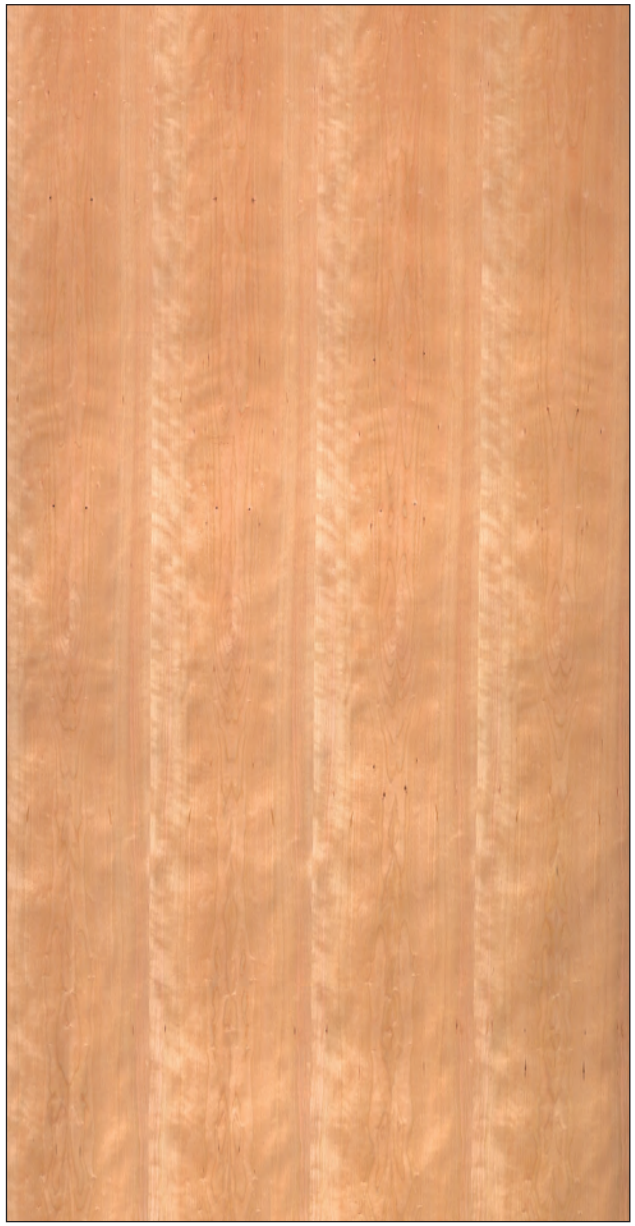
Cherry, Plain Sliced, 1 Back



Cherry, Plain Sliced, Book Match, Running Match, AA



Cherry, Plain Sliced, Book Match, Running Match, AA

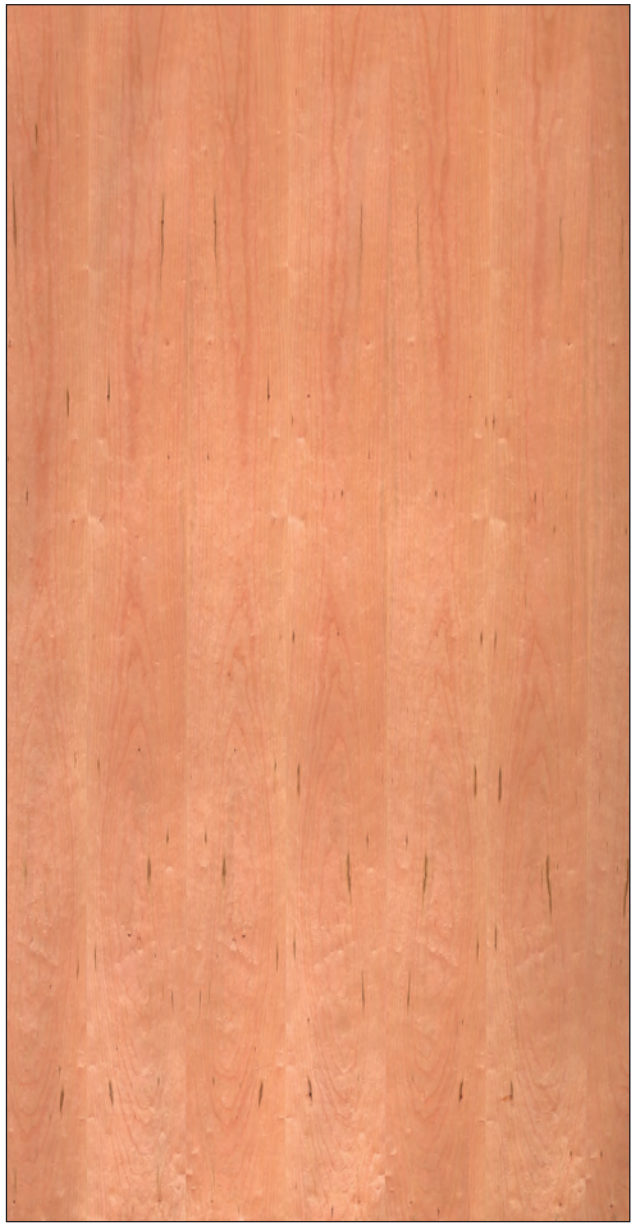


Cherry, Plain Sliced, Book Match, Center Match, A

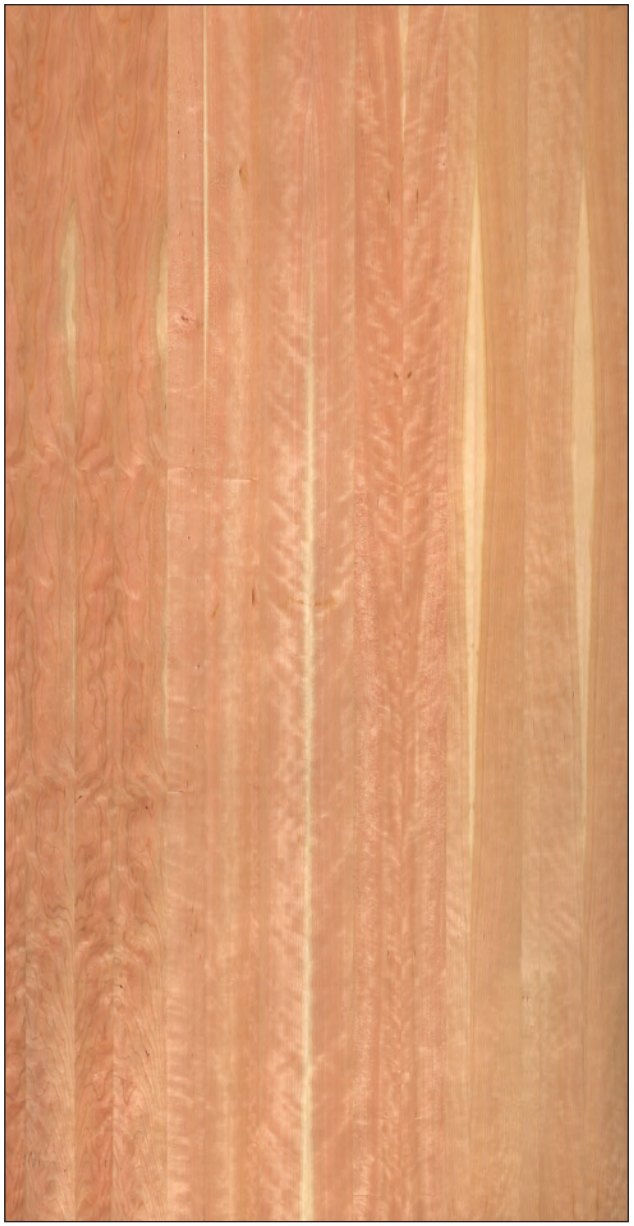
Cherry, Plain Sliced, Book Match, Balance Match, A

Cherry, Plain Sliced, Book Match, Running Match, B

Cherry, Plain Sliced, Book Match, Running Match, B



Cherry, Plain Sliced, Book Match, Running Match, C



Cherry, Plain Sliced, Mismatch, C

Helpful Hint

Natural color is allowed in any grade of birch. Be sure to clearly communicate your color preference to your supplier when placing an order.

BIRCH

Birch, Rotary, Whole Piece Face, A

Birch, Rotary, Book Match, Balance Match, B

Birch, Rotary, Whole Piece Face, C

Birch, Rotary, Whole Piece Face, D

Birch, Rotary, 4 Back

Birch, Rotary, 3 Back

Birch, Rotary, 2 Back

Birch, Rotary, 1 Back

Birch, Rotary, Book Match, Balance Match, A

Birch, Rotary, Book Match, Center Match, A

Birch, Rotary, Book Match, Center Match, A

Birch, Rotary, Book Match, Running Match, B

Birch, Rotary, Pleasing Match, B

Birch, Rotary, Book Match, Balance Match, B

Birch, Rotary, Whole Piece Face, C

Birch, Rotary, Whole Piece Face, C

Birch, Rotary, Whole Piece Face, D

Birch, Rotary, Whole Piece Face, D

Birch, Rotary, Whole Piece Face, E

Birch, Rotary, Whole Piece Face, E

Helpful Hint

Natural color is allowed in any grade of maple. Be sure to clearly communicate your color preference to your supplier when placing an order.

MAPLE

Maple, Plain Sliced, Book Match, Running Match, A

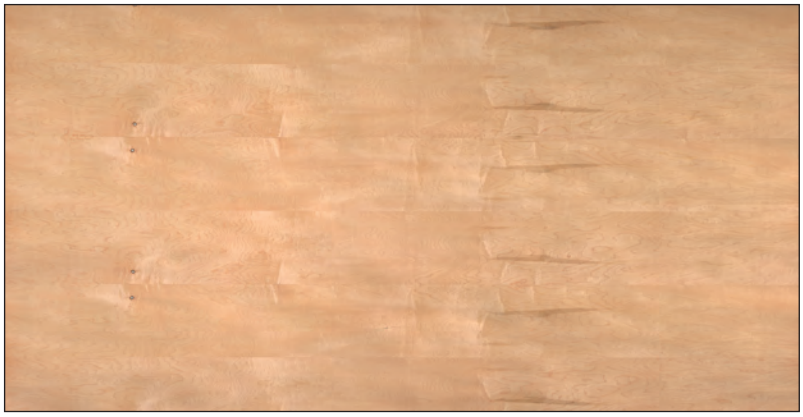
Maple, Rotary, Whole Piece Face, B

Maple, Rotary, Slip Match, Balance Match, C

Maple, Rotary, Whole Piece Face, D

Maple, Rotary, 4 Back

Maple, Rotary, 3 Back



Maple, Rotary, 2 Back

Maple, Rotary, 1 Back

Maple, Plain Sliced, Book Match, Center Match, AA

Maple, Plain Sliced, Book Match, Running Match, AA

Maple, Rotary, Book Match, Balance Match, A

Maple, Plain Sliced, Book Match, Balance Match, A

Maple, Rotary, Book Match, Balance Match, B

Maple, Rotary, Whole Piece Face, A

Maple, Rotary, Slip Match, Center Match, B

Maple, Rotary, Book Match, Balance Match, B

Maple, Rotary, Book Match, Balance Match, C

Maple, Rotary, Whole Piece Face, C

Maple, Rotary, Whole Piece Face, D

Maple, Rotary, Whole Piece Face, E

RED OAK

Red Oak, Plain Sliced, Book Match, Running Match, AA

Red Oak, Plain Sliced, Book Match, Running Match, A

Red Oak, Rotary, Book Match, Balance Match, B

Red Oak, Rotary, Whole Piece Face, C

Red Oak, Rotary, 1 Back

Red Oak, Rotary, 2 Back

Red Oak, Rotary, 3 Back

Red Oak, Rotary, 4 Back

Red Oak, Plain Sliced, Book Match, Running Match, AA

Red Oak, Plain Sliced, Book Match, Running Match, AA

Red Oak, Plain Sliced, Book Match, Running Match, A

Red Oak, Plain Sliced, Book Match, Running Match, A

Red Oak, Rotary, Book Match, Balance Match, A

Red Oak, Rotary, Book Match, Balance Match, A

Red Oak, Rotary, Slip Match, Balance Match, B

Red Oak, Rotary, Book Match, Running Match, B

Red Oak, Rotary, Whole Piece Face, C

Red Oak, Rotary, Whole Piece Face, C

PINE

Pine, Plain Sliced, Book Match, Running Match, A (Clear)

Pine, Plain Sliced, Plank Match, A (Knotty)

Pine, Plain Sliced, Plank Match, B

Pine, Plain Sliced, Plank Match, C

WHITE OAK

White Oak, Plain Sliced, Book Match, Running Match, AA

White Oak, Plain Sliced, Book Match, Balance Match, A

White Oak, Quarter Sliced, Book Match, Running Match, B

White Oak, Plain Sliced, Mismatch, C

WALNUT

Walnut, Plain Sliced, Book Match, Running Match, A

Walnut, Plain Sliced, Book Match, Running Match, B

Walnut, Plain Sliced, Book Match, Running Match, C

Walnut, Plain Sliced, Mismatch, C

ASH

Ash, Rotary, Book Match, Running Match, A

Ash, Plain Sliced, Book Match, Running Match, B

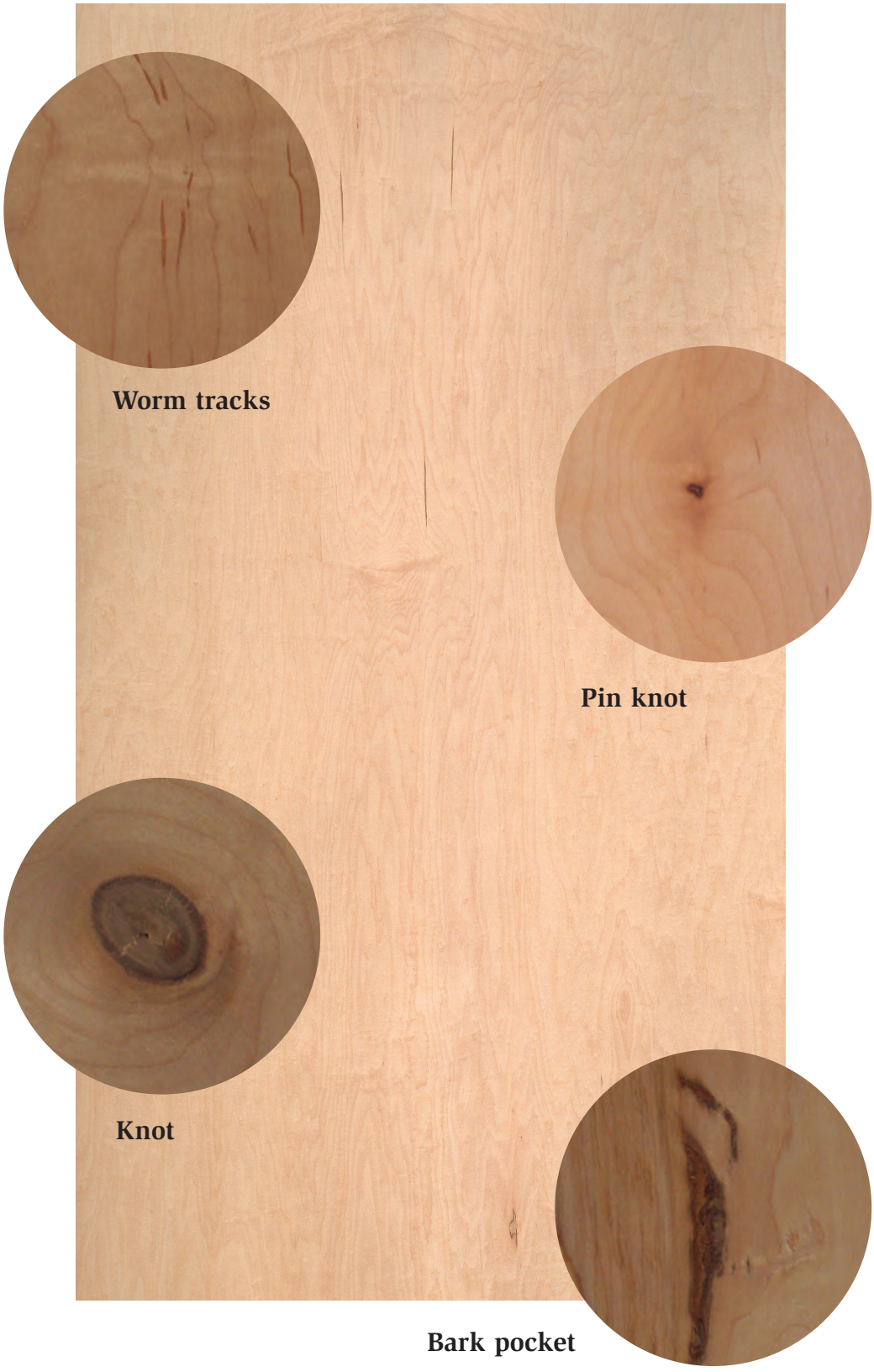
Ash, Rotary, Whole Piece Face, C

Ash, Rotary, Whole Piece Face, D

NATURAL CHARACTERISTICS OF CHERRY

NATURAL CHARACTERISTICS OF RED OAK

NATURAL CHARACTERISTICS OF MAPLE



NATURAL CHARACTERISTICS OF BIRCH

COMMON CHARACTERISTICS IN HARDWOOD PLYWOOD

Burl

Pin knot

Knot

Bark pocket

Mineral

Gum

Helpful Hint

Because the Standard allows for a range of characteristics within each grade, you should talk with your supplier if you want panels with a specific look.

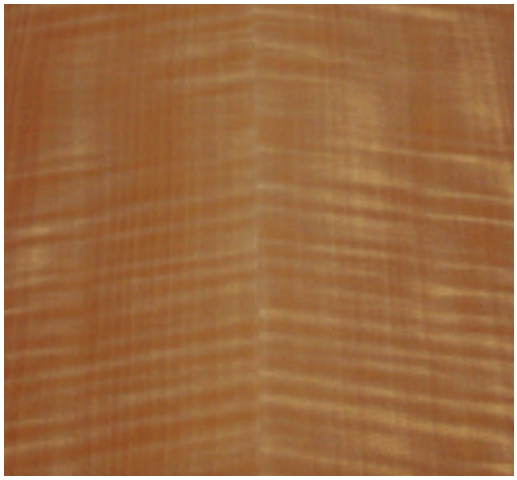
Worm track (Commonly, but incorrectly, referred to as 'vine mark' or 'sugar')

Flake

Helpful Hint

By its nature, figure is difficult to quantify. It is therefore important to clearly explain to your supplier the amount and type of figure that you find acceptable.

Repaired split



Cross bar figure

Manufactured cathedral (Also referred to as 'split heart')

Repaired knot

MAINTAINING THE QUALITY: PROPER HANDLING AND STORAGE

Between the time they are manufactured and put into their final application, there are many opportunities for hardwood plywood panels to be damaged. The following handling and storage tips should be observed at every step along the route to ensure the panels reach their final destination unscathed.

Handling

- Minimize Movement – The best way to minimize handling damage is by handling the panels as little as possible. Plan your warehousing and process flow operations to minimize the need to handle the panels.
- Proper Strapping – When you do need to move panels, make sure that they are properly secured and strapped. This will minimize the chances that the units will unexpectedly shift during transport.
- Dunnage – Keep the panels properly protected until they are ready for use on the job site. The proper dunnage will absorb many handling dings and nicks before they reach the panels.
- Training – Properly trained employees are your best defense against damage. Make sure all employees are trained in the proper and safe use of fork trucks, pallet jacks, and other handling equipment. If your employees are careful and know how to handle panels, your panels will be in good shape.

Storage

- Proper Stacking – Proper stacking is vitally important to protecting panels. Make sure you maintain clean stacks with no protruding edges. When stacking units, keep like lengths of similar product together and maintain proper alignment and quality of stacking sticks to avoid bending or flexing panels. The sticks should be thick enough to allow fork truck tines to pass unobstructed between units. Maintaining safe stack heights and equal row spacings will keep your panels and employees safe.
- Temperature – Wood is a natural material and is negatively affected by extreme swings in temperature. Also, wood stored in direct sunlight may heat up enough to warp. To minimize damage, storage temperatures should be maintained between 60–90°F.
- Moisture – Extreme swings in humidity and direct contact with water can both damage the appearance and performance of hardwood panels. It is extremely important to store panels in a climate controlled environment to eliminate the impacts of moisture. The storage environment's relative humidity should mimic the anticipated service environment, usually 30–55% RH.
- Light – Although most wood will change color upon exposure to sunlight, the effect is more pronounced in some of the species commonly used in hardwood panels. Cherry, for example, will begin to change color within a few hours of exposure to sunlight. For that reason, panels should be neatly stacked and covered during storage.
- Coverings – If plywood is received with poly or plastic wrapping, the wrapping should be loosened to allow the wood to breath. Tight wrapping may create condensation and encourage mold. Also, opened units should have cover sheets to promote cleanliness and prevent discoloration from light exposure.

Delivery and Fabrication

- Acclimation Period – Do not deliver panels to the job site until they are needed and the site is ready, but allow at least 48 hours for the panels to acclimate to the use environment before installation. Panels that aren't given enough time to acclimate on the job site prior to fabrication may warp during use.

TROUBLESHOOTING COMMON HARDWOOD PLYWOOD PROBLEMS: QUICK REFERENCE

Problem	Description	Solution	Prevention
Barber pole	Light and dark color variations in adjacent veneer components in a single sheet of plywood. Occurs naturally when book matching face veneers.	Difficult after staining. Proper finish procedures recommended prior to finishing project.	Sanding, wash coat, glue sizing. Slip match components.
Checking	Small slits or splits in the face veneer.	Very difficult.	Climate controlled environment. Detection by end user prior to panel processing.
Contamination	Random spots or blotches caused by contamination by water, oil, etc. May be confused with natural figure.	Difficult after staining. Sand back to raw wood, use proper finishing techniques.	Proper storage and handling to prevent contamination. Detection by end user prior to panel processing.
Core telegraph	Core voids, laps, or other irregularities detectable on the surface of the panel. May only be visible after finishing.	None	Discuss core options with your supplier. Detection by end user prior to panel processing.
Delamination	Separation of panel plies.	Normally detected by end user at panel cut up. Return for credit as originally supplied.	May occur as a result of manufacturing problems or improper care and storage.
Glue bleed-through	Spots where stain will not penetrate. Normally in areas of open grain in oaks and ash or at splice lines of veneers.	Sanding, special techniques by qualified finisher.	Sanding. Detection by end user prior to panel processing.
Iron stain (blue stain)	Blue or black stain, primarily in oak.	Sanding or chemical treatment.	Sanding, proper material handling and storage. Awareness of the cause. Detection by end user prior to panel processing.
Knife marks	Thin scratches in the veneer across the grain. Frequently not visible until application of stain.	Sanding	Sanding. Detection by end user prior to panel processing.
Natural figure	Random dark areas or blotches caused by the grain or natural figure in the wood.	Difficult after staining. Sand back to raw wood, use proper finishing techniques.	Detection by end user prior to panel processing. Proper finishing procedures can minimize blotches.
Warping	Panel deviation from a flat plane.	Allow climate acclimation.	Climate controlled environment. Maintain balanced construction and same species front and back.
Windshake	Ruptured and rough grain.	None	Select higher grade veneers.

TROUBLESHOOTING AT THE FINISH LINE: THINKING AHEAD TO PREVENT PROBLEMS

Barber pole occurs as a natural effect of book matched veneers. When veneer is cut, the knife creates a "loose" side with open grain on the bottom of the piece of veneer and a "tight" side with compressed grain on the top of the next piece of veneer. The process of book matching flips each adjacent veneer component, thereby alternating the loose and tight sides. The loose and tight sides of the veneer may absorb stain differently, creating alternating light and dark veneer components. In addition, the loose and tight sides may reflect light differently, compounding the problem. The best method of eliminating the barber pole effect is through glue sizing or the use of a wash coat prior to finishing to even out the veneer surfaces.

Checking due to stress from dimensional changes in the panel plies is most commonly seen as splits in the face veneer parallel to the grain. The greater the moisture change in the plywood, the more likely it is that checks will occur. Face checking can also occur if too much surface finish is applied to a panel or if subsequent coats of finish are applied before the previous coat is completely dry. If the finish is too thick, it may not have sufficient elasticity to move with the natural changes in the underlying wood substrate. These checks will appear in the finish, and not necessarily in the face veneer.

Contamination of panel products may occur during manufacturing, transportation, handling and storage, or a variety of other opportunities. The most common causes of contamination are water, perspiration, oil, or adhesives. The stains may not be visible prior to staining and each type may require different solutions. Proper sanding prior to staining and finishing is the best way to minimize finish problems from contamination.

Core lap occurs when an inner ply veneer leaf overlaps the veneer leaf adjacent to it rather than evenly butt joining. The result is an area with an extra layer of veneer in the inner ply. As the plywood is pressed, the core lap area resists compression, creating a slightly raised area of more highly compressed veneers in the finished panel. When the panel is further processed by sanding, the sander may burn or polish the high spot. This area will receive stain differently than the rest of the panel.

Core telegraphing, most often associated with veneer cores, results from irregularities in the core. Veneer core plywood is the most popular core choice. However, because veneer core is an assembled product there is a higher chance of core irregularities and thickness variations. The specifier should discuss the available core options with their supplier when core telegraphing is a problem.

Delamination is a separation of plies through failure of the adhesive bond. Several conditions, normally related to moisture, may cause delamination. The end user should understand that delamination is a rare occurrence. It is usually identified at the time the panel is cut and replacement as originally supplied is normal for most manufacturers.

Detection prior to processing. **Visual inspection** by the end user is the most basic requirement of proper finishing. All panels should be inspected for damage or problems before any work is begun, and any problems should be fixed as soon as they are noted. Most problems can be solved prior to staining and application of the topcoat, but not after.

Finish sampling involves finishing selected components early in the project to confirm the look of the finished product. The more critical the end appearance, the earlier the sampling should occur, in some cases prior to assembly of the parts. If finish samples are not practical, consider a simple **pre-wipe of mineral spirits** on selected components. Defects will be visible and, after sanding, the pre-wipe will not affect the finish.

Glue bleed through may occur through pores of open grain woods or at splice lines of veneer components. For the end user, the best solution for this problem is detection prior to processing of the plywood panel and sanding of the affected areas.

Helpful Hint

Solid wood and veneer will finish differently, even when they're of the same species. Use care when finishing a project that contains both.

Glue sizing involves applying a solution of diluted glue to the face of the panel to even out irregularities in the panel surface and provide for a more uniform surface for finishing. This technique is especially helpful in solving problems like barber pole and end grain figure that are caused by differences in the wood surface.

Iron stain, sometimes called "blue stain," may occur in oak veneers when the natural tannic acid in the wood comes in contact with iron and moisture. The source of iron may be the manufacturing equipment used in production or even steel wool, which should not be used on raw wood. Enough moisture may develop during heavy rains and high humidity conditions, particularly in buildings not yet humidity controlled, to create a problem. These stains may be sanded out or removed chemically.

Knife marks occur when the veneer knife develops nicks or imperfections that are then transferred to the veneer surface. For the end user, the best solution for this problem is detection prior to processing of the plywood panel and sanding of the affected areas.

Natural figure occurs naturally in wood and is caused by unusual growth patterns in the wood. Some form of figure is often present in wood, so it is important to discuss your tolerance for figure with your supplier when specifying panels. The unusual grain patterns in figure can present finishing difficulties. Dark stains present special challenges as the darker the stain, the greater the chance of uneven color consistency. The finisher should analyze each individual situation carefully and consider the use of a wash coat or glue sizing if appropriate.

Sanding is a mandatory finishing step. Preparation is everything. The panel should not be considered finish sanded until the proper sanding is performed just prior to finishing. Handling marks, perspiration stains, raised grain from humidity, and inconsistent grain characteristics will always exist in the product. Complete and even sanding is the most important step in creating a fine finish.

Helpful Hint

Panels are **not** finish sanded at the mill. The end user must sand the entire panel before finishing.

Warping is any distortion of a panel from an even plane. Warping may be caused by extreme climate changes or by components on each side of the center ply that are not reasonably balanced in species, thickness, moisture content, grain orientation, or dimensional change coefficients. Maintaining a balanced panel construction (including the same wood species on the front and back of the panel and finishing the back of the panel as well as the front) and allowing the panels to acclimate to a climate controlled environment before processing will reduce the likelihood that a panel will warp.

Wash coat is a diluted solution of lacquer or sanding sealer applied to wood to even out the grain texture of the panel and promote uniform stain penetration. Formulas vary, but 8 to 10 parts thinner to one part sealer is recommended. After the wash coat has dried, the panel must be sanded back to the wood using 150-180 grit sandpaper.

Helpful Hint

Once a panel has been sanded, it must be finished within 24 hours. Panels held longer than 24 hours after sanding must be re-sanded.

Water spots occur any time water touches the panel and result in raised grain that accepts stain more readily than other areas. Water spots may be eliminated through sanding. In extreme cases, the entire panel should be wiped with a mix of 25% lukewarm water to 75% alcohol. Apply this evenly to the entire panel surface. After drying, sand the entire product. Check the moisture content before finishing.

Windshake is a generic term used to describe veneer surface roughness caused by several conditions. It is identified as a rupture in the grain that usually follows the annual growth rings. Sanding will not remove windshake as it permeates the entire veneer thickness. Windshake is not allowed in the higher grades of veneer.

For more detailed product and finishing information, the reader is encouraged to read the following publications, which are available for purchase from HPVA's website, www.hpva.org:

- A Complete Guide to Hardwood Plywood and Face Veneer, Ang Schramm
- Taunton's Complete Illustrated Guide to Finishing, Jeff Jewitt
- Technical Brief, "Moisture Management for the Control of Checking and Warping in Hardwood Plywood Panels"
- Ply-Tips Vol. 1, "Helpful Hints to Ensure a Beautiful Finish on Wood Veneered Products"
- Ply-Tips Vol. 2, "Preventing Checking and Warping in Wood Veneered Panels"
- Ply-Tips Vol. 3, "Proper Preparation Procedures for Finishing Wood"
- Ply-Tips Vol. 4, "Solutions to Common Wood Finishing Problems"

HARDWOOD PLYWOOD ORDER FORM

Your name _____ Company name _____

Address _____

Phone _____ Fax _____

Email _____

Ordering plywood in accordance with the American National Standard for Hardwood and Decorative Plywood?
❑ YES ❑ NO Standard Version _____

Intended End Use of Product _____

_____

Face Species _____ Face Grade _____

Color Selection (if applicable) _____

Back Species _____ Back Grade _____

Panel Width _____ Panel Length _____

Panel Thickness _____ Number of Plies _____
(include face and back)

Veneer Cut

❑ Rotary ❑ Plain Sliced ❑ Rift ❑ Quarter Sliced

Matching Type

❑ Book ❑ Slip ❑ Whole Piece ❑ Random ❑ Pleasing ❑ Plank

❑ Other _____

Matching Arrangement

❑ Running ❑ Balance ❑ Center ❑ Other _____

Core Material

❑ Veneer; Grade _____ ❑ Particleboard ❑ MDF
❑ Combination with composite inner ply
❑ Combination with composite crossband ❑ Other _____

Bond Type

❑ Technical ❑ Type I (Exterior) ❑ Type II (Interior)

Special Requirements (curved, prefinished, etc.) _____

_____

_____

Number of Panels _____ Delivery Date _____

Price Information _____ Manufacturer _____

Comments _____

_____

_____

_____

_____

MAKING A CLAIM

By purchasing an HP-1 panel, you have a line of recourse should it become necessary to file a claim. Copies of the purchase documents will state specifically what product was ordered.

A 5% tolerance on any given order or shipment is allowed: 95% must meet or exceed minimum requirements and, thus, no more than 5% of the order may be out of spec. If you are unhappy with a shipment, the first thing to do is to contact your supplier. In most cases the issue will be clarified and the matter resolved. If a claim is still warranted, please keep the following in mind:

- All complaints regarding the quality of a shipment should be made within 15 days of receipt of the product.
- The purchaser must report any defects as soon as they are noticed, and before any further processing is completed.
- If an attribute of the panel that is governed by the Standard (glue bond, moisture content, formaldehyde level, grade, etc.) is in question, a reinspection by a qualified agency may be requested (see *HPVA Dispute Settlement Service below*).
- If a reinspection is requested, the attribute(s) in question must be clearly specified. Only those attributes that are specifically identified are open for reinspection.
- The cost of the reinspection will be paid by the seller if the shipment is more than 5% out of spec.
- The cost of the reinspection will be paid by the buyer if the shipment is less than 5% out of spec.
- The seller is not responsible for any of the cost of processing already completed on defective panels.
- If the shipment is more than 5% out of spec, the buyer does not have to accept those panels that, as a result of the reinspection, are determined to be out of spec, but should accept the balance of the shipment as invoiced.
- The responsibility of the seller is limited to the replacement of, or the cost of, defective materials as specified in the original purchase agreement.

Helpful Hint

Many stock panel manufacturers tint their adhesives with a unique identifier to aid in identification. Contact HPVA for help identifying a panel if the manufacturer is in doubt.

HPVA Dispute Settlement Service

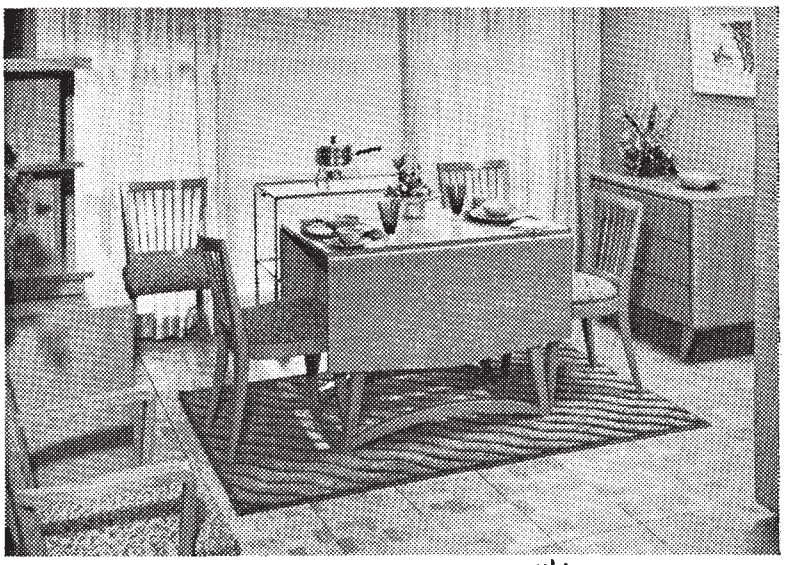
As outlined in the above section, claims may be reinspected by a qualified agency. The criteria for such an agency are that it:

- has the facilities and trained technical personnel to perform the reinspection
- has developed procedures to be followed in performing the reinspection
- is not financially dependent upon any single company manufacturing the product
- is not owned, operated, or controlled by any such company

The Hardwood Plywood and Veneer Association meets these criteria and offers a dispute settlement service to both members and non-members alike. To find out more about this service, contact HPVA.

It was as true then as it is now . . .

hpi Hardwood plywood



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helps you trade-up...for more profit per sale...

The sales-making final touch for smartly-designed furniture is the natural warmth and beauty of stronger, sturdier *HPI* Hardwood Plywood! It provides deep lasting elegance, *enduring* quality that no superficial substitute can ever hope to match. That's why you sell *faster*, trade-up *easier* . . . when you feature the distinctive beauty, extra value of *HPI* Hardwood Plywood!

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