

Architectural
Woodwork Standards

SHEET PRODUCTS

SECTION



SECTION 4

Sheet Products

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introductory information

INTRODUCTION

Section 4 is the second “material” section. This section includes a wide range of sheet goods, Hardwood and Softwood Veneers, High Pressure Decorative Laminate, Overlays, Backers, Solid Surface, Solid Phenolic, Epoxy Resin, and Natural and Manufactured Stone. This section identifies common panel cores and panel surfaces referred to in subsequent product sections. It contains material rules specific to all of the sheet products the section covers.

Quality assurance can be achieved by adherence to the AWS and will provide the owner a quality product at competitive pricing. Use of a qualified Sponsor Member firm to provide your woodwork will help ensure the manufacturer’s understanding of the quality level required. Illustrations in this Section are not intended to be all inclusive, other engineered solutions may be acceptable. In the absence of specifications; methods of fabrication are the manufacturer’s choice. The design professional, by specifying compliance to the AWS increases the probability of receiving the product quality expected.

PLYWOOD

The term “plywood” is defined as a panel manufactured of three or more layers (plies) of wood or wood products (veneers or overlays and/or core materials), generally laminated into a single sheet (panel).

TYPES OF PANELS

There are a wide range of panel materials available for the fabrication of architectural woodwork.

Property and performance characteristics are influenced by the panel grade, panel thickness, and materials used for the core:

- Surface uniformity has a direct relationship to the performance of the face veneers.
- Dimensional stability relates to the effect of exposure to wide swings in temperature and relative humidity.
- Screw holding and bending strength are influenced by and should be considered in design engineering.

Architectural panels with applied decorative surface materials are made up of a variety of core types including: Particleboard, Medium Density Fiberboard (MDF), Veneer, Hardboard, Lumber, Combination and Agrifiber/Agrofiber.

PRIMARY CORE MATERIALS

- **Industrial Grade Particleboard** - Sometimes referenced as composite core, is made of wood particles of various sizes that are bonded together with a synthetic resin or binder under heat and pressure.

Medium Density Industrial Particleboard is used in the broadest applications of architectural woodwork. It is especially well suited as a core for veneers and decorative laminates.

When used as panels without surface plies, the product is referred to as particleboard. When used as an inner core with outer wood veneers, the panel is referred to as particle core plywood.

Industrial particleboard is commercially classified by “density,” which is measured by the weight per cubic foot of the panel product.

- Medium Density (M series) = generally between 40-50 pounds per ft³ (640-800 kg per m³).
- High Density (H series) = generally above 50 pounds per ft³ (800 kg per m³).

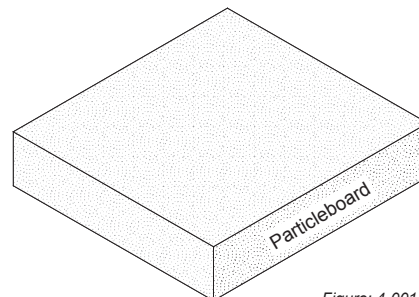


Figure: 4-001

- **Moisture resistant particleboard** - Some Medium Density Industrial Particleboard is bonded with resins more resistant to swelling when exposed to moisture. The most common grades are ANSI A-208.1 (latest edition) Type M-2-Exterior Glue and M-3-Exterior Glue.

- **Fire Retardant Particleboard** - Some Medium Density Industrial Particleboard has been treated during manufacture to carry a UL stamp for Class I flame spread rating (Flame spread 20, Smoke developed 450). Fire retardant Medium Density Fiberboard is also available.

- **Medium Density Fiberboard (MDF)** - Sometimes referenced as composite core, is made of wood particles reduced to fibers in a moderate pressure steam vessel, combined with a resin, and bonded together under heat and pressure.
- Due to the finer texture of the fibers used in manufacturing Medium Density Fiberboard (MDF) it is smoother than Medium Density Particleboard. The uniform texture and density of the fibers create a homogenous panel that is very useful as a core for paint, thin overlay materials, veneers and decorative laminates. MDF is among the most stable of the mat formed panel products. When used as an inner core with outer wood veneers, the panel is referred to as MDF core plywood.

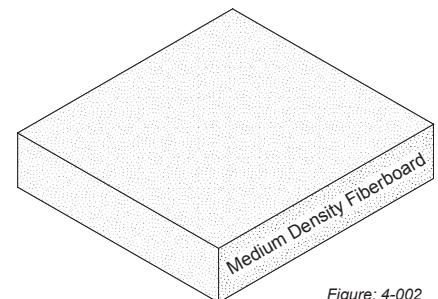


Figure: 4-002

- **Moisture Resistant Mdf** - Can be manufactured to meet the ANSI A-208.2 (latest edition) reduced thickness swell criteria.
- **Veneer** - Is separated into two groups according to materials and manufacturing:
 - **Hardwood Veneer** - Panels manufactured of hardwood veneers.
 - **Softwood Veneer** - Panels manufactured of softwood veneers.

Hardwood or Softwood Veneers used as a core is not recommended in many areas of the AWS due to poor stability, but do have many other structural characteristics. It is recommended that veneer core panels be used only when they can be housed or in areas where warping is not a significant issue.

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PRIMARY CORE MATERIALS (continued)

• Veneer (continued)

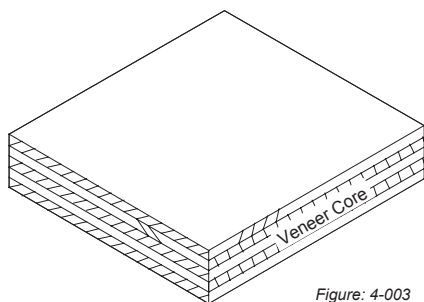


Figure: 4-003

What many think of as traditional "plywood", is a panel core made up of an odd number of plies, 3 or more (except when the center is constructed of two unidirectional plies), alternating layers of veneers, all less than 1/4" (6.4 mm) thick, pressed and glued into a single sheet. The two outside veneer layers are the Face and Back. The interior veneer bands are cross bands and parallel bands. The latter is sometimes referenced as centers. Veneer bands are layered at right angles to the adjoining veneer layer.

- **Hardboard** - Is defined as inter felted fibers consolidated under heat and pressure to a density of 500 kg per m³ (31 pounds per cubic foot) or greater.

Hardboard is available with either one side (S1S) or two sides (S2S) smooth.

There are typically two types of hardboard core used by architectural manufacturers:

- Standard (untempered).
- Tempered, which is standard hardboard subjected to a curing treatment increasing its stiffness, hardness, and weight.

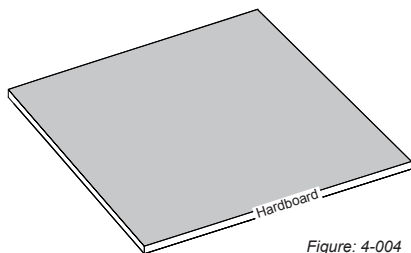


Figure: 4-004

- **Lumber** - Is where the center ply, called the "core" is composed of strips of lumber edge glued into a solid slab. This type is usually 5-ply, 3/4" (19 mm) thick, but other thickness from 1/2" (12.7 mm) to 1-1/8" (28.6 mm) are manufactured for special uses. There are three main types:

- **Staved** - is where the core strips are random length and butt joined.
- **Full Length** - is where the core strips are one piece in length.
- **Banded** - is where the outside strips run full length and the others are random length. Banding may be the same species of lumber as the rest of the core, but it is usually matched to the face and might include all four edges. Banded plywood is typically produced for special uses, such as furniture, desk tops, and cabinet doors.

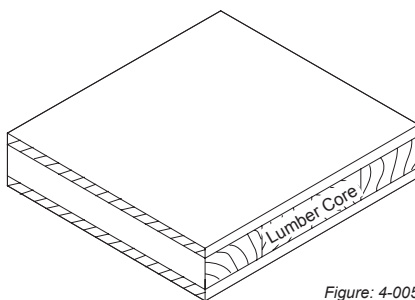


Figure: 4-005

- **Agrifiber/Agrofiber** - Panel products made from straw and similar fiber are appearing in the marketplace. Panels shall meet the performance characteristics of ANSI A208.1 or ANSI A208.2 standards.

The characteristics of agrifiber/agrofiber core material performance vary by manufacturer, and are not included in the following table.

- **Combination** - A balanced hybrid blend of veneer and composition core materials offering some of the properties of both. Typically these cores have internal layers which are constructed of three or five plies of veneer or a center layer of wafer board (randomly oriented wafers) or other wood fiber which are sandwiched between thin laminations of a composite product like MDF, particleboard, hardboard, etc.

Typically these products result in stronger, lighter weight, dimensionally stable panels with increased screw holding ability, and superior surface flatness. Combination panels shall meet the standards of particleboard or MDF as stated in this manual, density excepted.

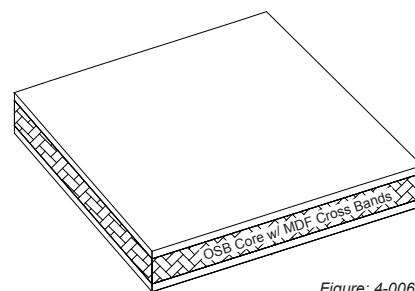


Figure: 4-006

- **Forming (Bendable)** - Assembled and/or machined cores made of hardboard, veneer, particleboard and/or MDF for radius work are manufactured under various trade names. When used for freestanding work these Forming Cores must be a balanced panel but if bound (restrained) the panel is not required to be balanced.
- **Solid Phenolic (SP)** - A composite of solid phenolic resins molded with a homogeneous core of organic fiber reinforced phenolic and one or more integrally cured surfaces of compatible thermoset nonabsorbent resins. SP has seen some use in recent years as wall surfacing, casework parts, and countertops.
- **Other Panel Material** - Shall meet the minimum performance characteristics of ANSI A208.1, ANSI A208.2 or ANSI/HPVA HP-1 (latest edition) standards.
- **Engineered Wood/Panel** - Is a general term used to describe any wood or plant fiber composite panel. Such products as Particleboard, MDF, SCL and LVL are described as an engineered wood or plant fiber. Typically they are made from wood or plant fiber or wood pieces and have specific esthetic and physical attributes.

introductory information

PRIMARY CORE MATERIALS (continued)

• Other Panel Material (continued)

- **Bamboo** is a building material attracting much attention due to its quick replenishing and growing cycles as a green product. It is

a grass product and not a true wood product. Due to its relatively new emergence in use as a building material, the performance evaluation as a stable and viable building material has not been established. The Architectural Woodwork Standards does

not cover or endorse the use of bamboo and encourages the design professional to consult with Bamboo manufacturers and distributors as to its characteristics and viability as an architectural millwork product.

Table: 4-007 - CHARACTERISTICS OF CORE PERFORMANCE

It is important for the reader to understand the difference between “flatness” and “dimensional stability” characteristics. Particleboard and MDF are the recommended cores for high pressure decorative laminate and wood veneer work because of their excellent flatness. Fair dimensional stability (expansion/contraction in panel size) is acceptable unless the product is exposed to wide swings in relative humidity, generally below 25% or above 55% with swings of more than 30 points.

Core Type	Flatness (Warp Resistance)	Visual Edge Quality	Surface Uniformity	Dimensional Stability	Screw Holding Face	Bending Strength
Particleboard, Medium Density	Excellent	Good	Excellent	Fair	Fair	Good
Particleboard, Moisture Resistant	Excellent	Good	Good	Fair	Fair	Good
Particleboard, Fire Retardant	Excellent	Fair	Good	Fair	Fair	Good
Medium Density Fiberboard (MDF)	Excellent	Excellent	Excellent	Fair	Good	Good
MDF, Moisture Resistant	Excellent	Excellent	Excellent	Fair	Good	Good
MDF, Fire Retardant	Excellent	Excellent	Excellent	Fair	Good	Good
Veneer	Fair	Good	Fair	Excellent	Excellent	Excellent
Lumber	Good	Good	Good	Good	Excellent	Excellent
Combination	Good	Fair	Excellent	Good	Excellent	Excellent

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 edgebands or fillers and Visual Edge Quality of lumber core assumes the use of “clear edge” grade. Surface Uniformity has a direct relationship to the performance of veneers placed over the surface. Dimensional Stability is usually related to exposure to wide swings in relative humidity. Screw Holding and Bending Strength are influenced by proper design and engineering.

DECORATIVE FACE MATERIAL AND CONSTRUCTION BALANCE

All panels may be used as cores for the application of decorative faces (e.g. veneer, plastic laminate) to the face and back. The whole is referred to as a panel. The parts being a core covered by a face and a balancing back. To achieve balanced construction, panels must be an odd number of layers (plies) symmetrical from the center line; e.g., inner plies, except the innermost middle ply, should occur in pairs, using materials and adhesives on both sides that contract and expand, or are moisture permeable, at the same rate.

A ply may consist of a single veneer, particleboard, medium density fiberboard, or hardboard. Each pair of inner plies should be of the same thickness and direction of grain at 90 degrees. Each ply of each pair is placed on opposite sides of the innermost ply or layer, alternating grain directions from the center out. (Particleboard and MDF do not have a specific grain orientation). The thinner the facing material, the less force it can generate to cause warping. The thicker the core, the more it can resist a warping movement or force.

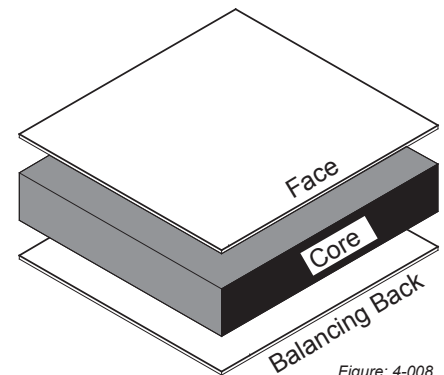


Figure: 4-008

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TYPES OF PLYWOOD PANELS:

• Particleboard Core

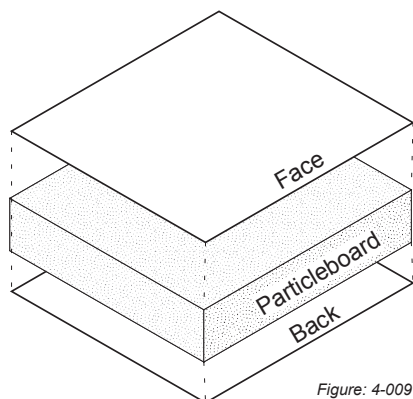


Figure: 4-009

• Medium Density Fiberboard (MDF) Core

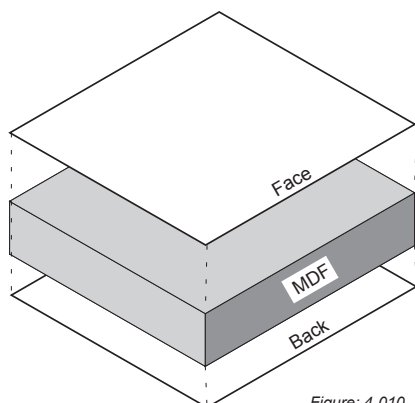


Figure: 4-010

• Veneer Core

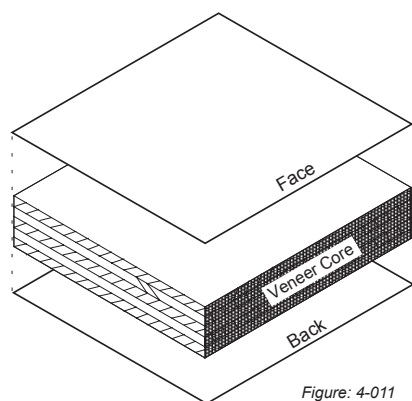


Figure: 4-011

• Lumber Core

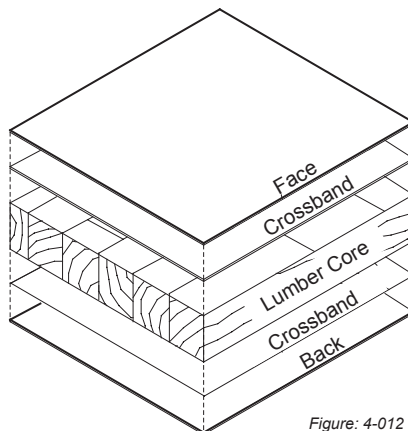


Figure: 4-012

Core

• Combination

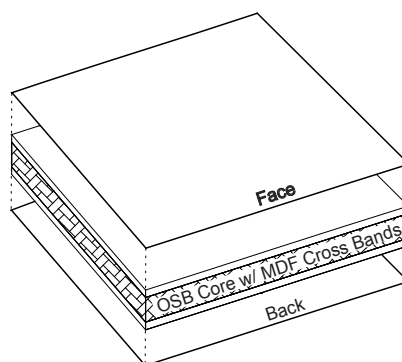


Figure: 4-013

WOOD VENEERS

Wood veneer is produced by veneer manufacturers in a variety of "industry standard" thicknesses. The slicing process is controlled by a number of variables. The thickness of the raw veneer has little bearing on the ultimate quality of the end product so long as show-through and sand-through is avoided.

- **Hardwood Veneer - Species:** Available in many domestic and imported wood species. Normally cut as plain sliced. Rift sliced and quarter sliced available in certain species at additional cost.

- **Softwood Veneer - Species:** Most common is Douglas Fir; Pines are available; other softwoods in limited supply. Most softwood veneer is Rotary cut. Plain sliced softwood veneer and "vertical grain" (quarter sliced) softwood veneer are limited in availability with long lead times and higher prices associated with special orders.

Rotary-cut softwood sheets are typically manufactured in various grades referring to the appearance of the face, back, and interior plies of the sheet and are intended for exterior (with a fully waterproof glue line) or interior (with a moisture resistant, but not waterproof, glue line). Clear faces, free of patches, are not typically available.

- **Veneer Grain** might not match the grain of solid stock, and it might not accept transparent finishes in the same manner; additional finishing steps might achieve similar aesthetic value.
- **Figure** is not a function of a species grade, and special desires must be so specified.
- **Special Characteristics**, such as sapwood, heartwood, ribbon stripe, birdseye and comb grain, must be so specified.
- **Natural**, as a type of wood species selection, allows an unlimited amount of heartwood and/or sapwood within a face and is the default selection, unless specified otherwise.
- **Select Red or White** simply means all heartwood or all sapwood, respectively, and must be so specified.
- **Species**, such as Hickory, Pecan, Butternut, or Maple, may exhibit special character or figure and users are advised to thoroughly investigate the expected grain and color of these species.
- **Reconstituted Veneers** are logs that are first sliced into veneer leaves, the leaves may be dyed, then glued under pressure in a mold to produce a large laminated block. The laminated block is then sliced across the glue line to create a faux grain with a designed appearance that is highly repeatable. Not all pre-dyed veneers are colorfast, consult with manufacturer.

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SPECIALTY SHEET PRODUCTS

Plywood with textured faces, prefinished plywood, overlaid plywood, composition sheets, flame spread rated plywood, moisture resistant plywood, lead lined sheets, projectile resistant armor (bullet proofing), reconstituted veneers, bamboo sheets, acrylic sheets, or PVC sheets are the products of the individual manufacturer, and are covered by their manufacturer's specification - not by these standards.

PANEL ADHESIVES

Are defined as:

- **Type I** Waterproof bond for limited exterior use (2 Cycle Boil Test plus Shear Test).
- **Type II** Water resistant bond for interior use (3 Cycle Soak Test).

FIRE RETARDANCE

Sheets are available with various types of fire retardant treated core, such as veneer, lumber, particleboard, and mineral core.

Flame-spread rating will vary for different species of untreated face veneers on treated cores, directly with the density of the untreated face veneers; the higher the density, the higher the flame spread rating.

Refer to the latest edition of the Underwriters' Laboratories listings for various flame-spread ratings available bearing U.L. Labels.

PHOTODEGRADATION

The effect on the appearance of exposed wood faces caused by exposure to both sun and artificial light sources is called photodegradation. If an entire face is exposed to a light source, it will photodegrade somewhat uniformly and hardly be noticeable, whereas partially exposed surfaces or surfaces with shadow lines might show nonuniform photodegradation. Some woods, such as American Cherry and Walnut, are more susceptible than others, and extra care should be taken to protect against the effects of nonuniform photodegradation.

OXIDATION

The effect on the appearance of exposed wood faces caused by exposure to atmosphere is called oxidation. This is analogous to browning reactions in freshly cut fruit; for instance, apples. Hardwoods can develop deep yellow to reddish brown discolorations on the surface of the wood when exposed to air immediately after sawing or peeling. These discolorations are especially noticeable on Cherry, Birch, Red Alder, Sycamore, Oak, Maple, and Sweet Gum. Some species, such as Alder, Oak, Birch, and Maple, develop these discolorations during air-seasoning. A related gray stain on several varieties of Southern Oaks also appears to be oxidative in nature. Proper selection, sanding, and finishing can minimize the effects of oxidation.

VENEER CUTTING

The manner in which a log segment is cut with relation to the annual rings will determine the appearance of the veneer. When sliced, the individual pieces of veneer, referred to as leaves, are kept in the order in which they are sliced, thus permitting a natural grain progression when assembled as veneer faces. The group of leaves from one slicing is called a flitch and is usually identified by a flitch number and the number of gross square feet of veneer it contains. The faces of the leaves with relation to their position in the log are identified as the tight face (toward the outside of the log) and the loose face (toward the inside or heart of the log). During slicing the leaf is stressed on the loose face and compressed on the tight face. When this stress is combined with the natural variation in light refraction caused by the pores of the wood, the result is a difference in the human perception of color and tone between tight and loose faces.

FOUR COMMON VENEER CUTS

- **Plain Slicing** (or Flat Slicing) - This is the slicing method most often used to produce veneers for architectural woodwork. Slicing is done parallel to a line through the center of the log. A combination of cathedral and straight grain patterns results, with a natural progression of pattern from leaf to leaf.

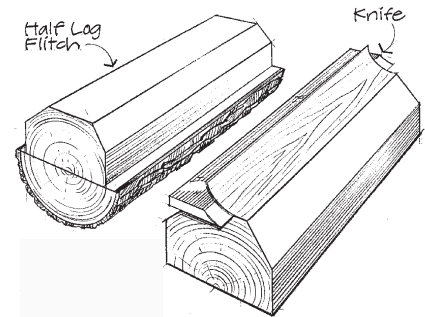


Figure: 4-014

- **Quarter Slicing** (or Quarter Cut) - Quarter slicing simulates the quarter sawing process of solid lumber, roughly parallel to a radius line through the log segment. In many species the individual leaves are narrow as a result. A series of stripes is produced, varying in density and thickness from species to species. "Fleck" (sometimes called flake) is a characteristic of this slicing method in Red and White Oak.

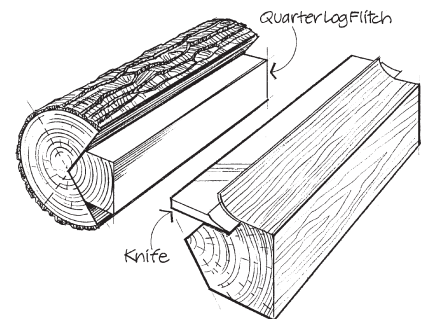


Figure: 4-015

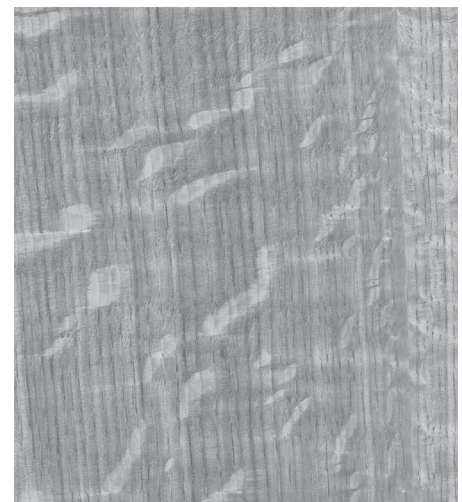


Figure: 4-016

- **Rift Slicing** (or Rift Cut) - Rift veneers are produced most often in Red and White Oak. Note that rift veneers and rift sawn solid lumber are produced so differently that a “match” between rift veneers and rift sawn solid lumber is highly unlikely. In both cases the cutting is done slightly off the radius lines minimizing the “fleck” (sometimes called flake) associated with quarter slicing.

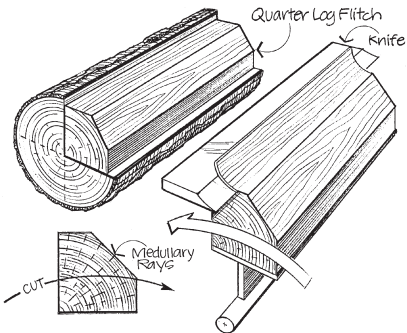


Figure: 4-017

- **Rotary Slicing** - The log is center mounted on a lathe and “peeled” along the general path of the growth rings like unwinding a roll of paper, providing a generally bold random appearance.

When transparent finish is specified; rotary sliced hardwood veneers are sometimes specified for:

- Wall Surfacing: Institutional panel faces.
- Doors: Institutional flush door faces.
- Cabinets: Semi-exposed (interior) surfaces and used in a limited way for exposed surfaces.

Some species may possess a special figure, for example birds eye, which is achieved by rotary slicing.

Careful consideration, specification, and communication are recommended when rotary cut is contemplated.

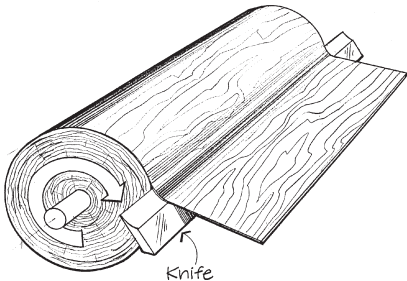


Figure: 4-018

Table: 4-019 - COMMON HARDWOOD VENEER SPECIES and CUTS

SPECIES	ROTARY	PLAIN SLICED	QUARTER SLICED	RIFT
Anigre		●	●	
Ash		●	●	
Beech		●	●	
Birch	●	●		
Cherry		●	●	
Hickory		●		
Lauan	●		●	
Mahogany, African		●	●	
Mahogany, American		●	●	
Makore		●	●	
Maple	●	●	●	
Oak, Red	●	●	●	●
Oak, White		●	●	●
Pecan		●		
Poplar	●	●		
Sapele		●	●	
Walnut		●	●	

introductory information

Table: 4-020 - WOOD VENEER SPECIES - General characteristics of selected species:

WOOD VENEER SPECIES - General characteristics of selected species:						
SPECIES	CUT (1)	WIDTH TO	LENGTH	FLITCH SIZE	COST (2)	AVAILABILITY
Alder	Plain Sliced	12" (305 mm)	10' (3048 mm)	Medium	Moderate	Moderate
Anigre	Plain Sliced	12" (305 mm)	10' (3048 mm)	Large	Moderate	Good
	Quarter Sliced	8" (203 mm)	12' (3658 mm)	Medium	High	Good
Anigre, Figured	Quarter Sliced	8" (203 mm)	12' (3658 mm)	Medium	Very High	Limited
Ash, American	Plain Sliced	12" (305 mm)	10' (3048 mm)	Large	Moderate	Moderate
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Medium	High	Moderate
Ash, European	Plain Sliced	10" (254 mm)	10' (3048 mm)	Medium	Moderate	Limited
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	Moderate	Moderate
Beech, European	Plain Sliced	10" (254 mm)	10' (3048 mm)	Large	Moderate	Good
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Medium	High	Good
Birch, Natural	Rotary	36" (914 mm)	10' (3048 mm)	Large	Low	Good
	Plain Sliced	8" (203 mm)	10' (3048 mm)	Small	Medium	Limited
Birch, Select Red and White	Rotary	36" (914 mm)	10' (3048 mm)	Large	Moderate	Good
	Plain Sliced	8" (203 mm)	10' (3048 mm)	Small	High	Limited
Cedar, Western Red	Plain Sliced	18" (457 mm)	10' (3048 mm)	Medium	Moderate	Limited
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Limited
Cherry, American (3)	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	High	Moderate
Ebony	Plain Sliced	6" (153 mm)	10' (3048 mm)	Very Small	Extreme	Very Limited
Fir, Douglas (Vertical Grain)	Quarter Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Good
Hickory	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	Moderate	Moderate
Jatoba	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good
Lacewood	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	High	Very Limited
Lauan (4)	Plain Sliced	15" (381 mm)	12' (3658 mm)	Medium	Moderate	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	Moderate	Moderate
Mahogany, African (5)	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Good
	Quarter Sliced	10" (254 mm)	12' (3658 mm)	Medium	High	Moderate
Mahogany, American (5) (Swietenia macrophylla CITES listed (6))	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Very Limited
	Quarter Sliced	10" (254 mm)	12' (3658 mm)	Medium	High	Very Limited
Makore	Plain Sliced	15" (381 mm)	12' (3658 mm)	Large	Moderate	Moderate
	Quarter Sliced	8" (203 mm)	12' (3658 mm)	Medium	High	Limited
Maple, American	Rotary	36" (914 mm)	10' (3048 mm)	Large	Low	Good
	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good (2)
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	High	Limited
Maple, Birds Eye	Rotary	24" (610 mm)	10' (3048 mm)	Medium	Very High	Limited
Meranti	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Good
	Quarter Sliced	10" (254 mm)	12' (3658 mm)	Medium	High	Moderate

SECTION 4

Sheet Products

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Table: 4-020 - WOOD VENEER SPECIES (continued)

SPECIES	CUT (1)	WIDTH TO	LENGTH	FLITCH SIZE	COST (2)	AVAILABILITY
Oak, English Brown	Plain Sliced	12" (305 mm)	10' (3048 mm)	Medium	High	Limited
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	Very High	Limited
Oak, Red	Rotary	36" (914 mm)	10' (3048 mm)	Large	Low	Good
	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Low	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Good
	Rift	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Good
Oak, White	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Low	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	Moderate	Good
	Rift	8" (203 mm)	10' (3048 mm)	Small	Moderate	Good
Poplar	Plain Sliced	15" (381 mm)	10' (3048 mm)	Medium	Low	Good
Rosewood, American	Plain Sliced	10" (254 mm)	10' (3048 mm)	Small	Very High	Very Limited
Sapele	Plain Sliced	15" (381 mm)	10' (3048 mm)	Large	Moderate	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Moderate
Sycamore	Plain Sliced	15" (381 mm)	12' (3658 mm)	Medium	High	Moderate
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	High	Limited
Teak	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	High	Moderate
	Quarter Sliced	5" (127 mm)	10' (3048 mm)	Small	High	Limited
Walnut (3)	Plain Sliced	15" (381 mm)	12' (3658 mm)	Large	Moderate	Good
	Quarter Sliced	6" (152 mm)	10' (3048 mm)	Small	High	Moderate
Wenge	Plain Sliced	10" (254 mm)	10' (3048 mm)	Small	High	Limited

- (1) When only Plain Sliced is listed, the width dimension for quartered Cut is narrower.
- (2) Seasonal factors may affect availability.
- (3) Cherry, Walnut and certain other hardwood species are required to be specified by origin, such as American Cherry, American Walnut, or English Brown Oak, because they can be significantly different in color and figure.
- (4) Lauan (White and Red), Tanguile, and other species are native to the Philippine Islands and are sometimes referred to as Philippine Mahogany; however, they are not a true Mahogany. The generic term Mahogany should not be specified without further definition.
- (5) Mahogany, American and African vary in color from a light pink to a light red, reddish brown to a golden brown or yellowish tan. Some Mahogany turns darker or lighter in color after machining. The figure or grain runs from plain sliced, plain stripe to broken stripe, mottled, fiddleback, swirl, and crotches.
- (6) CITES, Convention on International Trade in Endangered Species or Wild Fauna and Flora.

PRODUCT ADVISORY:

Due to adverse reaction of some veneers laminated to fire rated (FR), ultra low emitting formaldehyde (ULEF or NAUF), medium density fiberboard (mdf) causing discoloration of the wood veneer even months after installation, major core manufacturers have issued disclaimers in the use of FR cores. They strongly suggest that use of FR ULEF mdf and particleboard cores should be done after testing compatibility of adhesives, wood veneer and cores. Any resulting discoloration with the use of these cores may be exempt in their warranties. Use of FR ULEF cores should only be considered after consultation with the board supplier.

introductory information

MATCHING ADJACENT WOOD VENEER LEAVES

It is possible to achieve certain visual effects by the manner in which the leaves are arranged. Matching of adjacent wood veneer leaves, as with the effect of different veneer cuts, can alter the appearance of a given panel or an entire installation. To create a particular appearance, the veneer leaves of a flitch are edge glued together in patterns.

Individual leaves of veneer in a sliced flitch increase or decrease in width as the slicing progresses. Thus, if a number of panels are manufactured from a particular flitch, the number of veneer leaves per panel face will change as the flitch is utilized. The manner in which these leaves are "laid up" within the panel requires specification.

Rotary cut veneers are difficult to match; therefore most matching is done with sliced veneers. The matching of adjacent veneer leaves must be specified. Special arrangements of leaves such as "diamond" and "box" matching are available. Consult your manufacturer for choices.

- **Book Matching** - A common match used in the industry. Every other piece of veneer is turned over so adjacent pieces (leaves) are opened like the pages of a book.

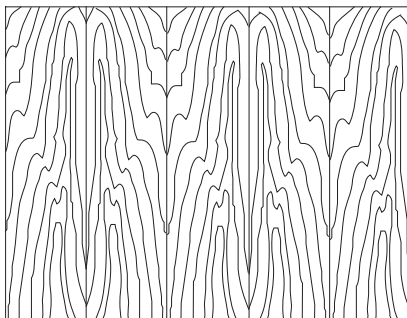


Figure: 4-021

Visual Effect - Veneer joints match, creating a symmetrical pattern. Yields maximum continuity of grain. When sequenced panels are specified, prominent characteristics will ascend or descend across the match as the leaves progress from panel to panel.

Barber Pole Effect in Book Match - Because the tight side and loose side of the veneer leaf faces alternate in adjacent pieces of veneer, they may accept stain differently, and this may result in a noticeable color variation. Book matching also accentuates cell polarization, causing the perception of different colors. These natural characteristics are often called barber pole, and are not a manufacturing defect.

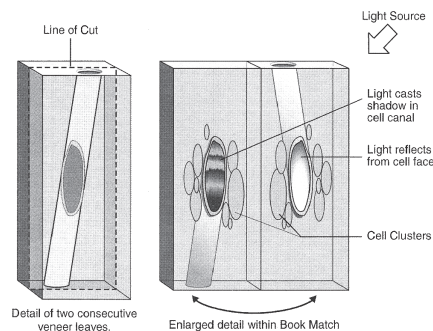


Figure: 4-022

- **Slip Matching** - Often used with quarter sliced and rift sliced veneers. Adjoining leaves are placed (slipped out) in sequence without turning, resulting in the same face sides being exposed.

Visual Effect - Grain figure repeats; but joints do not show visual grain match.

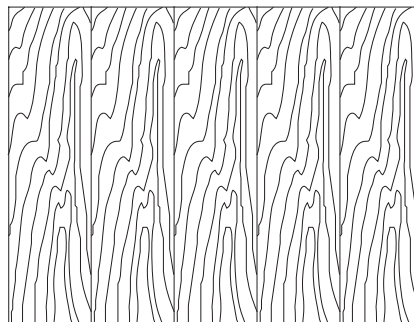


Figure: 4-023

The lack of grain match at the joints can be desirable. The relatively straight grain patterns of quartered and rift veneers generally produce pleasing results and a uniformity of color because all faces have the same light refraction.

- **Random Matching** - Veneer leaves are placed next to each other in a random order and orientation, producing a "board by board" effect in many species.

Visual Effect - Casual or rustic appearance, as though individual boards from a random pile were applied to the product. Conscious effort is made to mismatch grain at joints.

Degrees of contrast and variation may change from panel to panel. This match is more difficult to obtain than book or slip match, and should be clearly specified and detailed.

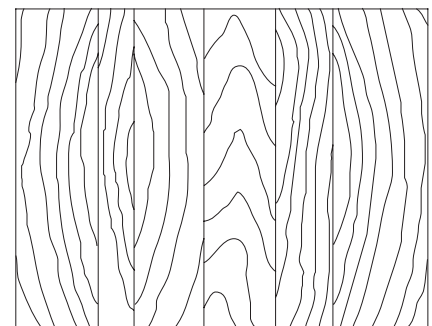


Figure: 4-024

- **End or Butt Matching** - Often used to extend the apparent length of available veneers for high wall panels and long conference tables.

Leaves are individually book (or slip) matched, first end to end and then side to side, alternating end and side.

Visual Effect - Yields best continuous grain patterns for length as well as width. Minimizes misalignment of grain pattern.

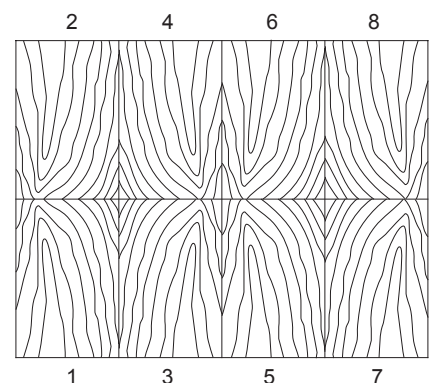


Figure: 4-025