

Architectural Woodwork Standards

SECTION - 4

Sheet Products

SECTION 4 ♦ SHEET PRODUCTS - WOOD & NON-WOOD FACED

(Including: Hardwood and Softwood Veneer, High-Pressure Decorative Laminate, Thermally Fused Overlays, Vinyl Film, Medium- and High-Density Overlays, Hardboard, Backers, Solid Surface, Solid Phenolic, Epoxy Resin, and Natural/Manufactured Stone)

GENERAL

1 INFORMATION

1.1 GRADES

1.1.1 **GRADE CLASSIFICATIONS ECONOMY, CUSTOM, and PREMIUM** are used within these standards only in reference to the acceptable quality of workmanship, material, or installation in a completed architectural woodwork product.

1.1.2 **THIS MATERIAL SECTION** deals with sheet products, which are a component of finished products covered in Sections 6 - 12.

1.1.2.1 **IN THIS SECTION**, the use of Grade classifications is only for the purpose of identifying sheet products that can be used in finished products meeting those Grades.

1.1.2.2 These Grade classifications are not intended to be used as Grades of raw material or to judge a stand-alone sheet.

1.1.3 **PANEL ASSOCIATION GRADES**, by themselves, should not be used for architectural woodwork, because even their highest grades might permit unacceptable defects.

1.1.3.1 The appearance of a piece in the end product is of primary importance, not whether it is cut from a larger sheet that contained characteristics which can be eliminated.

1.1.4 SHEET REQUIREMENTS

1.1.4.1 Apply only to surfaces visible after manufacture and installation.

1.1.4.2 Establish criteria as to which, if any, natural characteristics are acceptable.

1.1.4.3 Limit the extent of characteristics that will be permitted based on an exposed area's size and the proximity of characteristics to one another.

1.1.4.4 Do not apply to special varieties of species that display unusual characteristics desirable for aesthetic and design reasons.

1.1.5 **MODIFICATIONS** by the contract documents shall govern if in conflict with these standards.

1.2 BASIC CONSIDERATIONS

1.2.1 **PLYWOOD** is defined as a panel composed of a crossbanded assembly of layers or plies of veneer, or veneers in combination with a lumber core, composite core (MDF or particleboard) or combination core, that are joined with an adhesive. Except for special constructions, the grain of alternate plies is always approximately at right angles, and the thickness and species on either side of the core are identical for balanced effect. An odd number of plies is always used, except when the center two pieces of veneer run parallel; then these are considered one pair of ply.

1.2.2 **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 (see Section 5).

1.2.3 **FIGURE** is not a function of a species grade, and any special desires must be so specified.

1.2.4 **SPECIAL CHARACTERISTICS**, such as sapwood, heartwood, ribbon stripe, birdseye and comb grain, if desired, are required to be specified.

1.2.5 **NATURAL**, as a type of wood species selection, allows an unlimited amount of heartwood or sapwood within a face and is the default selection, unless specified otherwise.

1.2.6 **SELECT RED** or **WHITE** simply means all heartwood or all sapwood, respectively, and must be so specified if desired.

GENERAL

- 1.2 **BASIC CONSIDERATIONS** (continued)
- 1.2.7 **SPECIES**, such as Hickory, Pecan, Butternut, or Mahogany, exhibit "special character", and users are advised to thoroughly investigate the expected grain and color of these more exotic species.
- 1.2.8 **HONDURAS** and **AFRICAN MAHOGANY** vary in color from a light pink to a light red, reddish brown to a golden brown or yellowish tan.
- 1.2.8.1 Some Mahogany turns darker or lighter in color after machining.
- 1.2.8.2 The figure or grain runs from plain sliced, plain stripe to broken stripe, mottled, fiddleback, swirl, and crotches.
- 1.2.9 **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.
- 1.2.9.1 The generic term **MAHOGANY** should not be specified without further definition.
- 1.2.10 **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 texture.
- 1.2.11 **PHOTODEGRADATION** is the effect on the appearance of exposed wood faces caused by exposure to both sun and artificial light sources. 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.
- 1.2.12 **OXIDATION** is the effect on the appearance of exposed wood faces caused by exposure to atmosphere. 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.
- 1.2.13 **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).
- 1.2.13.1 Clear faces, free of patches, are not typically available.
- 1.2.14 **SPECIALTY** sheet products, such as 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.
- 1.2.15 **FIRE-RETARDANT** sheets are available, but not readily, with various types of treated core, such as veneer, lumber, particleboard, and mineral core.
- 1.2.15.1 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.
- 1.2.15.1.1 Refer to the latest edition of the Underwriters' Laboratories listings for various flame-spread ratings available bearing U.L. Labels.
- 1.2.16 **PANEL ADHESIVES** include and are defined as:
- 1.2.16.1 **TYPE I** Waterproof bond for limited exterior use (2 Cycle Boil Test plus Shear Test).
- 1.2.16.2 **TYPE II** Water-resistant bond for interior use (3 Cycle Soak Test).

GENERAL

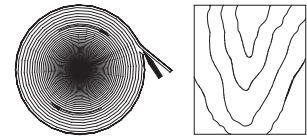
1.2 BASIC CONSIDERATIONS (continued)

1.2.17 **CHECKING** or **WARPAGE** of wood-veneered sheets can be avoided by proper environmental maintenance, such as being:

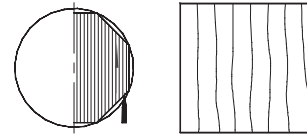
- 1.2.17.1 Protected from extremes in relative humidity and temperature.
- 1.2.17.2 Finished on both surfaces to retard moisture movement in and out of the panel.
- 1.2.17.3 Placed in locations that avoid directly facing air vents and/or radiant heat sources.

1.2.18 **WOOD-VENEER SLICING** is an important factor in the various visual effects obtained. Two veneer slices of the same species will have entirely different visual character, even though their color values are similar. As a log segment is sliced, the leaves of veneer are retained in a sequential flitch. These veneer-sliced options include:

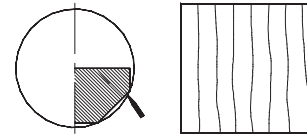
1.2.18.1 **ROTARY SLICED** - The log is mounted centrally in the lathe and turned against a razor-sharp blade, like unwinding a roll of paper. Because this slice follows the log's annular growth rings, a bold variegated grain marking is produced. Rotary-sliced veneer is exceptionally wide.



1.2.18.2 **PLAIN SLICED (or FLAT SLICED)** - The half log is mounted with the heart side floating against the guide plate of the slicer, and the slicing is done parallel to a line through the center of the log, producing a variegated figure.

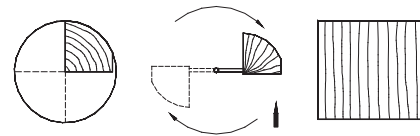


1.2.18.3 **QUARTER SLICED** - The quarter log is mounted on the guide plate so that the growth rings of the log strike at approximately right angles, producing a series of stripes that are straight in some woods and varied in others. In Oak, this slicing can produce unlimited amounts of medullary ray.



1.2.18.3.1 **VERTICAL GRAIN SLICED** - Unique to some softwoods, the vertical grain effect is produced by slicing perpendicularly to the growth rings.

1.2.18.4 **RIFT SLICED** - Unique to various species of Oak, the rift or comb grain effect is obtained by slicing perpendicular to the Oak's medullary rays on either the lathe or the slicer. Medullary ray cells are distinct characteristics of Oak that radiate from the center of the log like the curved spokes of a wheel. Rift slicing limits the appearance of the medullary ray flake and produces a rather straight grain. Comb grain is a further hybrid selected from the rift slice.



1.2.18.5 COMMON HARDWOOD VENEER SPECIES and CUTS

SPECIES	ROTARY	PLAIN SLICED (FLAT-CUT)	QUARTERED	RIFT & COMB GRAIN
Anigre		●	●	
Ash	●	●	●	
Beech		●	●	
Birch	●	●		
Cherry	●	●	●	
Hickory	●	●		
Lauan	●		●	
Mahogany, African	●	●	●	

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1.2 BASIC CONSIDERATIONS (continued)

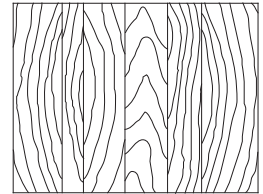
1.2.18 WOOD-VENEER SLICING (continued)

1.2.18.5 COMMON HARDWOOD VENEER SPECIES and CUTS (continued)

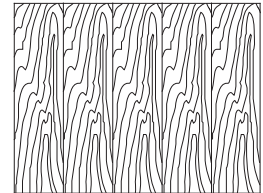
SPECIES	ROTARY	PLAIN SLICED (FLAT-CUT)	QUARTERED	RIFT & COMB GRAIN
Mahogany, Honduras	●	●	●	
Maple	●	●	●	
Meranti	●		●	
Oak, Red	●	●	●	●
Oak, White	●	●	●	●
Pecan		●		
Poplar, Yellow	●	●		
Sapele		●	●	
Walnut, Black	●	●	●	

1.2.19 **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 such as:

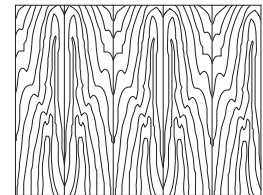
1.2.19.1 **RANDOM MATCH** - Veneer leaves are joined out of flitch sequence with the intention of creating a casual unmatched effect. Veneers from several logs may be used in the manufacturing of a set of panels.



1.2.19.2 **SLIP MATCH** - Veneer leaves are joined side by side, as they are taken in sequence from the flitch, so that the pieces are not matched for color or grain at the joints. This method of matching repeats the same flitch characteristics from piece to piece. Some species of hardwood do not blend well into this pattern. Generally, quarter- and rift-sliced veneers are slip-matched.



1.2.19.3 **BOOK MATCH** - Every other veneer leaf is turned over as the leaves are taken in sequence from the flitch, similar to turning or unfolding the pages of a book. Since one leaf will be loose-side-up and the next tight-side-up, book-matching produces a color shading, while maintaining a good match for color and grain at the joints. **TIGHT** and **LOOSE LEAVES** might refract light differently and cause a noticeable color variation (barber pole effect) in some species. This is a natural characteristic and not a manufacturing defect. It might be possible to minimize this effect utilizing special finishing techniques.

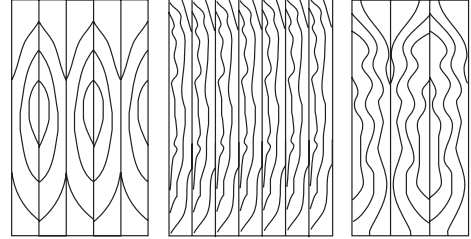


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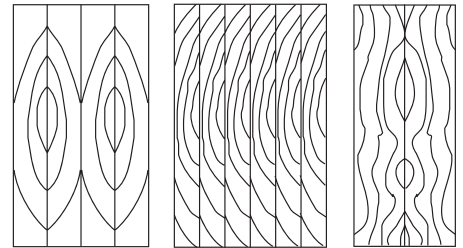
1.2 BASIC CONSIDERATIONS (continued)

1.2.20 **MATCHING OF WOOD VENEER LEAVES WITHIN A PANEL FACE** - 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, and is classified as follows:

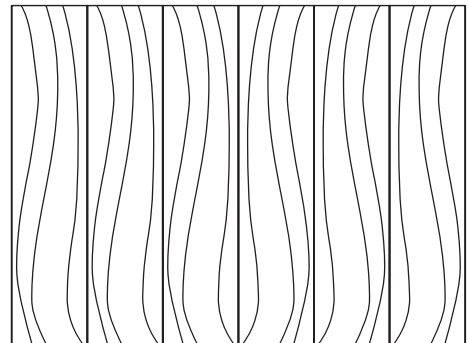
1.2.20.1 **BALANCED MATCH** - Each panel face is assembled from veneer leaves of uniform width before edge trimming. Panels may contain an even or an odd number of leaves, and distribution might change from panel to panel within a sequenced set - shown in Book and Slip match.



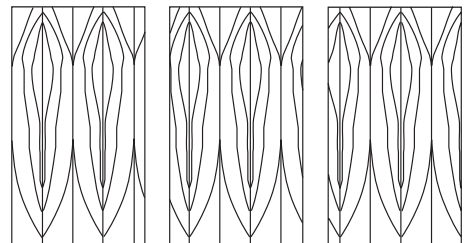
1.2.20.2 **CENTER BALANCE MATCH** - Each panel face is assembled from an even number of veneer leaves of uniform width before edge trimming, with a veneer joint in the center of the panel, producing horizontal symmetry. A small amount of figure is lost in this process.



1.2.20.3 **SLIP, CENTER, BOOK MATCH** - Each panel face is assembled of an even (four or more) number of veneer leaves. The veneer leaves are laid out as a slip-matched panel face; then at the center, one half of the leaves are booked to the other half. Quarter- and rift-sliced veneers are generally used for this match, which allows for a pleasing balance of sweep and character marks.



1.2.20.4 **RUNNING MATCH** - Each panel face is assembled from as many veneer leaves as necessary. This often results in an asymmetrical appearance, with some veneer leaves of unequal width. Often the most economical method at the expense of aesthetics, it is the standard for Custom Grade and must be specified for other Grades. Running matches are seldom "sequenced and numbered" for use as adjacent panels. Horizontal grain "match" or sequence cannot be expected.

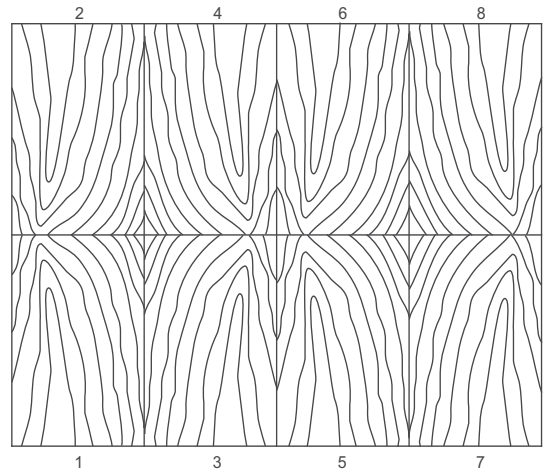


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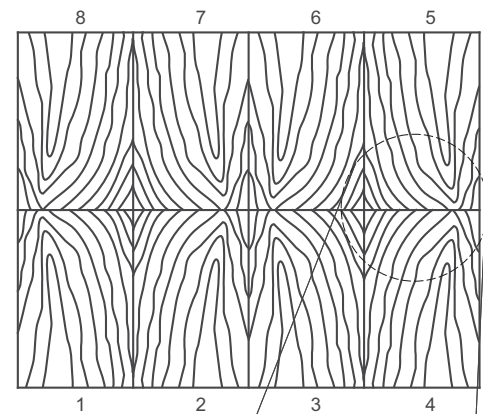
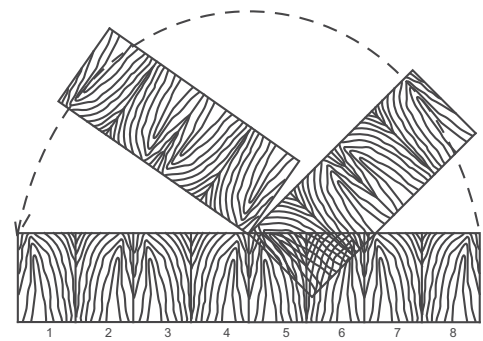
1.2 BASIC CONSIDERATIONS (continued)

1.2.21 **END-MATCHING OF WOOD VENEERS** - Often used to extend the apparent length of available veneers for high wall panels and long conference tables. End matching occurs in two types:

1.2.21.1 **ARCHITECTURAL END MATCH** - Leaves are individually book-matched (or slip-matched), first end-to-end and then side-to-side, alternating end and side. It yields the best continuous grain patterns for length as well as width, and minimizes misalignment of grain pattern.



1.2.21.2 **PANEL END MATCH** - Leaves are book-matched (or slip-matched) on panel subassemblies, with sequenced subassemblies end-matched, resulting in some modest cost savings on projects where applicable. For most species, it yields a pleasing, blended appearance and grain continuity. Some misalignment of grain pattern will occur and is not a defect.



Natural grain pattern mismatch occurs.

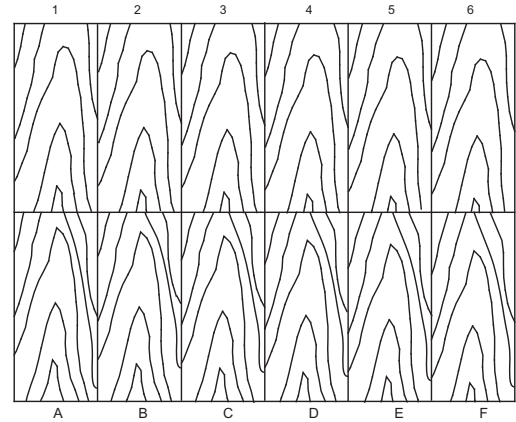
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1.2 BASIC CONSIDERATIONS (continued)

1.2.21 END-MATCHING OF WOOD VENEERS (continued)

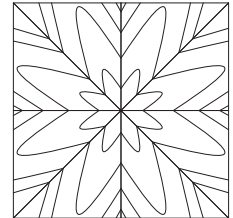
1.2.21.3 **CONTINUOUS END MATCH** - Leaves are individually book-matched (or slip-matched). Separate panels are stacked in sequenced order, either horizontally or vertically in the elevation. (Horizontal sequence illustrated.) It yields sequenced grain patterns for elevations, with a pleasing blend of figure horizontally or vertically.

NOTE: Each label represents a full panel from a set.

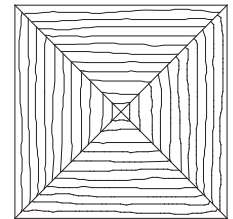


1.2.22 **SPECIALTY OR SKETCH MATCHES OF WOOD VENEERS** - There are regional variations in the “names” of the following veneer leaf-matching techniques, drawn as squares for simplicity. It is strongly recommended that the design professional use both names and drawings to define the desired effect, using a rectangle, polygon, circle, ellipse, or other shape. Rift-sliced, quarter-sliced, and highly figured veneers are generally used for these speciality matches. The different matches of veneer cause the reflection of light to vary from adjoining leaves, bringing “life” to the panel. Due to the inherent nature of the veneering process, alignment at corners might vary.

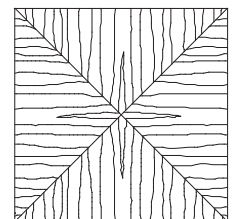
1.2.22.1 **SUNBURST MATCH** - is made of six or more veneer leaves cut at the appropriate angle with the grain radiating from the center. These veneer leaves are then book-matched, assembled, and trimmed for final size.



1.2.22.2 **BOX MATCH** - is made of four leaves with the grain running parallel to the perimeter of the panel. The leaves are cut at the appropriate angle and end-matched.



1.2.22.3 **REVERSE OR END GRAIN BOX MATCH** - is made of four leaves with the grain running at right angles to the perimeter of the panel. The leaves are cut at the appropriate angle and book-matched.

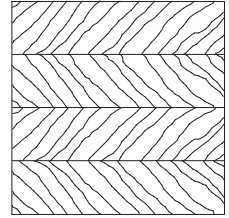


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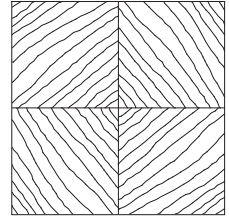
1.2 BASIC CONSIDERATIONS (continued)

1.2.22 SPECIALTY OR SKETCH MATCHES OF WOOD VENEERS (continued)

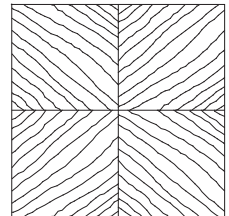
- 1.2.22.4 **HERRINGBONE OR V-BOOK MATCH** - is one or more pairs of assembled slipped or booked leaves. Each assembled set of leaves is cut at generally 45 degrees to one edge of the panel. The assembled set of leaves is then end-matched to the adjoining assembled set of leaves.



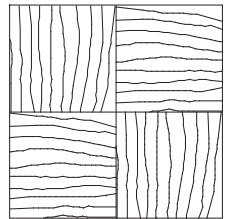
- 1.2.22.5 **DIAMOND MATCH** - is made of four leaves with the grain running 45 degrees to the perimeter of the panel and surrounding the center. The leaves are cut at the appropriate angle and end-matched.



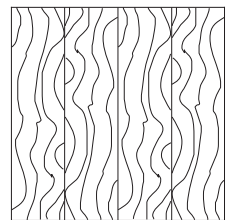
- 1.2.22.6 **REVERSE DIAMOND MATCH** - is made of four leaves with the grain running 45 degrees to the perimeter of the panel and radiating from the center. The leaves are cut at the appropriate angle and book-matched.



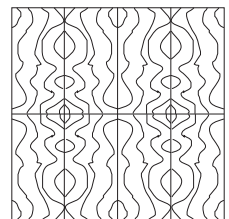
- 1.2.22.7 **PARQUET MATCH** - is made by dividing the panel into multiple equal-sized pieces and cutting the veneer to the same size. Each veneer leaf is joined at right angles to the adjoining piece of veneer.



- 1.2.22.8 **SWING MATCH** - is made by dividing the panel into multiple paired sets. For each paired set, two leaves of veneer are cut at half the width of the set. One of these two veneer leaves is rotated 180 degrees and joined to the other. This pair is then adjoined to the other pairs assembled in the same way.



- 1.2.22.9 **BOOK and BUTT MATCH** - is made by book-matching veneer leaves 1, 3, 5, and 7 (set A) of the 8-leaf sequence. The remaining leaves 2, 4, 6, and 8 (set B) are also book-matched. Set B is then flipped up and over the top end of set A, resulting in an end match.



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1.2 BASIC CONSIDERATIONS (continued)

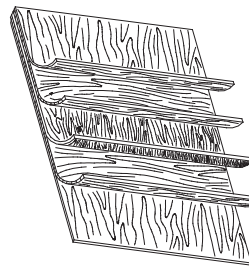
- 1.2.23 **HIGH-PRESSURE DECORATIVE LAMINATE (HPDL)** - is a stand-alone product that can be laminated onto a core as the face of a sheet product or directly onto a structure as a covering. HPDL is produced in a one-step process by fusing together, under heat and pressure, multiple layers of kraft paper saturated with phenolic resin, together with a layer of melamine-saturated decorative paper.
- 1.2.23.1 **HORIZONTAL GRADE** - Suitable for horizontal surface applications and ranges in thickness from 0.39" to 0.048" (1 mm to 1.22 mm). This is considered a General Purpose Grade.
- 1.2.23.2 **VERTICAL GRADE** - Suitable for vertical surface applications and ranges in thickness from 0.020" to 0.028" (0.50 mm to 0.71 mm). This is considered a General Purpose Grade.
- 1.2.23.3 **POST-FORMING** - Can be formed around curved edges by application of heat and restraint. Maximum thickness is approximately 0.039" (1 mm) and can normally be formed to a radius as small as 3/8" (9.5 mm).
- 1.2.23.4 **BACKER** - Produced without a decorative face and available as standard (slightly thinner than decorative) or regrind (reclaimed HPDL with decorative sheet sanded off).
- 1.2.23.5 **SPECIALITY** - Special purpose such as cabinet liner, high-wear, fire-rated, electrostatic-dissipative, and chemical-resistant.
- 1.2.23.6 **NOTE** - Some HPDLs utilize a white background paper to achieve the high-fidelity, contrast, and depth of color in their printed patterns, which leaves a white line at the exposed edges of the laminate and can be extremely noticeable in darker colors.
- 1.2.24 **LOW-PRESSURE DECORATIVE LAMINATE (LPDL)** - Commonly referred to as TFM (Thermally Fused Melamine), low pressure, direct pressure, or simply as melamine overlays. Thermally fused papers and foils generally weigh between 60 and 130 g/m², and are similar to that used in HPDLs. Saturated with reactive resins and partially cured during manufacture to allow for storage and handling, the papers achieve final curing when they are hot-press laminated to a substrate, providing a hard, permanent thermoset bond between the paper and the substrate.
- 1.2.24.1 **MELAMINE** - impregnated papers, the most common, are noted for their hardness, scratch resistance, and color stability.
- 1.2.24.2 **POLYESTER** - impregnated papers are noted for their chemical, stain, water, and impact resistance; color clarity; and machinability.
- 1.2.25 **VINYL FILM** - The solid integrated color, semirigid film is made of polyvinyl chloride (PVC) and is commonly used in drawer-box construction.
- 1.2.26 **MEDIUM-DENSITY OVERLAY (MDO)** - is a thermosetting phenolic resin-impregnated, cellulose-fiber overlay that provides a smooth, uniformly paintable surface.
- 1.2.27 **HIGH-DENSITY OVERLAY (HDO)** - is a thermosetting phenolic resin-impregnated, cellulose-fiber overlay that provides a hard, smooth, uniformly textured surface of such character that further finishing is not necessary. Some evidence of underlying grain may appear.
- 1.2.28 **HARDBOARD** - is a sheet manufactured from interfelted lignocellulosic fibers consolidated under heat and pressure.
- 1.2.28.1 **APPLICABLE GRADES** - Tempered and Standard
- 1.2.29 **SOLID SURFACE** - is a manufactured, filled cast polymeric resin panel. The fillers enhance both its performance properties and aesthetics. With a homogeneous composition throughout its thickness, solid surface requires no finish coat and is capable of being fabricated with inconspicuous seams and repaired to its original finish.
- 1.2.29.1 **COLOR and PATTERN MATCH** - Suggest use of same batch material at adjacent sheets.
- 1.2.30 **SOLID PHENOLIC** - is a sheet product composed of melamine-impregnated decorative surface papers superimposed over a varying number of kraft phenolic core sheets to achieve a desired thickness.

GENERAL

1.2 BASIC CONSIDERATIONS (continued)

1.2.31 PANEL CORES

- 1.2.31.1 **VENEER CORE** - is where all plies are veneer, less than 1/4" (6.4 mm) thick, and with always an odd number of plies from 3 or more, except when the center is constructed of two unidirectional plies. The middle ply is called the "center". The plies on either side of the center, but beneath the outer plies, are called "crossbanding." The outer plies are called "faces" and "backs".

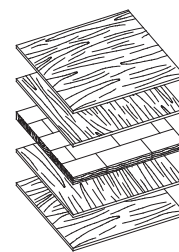


- 1.2.31.2 **LUMBER CORE** - is where center ply, called the "core" is composed of strips of lumber edge-glued into a solid slab. This type is usually 5-ply, 3/4" (19 mm) thick, but other thickness from 1/2" (12.7 mm) to 1-1/8" (28.6 mm) are manufactured for special uses. There are three main types:

1.2.31.2.1 **STAVED** - is where all the core strips are random length and butt-joined.

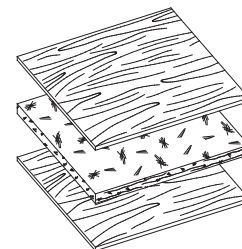
1.2.31.2.2 **FULL-LENGTH** - is where all the core strips are one piece in length.

1.2.31.2.3 **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.



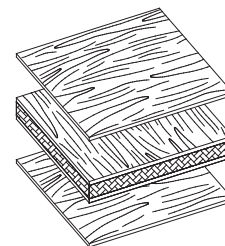
- 1.2.31.3 **COMPOSITE CORE** - is made from wood particles and called particleboard or medium-density fiberboard and/or agrifiber (made from agricultural waste products).

It is acceptable, provided it meets or exceeds the performance property requirements of ANSI A208-1 or 2.



- 1.2.31.4 **COMBINATION CORE** - is an engineered speciality core, such as random waferboard or oriented strand board developed for specific needs and to increase the utilization of remaining resources. It is typically made from a composition or veneer center core with balanced veneers applied for stability and face veneer uniformity.

It is acceptable, provided it meets or exceeds the performance property requirements of ANSI A208-1 or 2.



- 1.2.31.5 **CORE PROPERTIES, PERFORMANCE, and AVAILABILITY** comparison (modified from that developed by HPVA).

1.2.31.5.1 Property and performance characteristics are influenced by the grade, thickness, and species density of the core:

1.2.31.5.1.1 Visual edge quality is rated before treatment and assumes clear "lumber".

1.2.31.5.1.2 Surface uniformity has a direct relationship to the performance of the face veneers.

1.2.31.5.1.3 Dimensional stability relates to the effect of exposure to wide swings in temperature and relative humidity.

GENERAL

1.2 BASIC CONSIDERATIONS (continued)

1.2.31 PANEL CORES (continued)

1.2.31.5 CORE PROPERTIES, PERFORMANCE (continued)

1.2.31.5.1 Property and performance characteristics (continued)

1.2.31.5.1.4 Screw holding and bending strength are influenced by and should be considered in design engineering.

1.2.31.5.2 "MR" designates "Moisture Resistant", and "FR" stands for "Fire Retardant".

1.2.31.5.3 COMPARISON TABLE

Core Type	<i>Flatness</i>	<i>Visual Edge</i>	<i>Surface Uniformity</i>	<i>Dimensional Stability</i>	<i>Screw Holding</i>	<i>Bending Strength</i>	<i>Availability</i>
Particleboard	5	3	5	3	1	3	R
MDF	5	5	5	3	3	3	R
Combination	5	3	5	3	5	5	L
Hardwood Veneer	1	3	3	5	5	5	R
Softwood Veneer	1	3	1	5	5	5	R
Lumber	3	3	3	3	3	5	L
Hardboard - Standard	5	5	5	5	1	3	R
Hardboard - Tempered	5	3	3	3	3	3	L
MR - Particleboard	5	3	3	3	1	3	L
MR - MDF	5	5	3	3	1	3	L
FR - Particleboard	5	1	3	3	1	3	L
Key: 5 = Excellent, 3 = Good, 1 = Fair, R = Readily, and L = Limited							

1.3 RECOMMENDATIONS

1.3.1 SPECIFY requirements for:

1.3.1.1 **UNIFORM COLOR**, special finishing techniques might be required (see Section 5).

1.3.1.2 **SPECIAL CHARACTERISTICS**, such as sapwood, heartwood, ribbon stripe, quarter sawn, rift sawn, or vertical grain.

1.3.2 **BLEACHED VENEERS** should not be used because of their potential finishing problems.

1.3.3 **VENEER CORE PANELS** should not be used for cabinet doors because they are likely to warp.

1.3.4 **FIRE-RETARDANT** cores should not be used for exteriors because they typically attract moisture.

1.3.5 **FORMALDEHYDE EMISSION REGULATIONS** should be carefully researched before shipping product into an unfamiliar area. Some states, such as California, have significantly reduced their allowable emissions.

1.4 ACKNOWLEDGEMENTS

1.4.1 **LOW-DENSITY FIBERBOARD (LDF)** sheets have distinct weight advantages; however, they typically offer substantially less in performance characteristics. LDF is permitted in general paneling products and/or woodwork fabrication, with the exception of casework.

1.4.1.1 **LDF** may be used for casework construction, provided its performance characteristics meet or exceed those required of particleboard.

1.4.1.1.1 Lacking defined standards, on request, the Associations will review individual products and issue approval as appropriate.

GENERAL

- 1.4 **ACKNOWLEDGEMENTS** (continued)
 - 1.4.2 **COMBINATION CORE** panels are a hybridization of veneer and composition cores offering the advantages of both. Typically these cores are constructed of three or five plies of veneer which are sandwiched between thin laminations of a composite product like MDF, particleboard, hardboard, etc. Other variations utilize a wafer board (randomly oriented wafers) center. Typically these products result in stronger, lighter weight, dimensionally stable panels with increased screw holding ability, and superior surface flatness.
 - 1.4.3 **CONTINUOUS PRESSURE LAMINATES** (melamine or polyester-based) are an alternative to and may be used in lieu of HPDL, provided they conform to the same standards as HPDL.
- 1.5 **INDUSTRY PRACTICES**
 - 1.5.1 A **PANEL'S GRAIN DIRECTION** is indicated by its size listing; for example, 48" x 96" (1219 mm x 2438 mm) means the grain direction runs with the 96" (2438 mm) direction, whereas a 96" x 48" (2438 mm x 1219 mm) panel's grain direction runs with the 48" (1219 mm) dimension.
 - 1.5.2 **SPECIES** not specifically covered by these standards shall be as agreed to between owner/design professional and manufacturer/installer as to length requirements and size/exposed area of permitted natural characteristics.

PRODUCT

2 SCOPE

2.1 All sheet products used for the fabrication or production of the architectural woodwork covered by these standards.

3 DEFAULT STIPULATION

3.1 If not otherwise specified or indicated in the contract documents, all sheet products shall match the default stipulation of the applicable product sections of these standards.

4 RULES - The following RULES shall govern unless a project's contract documents require otherwise.

These rules are not intended to create a sheet grade; they are only intended to establish the acceptable requirements and/or characteristics after the architectural woodwork is completed or installed.

Where E, C, or P is not indicated, the rule applies to all Grades equally.

ERRATA, published on the Associations' websites at www.awinet.org, www.awmac.com, or www.woodworkinstitute.com, shall TAKE PRECEDENCE OVER THESE RULES, subject to their date of posting and a project's bid date.

ARROWS INDICATE TOPIC IS CARRIED FROM ↑ OR ONTO ↓ ANOTHER PAGE.

DESCRIPTION		E	C	P
GENERAL ↓	4.1 GENERAL			
	4.1.1	Aesthetic GRADE RULES apply only to exposed and semi-exposed surfaces visible after installation.		
	4.1.2	GRAIN DIRECTION is indicated by a panel's size listing.		
	4.1.3	SPECIES not covered by these standards shall be as agreed to between owner/design professional and manufacturer/installer as to length requirements and size/exposed area of permitted natural characteristics.		
	4.1.4	REFERENCE STANDARDS , adopted for the performance, fabrication, and appearance of face veneers, laminates, overlays, backers, and cores:		
	4.1.4.1	Hardwood Plywood - ANSI/HPVA - HP-1 (latest edition)		
	4.1.4.2	Softwood Plywood - U.S. Product Standard - PS-1 (latest edition)		
4.1.4.3	Medium-Density Overlay (MDO) - APA PS-1 (latest edition)			
4.1.4.4	High-Density Overlay (HDO) - APA PS-1 (latest edition)			