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MATCHING WITHIN INDIVIDUAL PANEL FACES

The 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:

- **Running Match** - The panel face is made from components running through the flitch consecutively. Any portion of a component left over from a face is used as the beginning component or leaf in starting the next panel. **This method is the default for Custom Grade.**

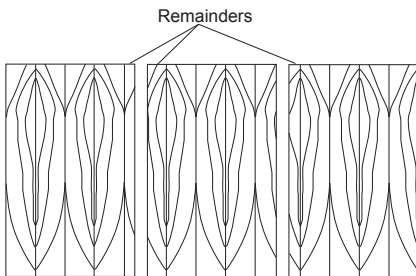


Figure: 4-026

- **Balance Match** - Each panel face is assembled from veneer leaves of uniform width before edge trimming. Panels may contain an even or odd number of leaves, and distribution may change from panel to panel within a sequenced set. While **this method is the default for Premium Grade**, it must be specified for other Grades, and it is the most common assembly method at moderate cost.

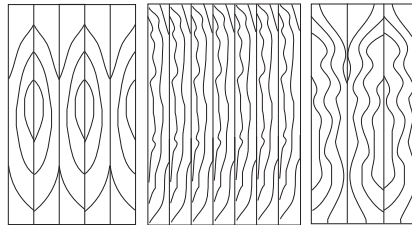


Figure: 4-027

- **Balance and Center Match** - Each panel face is assembled of an even number from veneer leaves of uniform width before edge trimming. Thus, there is a veneer joint in the center of the panel, producing horizontal symmetry. A small amount of figure is lost in the process. Considered by some to be the most pleasing assembly at a modest increase in cost over Balance Match.

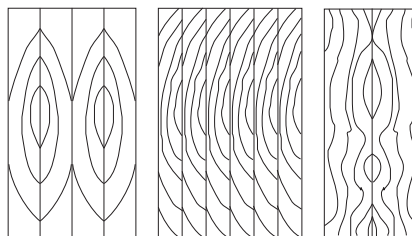


Figure: 4-028

- **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.

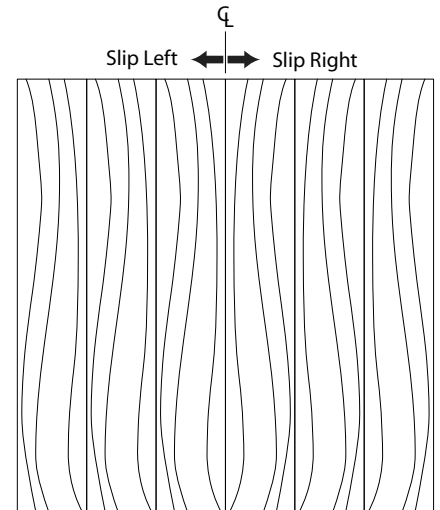


Figure: 4-029

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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 layup process, alignment at corners might vary.

- **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.

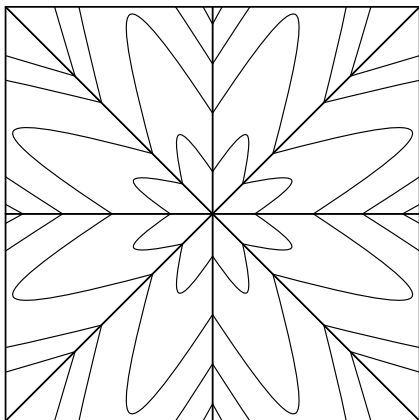


Figure: 4-030

- **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.

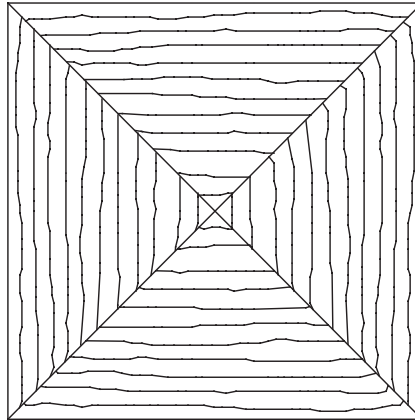


Figure: 4-031

- **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.

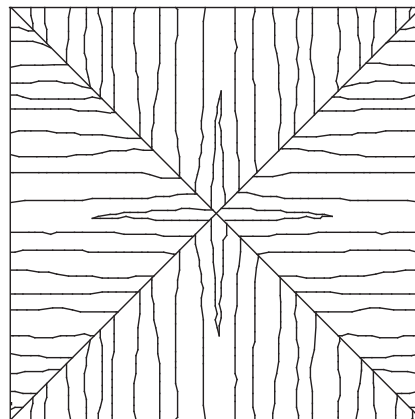


Figure: 4-032

- **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.

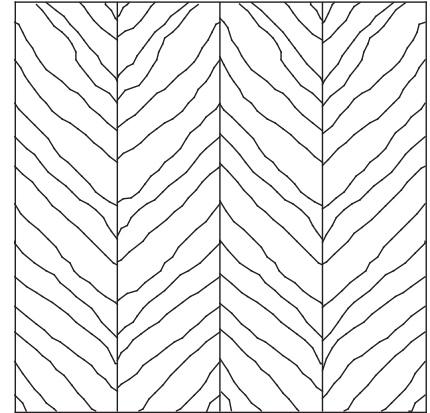


Figure: 4-033

- **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.

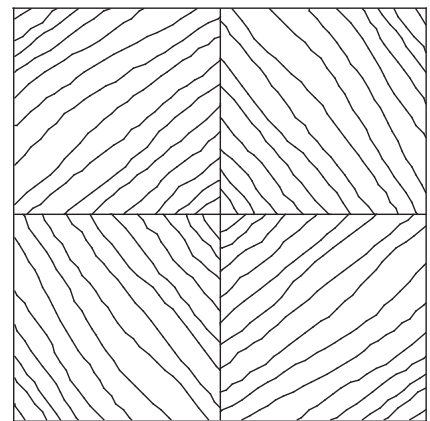


Figure: 4-034

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- **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.

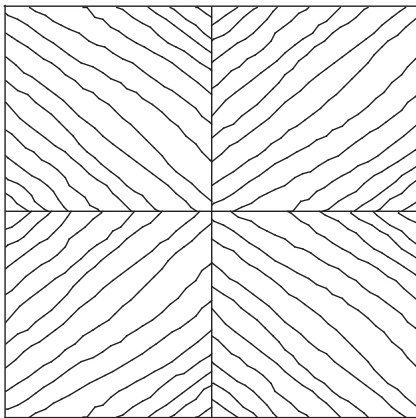


Figure: 4-035

- **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.

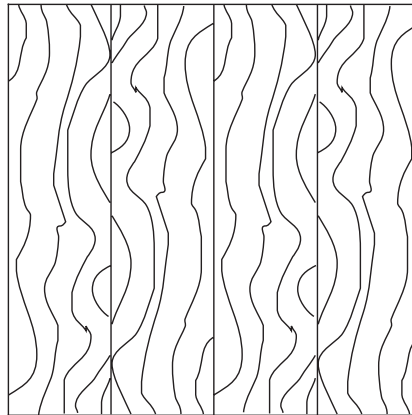


Figure: 4-037

- **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.

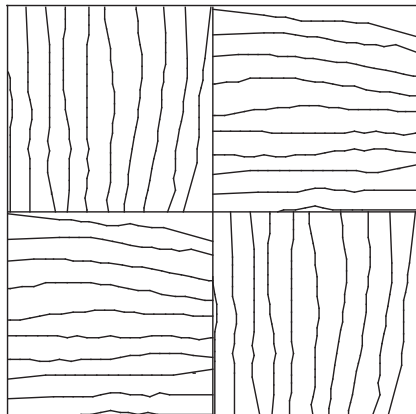


Figure: 4-036

- **Book and Butt Match** - is made by book matching highly figured veneer leaves (such as burl) 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.

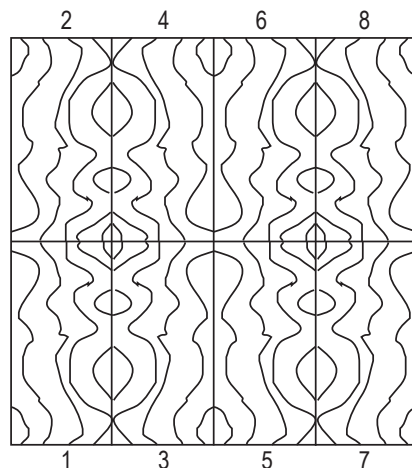


Figure: 4-038

MATCHES BETWEEN PANELS

- **Not Matched** - Veneered panels are generally manufactured without matching and may or may not be similar in grain and color.
- **Sequence Matched** - Veneered panels may be sourced and/or manufactured in sequence. These panels will be well matched for grain and color.
- **Sequence Matched & Custom Width** - Generally veneered panels are manufactured in 4' x 8' and occasionally in 4' x 10' panels. The design professional may specify veneered sequence panels in custom width for the specific project and/or elevation. These panels will be well matched for grain and color.
- **Blueprint Matched** - The design professional may specify blueprint matched panels which will be custom sized height and width as well as sequencing for the specific project and/or elevation. These panels will be matched for grain and color.

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DECORATIVE LAMINATES, OVERLAYS, and PREFINISHED PANEL PRODUCTS

Decorative surfacing materials are often applied to wood product cores such as industrial particleboard, fiberboard, hardboard, etc. Terminology and definitions of these overlay products follow, broadly grouped as:

- **Medium Density Overlay (MDO)** - Pressed resin impregnated paper overlays, highly resistant to moisture, applied to suitable cores for both interior and exterior uses. The seamless panel face and uniform density furnishes a sound base for opaque finishes and paint.
- **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.
- **Thermoplastic Sheet** - Semi rigid sheet or roll stock extruded from a nonporous acrylic/polyvinyl chloride (PVC) alloy solid color throughout. Withstands high impact. Minor scratches and gouges are less conspicuous due to the solid color.
- **Vinyl Films** - Polyvinyl chloride (PVC) film, either clear or solid color, used extensively for decorative vertical surfaces in mobile homes, recreational vehicles, commercial panels and movable walls. Some films are available with scuff resistant top coatings.
- **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. Decorative laminate 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.

The assembly offers resistance to wear and many common stains and chemicals. Common uses include casework exteriors, countertops, and wall paneling.

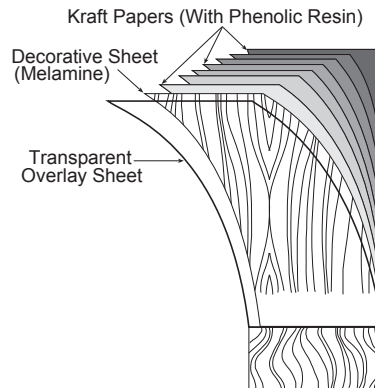


Figure: 4-039

Some decorative laminates 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.

- **Low Pressure Decorative Laminate (LPDL)** - Decorative thermally fused panels flat pressed from a thermoset polyester or melamine resin impregnated web. Most products are prelaminated to Industrial Particleboard or Medium Density Fiberboard cores when they arrive at the woodwork fabricator. Performance characteristics are similar to High Pressure decorative laminate except for the impact test.

Thermally fused papers and foils are similar to that used in the manufacture of decorative laminate. 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 core, providing a hard, permanent thermoset bond between the paper and the core.

- **Melamine** - Impregnated papers, the most common, are noted for their hardness, scratch resistance, and color stability.
- **Polyester** - Impregnated papers are noted for their chemical, stain, water, and impact resistance; color clarity; and machinability.

COMMON HPDL TYPES

The basic types form the majority of applications of high pressure decorative laminate in North America are:

- **General Purpose (HGS and HGL)** Used for most horizontal applications, such as desk tops and self-edged kitchen countertops, "HG" laminates offer durability, resistance to stains, and resistance to heat.
- **Vertical (VGS and VGL)** A slightly thinner material, "VG" laminates are produced for areas which will receive less wear and impact than typical horizontal materials. They are an excellent choice for cabinet doors, the sides of casework, primarily decorative display shelves and vertical panels.
- **Post-forming (HGP and VGP)** Specifically for applications where a radiused surface is desirable, "P" laminates offer strong performance in both horizontal and vertical applications.

A major advantage of formed surfaces on the exposed corners of casework and service counters is the edge's resistance to chipping damage. Most chip damage occurs at sharp 90° corners. Surfaces are thermoformed under controlled temperature and pressure.

- **Cabinet Liner (CLS)** A thin vertical sheet, this type is designed for areas where the surface, which is not considered decorative, generally white or off white in color, but will need to withstand less wear, such as the inside surfaces of cabinets and closets.
- **Backing Sheet (BKL)** Backing materials are essential in the fabrication of decorative laminate clad surfaces to prevent warping and to protect against dimensional instability of both laminate and core in conditions of changing temperature and humidity. Backing sheets are non decorative, and both economical and effective in the creation of a successful application. Produced without a decorative face and available as standard (slightly thinner than decorative) or regrind (reclaimed decorative laminate with decorative sheet sanded off).

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COMMON HPDL TYPES (continued)

- **Flame Retardant (HGF)** Some of these laminates are capable of providing flame retardant characteristics as determined by test methods required by the authority having jurisdiction. HGF is the most common type used.

In summary, these common decorative laminate types have the limitations of high pressure decorative laminate:

- They are for interior use only, and will not be successfully used outdoors or under heavy exposure to the ultraviolet rays of the sun.
- They should not be used as cutting surfaces, because knives and other sharp tools will readily deface the surface and lower its other performance capabilities.
- They should not be exposed to caustic chemicals, such as drain and toilet bowl cleaners, which can permanently etch the surface.
- While they offer outstanding heat resistance, exposure to constant heat from a curling iron, an electric skillet or coffee pot, for example can harm the surface and may cause it to delaminate, discolor or blister.

COLOR THROUGH DECORATIVE LAMINATES

The interest in specifying solid color decorative laminates and the resurgence of interest in very pale pastels and neutral shades have caused increasing concern with the brown line visible at glued decorative laminate edges.

Color through decorative laminates were formulated specifically to provide light colors without this brown line.

Color through decorative laminate may be applied to cores in three basic ways:

- As sheets, to form a decorative face with a true monolithic look;
- As edge trims, to match a face of conventional decorative laminate or to accent a natural material such as wood or leather;
- As decorative inlays.

Color through decorative laminate is produced with multiple layers of decorative papers, rather than the decorative plus kraft composition of conventional laminate. As a result, this material is slightly stiffer and slightly more brittle when flexed.

Selection of adhesive should take into consideration that a visible glue line may detract. Adhesive should be untinted.

SOLID PHENOLIC LAMINATES (SP)

High pressure decorative laminates are produced by several manufacturers in thicknesses adequate to preclude the use of a core (minimum 1/8" (3.2 mm)).

Unlike conventional sheets, they may be drilled and tapped, and offer significant screw holding capacity.

Depending on thickness, these laminates may be used for many flat applications, such as toilet and dressing room partitions, workbenches, shelving, and table tops.

Panels are heavy for their size—an asset in sturdiness of the end application, but a factor which must be considered when planning for time and cost of labor and transportation as well as for support structures.

STATIC-DISSIPATIVE LAMINATES

High pressure decorative laminate is a good electrical insulator—in fact, it was for the specific purpose of electrical insulation that the product was originally developed.

HPDL does not store static electricity, and it is therefore a suitable material for use in hospital areas, i.e.: operating rooms, X-ray rooms, and computer room controlled environments where the accumulation and retention of static electricity must be avoided.

However, the growing need for work surfaces in areas such as electronic clean rooms, where electrostatic charges must be actively, continuously channeled away, has triggered the development of specifically conductive (static-dissipative) laminates such as: Anti Static, Static Dissipative and Conductive.

These HPDL sheets have a conductive layer enclosed in, or backing, the sheet. Connected to suitable grounding, they create a decorative, sturdy, practical work surface. Applications include electronic workbench tops and work areas around instrument monitoring devices, in lab testing environments, around photo equipment and on computer desktops.

Antistatic laminates are produced in a number of compositions, thicknesses, colors and patterns. Consult manufacturers' literature for details.

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CHEMICAL-RESISTANT DECORATIVE LAMINATES

Chemical resistant HPDL offers the familiar advantages of HPDL: resistance to wear, conductive and radiant heat, and impact; as well as ease in cleaning, color fastness, and relatively light weight. Although this product may resist some chemicals, depending on the testing methods of the individual manufacturer's, it is the design professional's responsibility to select the appropriate material for the chemical resistance required.

These laminates may be applied on vertical as well as horizontal surfaces, to extend protection to cabinet doors and sides. And they may be post-formed for seamless edges.

Adhesives should be specified carefully. Edges which may be exposed to chemical attack should be glued with chemical-resistant adhesives. Formulation of chemical-resistant decorative laminate differs from producer to producer. Consult product literature to make sure the material you specify meets the needs of your projects.

They are available in varying thicknesses and a number of color and patterns depending on manufacturer.

METAL-FACED LAMINATES

High pressure decorative laminates are produced with metal veneers and a backer of kraft paper and phenolic resin.

The material used for much of the metal laminates is interior-type anodized aluminum. Other materials, including copper and nickel alloys may be specified in various formats; however, some metals, such as stainless steel or plated metal, are not conducive to machining with woodworking equipment.

FLAME SPREAD RATING of DECORATIVE LAMINATES

Safer materials for interiors are a primary concern for commercial and institutional design professionals across North America. The threat of fire and its concomitant hazard of smoke has created a critical need for interior materials that address this concern without aesthetic sacrifice.

Manufacturers of decorative laminate materials offer fire and smoke retardant grades for interior application. The addition of fire retardant does not affect the performance characteristics of decorative laminate; wear and stain resistance, ease of maintenance, and color stability remain very strong.

Rated high pressure decorative laminates are evaluated and certified according to ASTM-E-84 test procedures (cataloged as ASTM-E-84 Tunnel Test; and as Test No. 723 by Underwriters Laboratories, Inc. Similar Canadian testing is cataloged as CAN4-512-79).

With appropriate choices of core and adhesive, panels clad with fire-rated decorative laminate may be produced to comply with Class 1, I, or A, fire codes. Finished panels, already certified, may also be specified from some decorative laminate manufacturers.

Major applications of rated decorative laminate include door, wall, and wainscot cladding in corridors, stairwells, entries, and elevators; as well as surfacing on fixtures and casework. These materials are supplied in both horizontal and vertical types, in a wide range of colors and patterns.

They may not be post-formed; the special formulation that produces fire retardant is not compatible with heat forming.

Adhesive choice for fire-rated decorative laminate is important. As with many types of fire retardant particleboard, some PVA adhesives are incompatible with the fire-retardant chemical composition of the decorative laminate material. Resorcinol adhesives are best for both chemical compatibility and flame spread rating of the end product. Contact adhesives do surprisingly well in some cases. Verify test ratings with your decorative laminate manufacturer.

NATURAL WOOD LAMINATES

An excellent example of the ongoing evolution of the high pressure decorative laminate process. Presently, natural wood laminates may be specified in two formats; both feature thin veneers of woods bonded under high pressure and heat to a core of kraft papers and phenolic resins. One process leaves the face of the wood untreated, and ready to finish. The other adds a protective face of melamine resin.

Performance characteristics vary with the presence or absence of the melamine resin. In both cases, the ease of cutting and bonding, as well as the wear resistance, improve in comparison to raw wood veneer. With the melamine face, the natural wood assumes much of the easy care and long wear properties of conventional high pressure decorative laminate.

Sequence matching of natural wood laminate panels is extremely limited; consult the laminate manufacturer.

SPECIAL SHEET PRODUCTS

Included in this classification are special panel products such as lead lined panels for X-ray areas, bullet resistant panels, honeycomb core panels when light weight is a consideration, etc.

- **Lead Lined Panels** - Usually a sheet of lead of a specified thickness, to meet X-ray shield requirements, is laminated between 2 layers of core material. A decorative overlay and balancing sheet can then be applied as required.
- **Bullet Resistant Panels** - Available as steel plate, glass, polycarbonate, acrylic or fiberglass reinforced material which can offer protection against many available small arms fire, depending upon the thickness specified. These panels are usually built into the interior of the structure of the counter, teller's lines, judge's benches, etc.

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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. Products (and manufacturer's warranties) vary and should be fabricated according to manufacturer's recommendations, including the use of unique fasteners and adhesives. Many decorative inlays are available. Consult your manufacturer about performance issues, materials, colors, and patterns. To ensure color and pattern match it is suggested to use same batch material at adjacent sheets.

OTHER PANEL PRODUCTS

Many new panel products are available, from recycled glass and epoxy impregnated metal shavings to plastic or acrylic panels created from a variety of natural and recycled materials. The options are wide spread and the sheer volume of products make it difficult to quantify. The AWS acknowledges these products and encourages design professionals to verify with individual product manufacturers that their products meet required performance standards. The AWS does not at present address these products.

SPECIFY REQUIREMENTS FOR

- **UNIFORM COLOR**, certain finishing techniques might be required to achieve uniformity (see Section 5).
- **CHARACTERISTICS**, such as sapwood, heartwood, ribbon stripe, quarter sawn, rift sawn, or vertical grain.
 - Natural, Sapwood and Heartwood are color and cut subsets of Ash, Beech, Birch, Maple, and Poplar. (see HPVA table).
 - Natural as a type of wood species selection, allows an unlimited amount of heartwood and/or sapwood within a face.
 - Sapwood is all sapwood and is generally referred to for example as Select White for Maple and Birch.
 - Heartwood is all heartwood and is generally referred to for example as Select Red for Birch.
- **SPECIAL FIGURE** characteristics.
- **TYPE I WATERPROOF BOND** for limited non climate controlled interior or exterior use (compliant with 2 Cycle Boil and Shear Tests).
- **FLAME SPREAD** and/or smoke development ratings.
- **SPECIALITY 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 resistant), reconstituted veneers, bamboo sheets, acrylic sheets, or PVC sheets which are the products of an individual manufacturer, are covered by their manufacturer's specification - not by these standards.

RECOMMENDATIONS

- **VENEER CORE PANELS** should not be used for cabinet doors because they are likely to warp, and:
 - Rotary cut softwood sheets with clear faces, free of patches, are not typically available.
 - Formaldehyde emission regulations should be carefully researched before shipping product into an unfamiliar area.
- **CHECKING or WARPAGE** of wood veneered sheets can be avoided by proper environmental maintenance, such as being:
 - Protected from extremes in relative humidity and temperature.
 - Finished on both surfaces to retard moisture movement in and out of the panel.
 - Placed in locations that avoid directly facing air vents and/or radiant heat sources.
- **LAMINATION OVER EXISTING OVERLAYS**
 - The application of any thickness of HPDL over the top of existing HPDL is not permitted. Experience shows that the adhesion of the new laminate to the existing surface is very low, often resulting in delamination and failure of the glue line.
 - Likewise, the application of HPDL over existing thermoset decorative overlay (melamine) is strongly discouraged. Some fabricators report success by aggressively sanding the melamine surface, followed by applying sufficient contact adhesive and adequate pressure. Delamination is a defect. The risk of delamination is high. Specify or use this procedure with care.

The **COMPLIANCE** portion of this Section has been intentionally excluded to protect our sale of Grade Rules, which allows us to provide these standards free of charge to Design Professionals.