APPENDIX


acajou

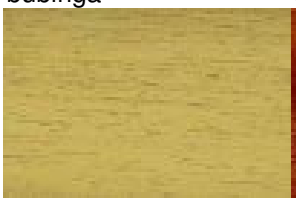
ash

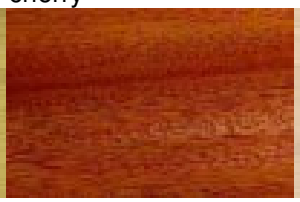
beech

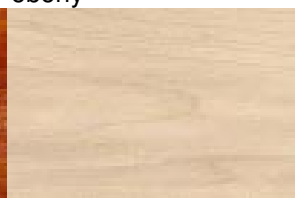

bubinga

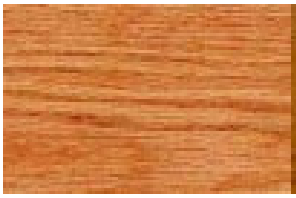

cherry

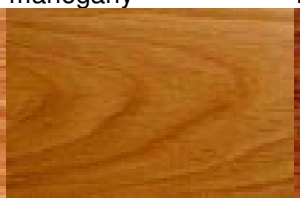

ebony

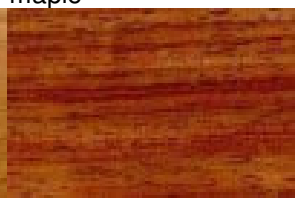

iroko

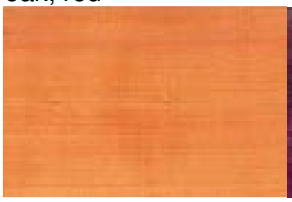

mahogany


maple

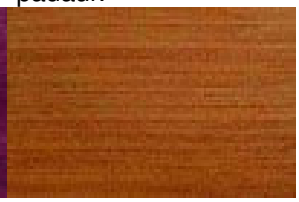

oak, red


oak, white


padauk


pear


purpleheart


redwood


teak


walnut

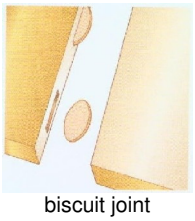

wenge

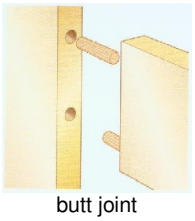
Franklin International

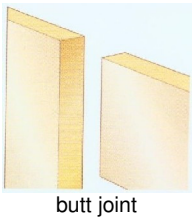
2020 Bruck Street Columbus, Ohio 43207
Construction Products Division
Technical Services (800) 347-4583

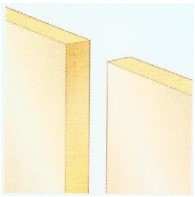
INDEX

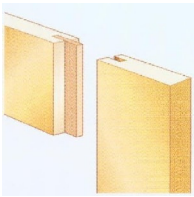
Common joints

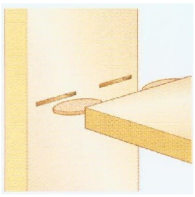

biscuit joint
long-grain to long-grain biscuit joint

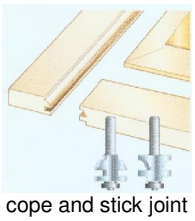

butt joint
doweled butt joint


butt joint
end-grain to long-grain butt joint

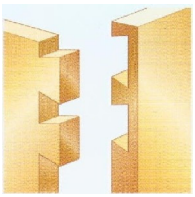

butt joint
long-grain to long-grain butt joint

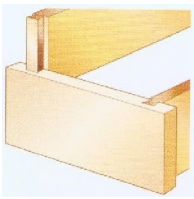

butt joint
butt spline joint

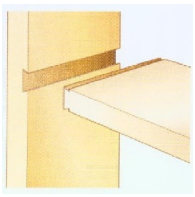

butt joint
T-butt with biscuits

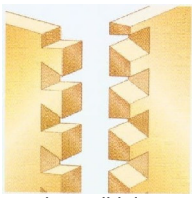

cope and stick joint

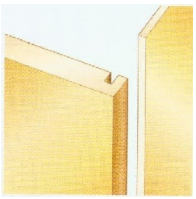

corner bridle joint


dovetail joint
half-blind dovetail joint


dovetail joint
sliding T dovetail joint

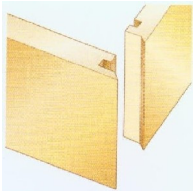

dovetail joint
straight sliding through dovetail joint

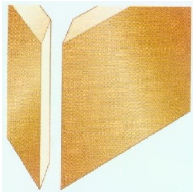

dovetail joint
through box dovetail joint

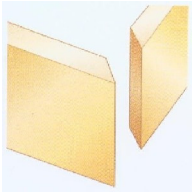

groove joint

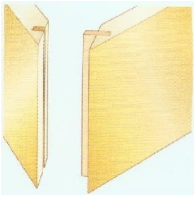

lap corner frame joint

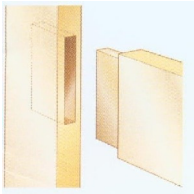

miter joint
biscuit miter joint


miter joint
lock miter joint

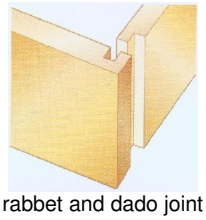

miter joint
long-grain to long-grain miter joint

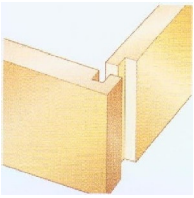

miter joint
short grain miter joint

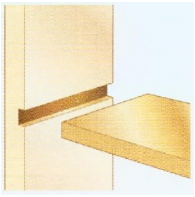

miter joint
spline miter joint

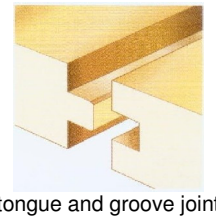

mortise and tenon joint
blind mortise and tenon joint


mortise and tenon joint
haunched mortise and tenon joint


rabbet and dado joint


rabbet joint


through dado joint


tongue and groove joint

Titebond Wood Glues

Titebond III Ultimate Wood Glue

An advanced, proprietary technology that offers the best possible performance in woodworking glues. This waterproof formula passes the ANSI/HPVA Type I water-resistance specification and offers superior bond strength, longer open assembly time and lower application temperature. Titebond III Ultimate Wood Glue is non-toxic, solvent free and cleans up with water – safer to use than traditional waterproof wood glues. It provides strong initial tack, sands easily without softening and is FDA approved for indirect food contact (cutting boards). The ultimate in wood glues – ideal for both interior and exterior applications.

Titebond II Premium Wood Glue

The first leading brand, one-part PVA wood glue to pass the ANSI/HPVA Type II water-resistance specification. It is ideal for exterior woodworking projects, including outdoor furniture, birdhouses, planters, mailboxes and picnic tables. Titebond II Premium Wood Glue offers strong initial tack, outstanding bond strength, fast speed of set and excellent sandability. It is FDA approved for indirect food contact (cutting boards) and is ideal for radio-frequency (R-F) gluing systems. It is easy to use, non-toxic, solvent free and cleans up with water.

Titebond Original Wood Glue

Recognized as the industry standard for general woodworking applications, this original aliphatic-resin glue has been the preferred choice of professionals for over 50 years. It provides strong initial tack and fast speed of set to reduce clamp time. Titebond Original Wood Glue develops a bond stronger than the wood itself, offers outstanding sandability and is unaffected by finishes. It provides excellent resistance to heat, solvents and mildew. It is ideal for both hardwoods and softwoods, as well as most other porous materials. Titebond Original Wood Glue is easy to use, non-toxic, solvent free and cleans up with water.

Titebond Polyurethane Liquid Glue

A professional-strength, waterproof formula specifically designed for a wide-range of applications. In addition to its superior wood-to-wood performance, it is ideal for metal, ceramic, most plastics, HPL, Corian, stone and other porous/non-porous materials.
Titebond Polyurethane Liquid Glue provides a longer open time than PVA glues, offers excellent sandability and is unaffected by finishes. As moisture causes the glue to foam, it has the ability to fill gaps and bridge irregularities in the substrates; however, it will not expand or contract in the joint once fully cured. It works well on exotic or "oily" woods and will not become brittle with age.

Titebond II Dark Wood Glue

Titebond II Dark Wood Glue is a dyed-version of Titebond II Wood Glue. It provides a strong initial tack and fast speed of set to reduce clamp time. It also develops a bond stronger than wood itself, offers excellent sandability and is unaffected by finishes. Titebond Dark is ideal for assembly, face and edge gluing as well as most other wood gluing applications. It is easy to use, non-toxic and cleans up with water.

Titebond Wood Molding & Trim Glue

The thickest, fastest drying glue available for use with porous and semi-porous substrates. This no-run, no-drip formula dries clear and is ideal for finish and trim carpentry, including crown moldings, chair rails, cabinet trim, baseboards and window casings. Titebond Molding & Trim Wood Glue provides strong initial tack and fast speed of set, yet allows realignment of working pieces to ensure proper positioning before bonding. This professional-grade glue develops a bond stronger than the wood itself, offers excellent sandability and is unaffected by finishes. Titebond Molding & Trim Wood Glue is easy to use, non-toxic, solvent free and cleans up with water.

Titebond Liquid Hid Glue

Titebond Liquid Hide Glue is the first hide glue to be offered in a liquid, ready-to-use form. It requires no mixing, heating or stirring. Professional woodworkers use Titebond Liquid Hide for its long assembly time, exceptional strength and unique crackling effect on wood. Titebond Liquid Hide provides superior creep-resistance, offers excellent sandability and is unaffected by solvent-based finishes. Its sensitivity to moisture allows for easy disassembly of parts, a critical benefit in antique restoration or the repair of musical instruments.

Titebond Home/School Glue

Titebond Home/School Glue is specifically designed for home, school and craft projects. It will wash out and won't stain clothing, making it ideal for children of all ages. It is also non-toxic, safe to use and is FDA approved for indirect food contact. Titebond Home/School is an all-purpose formula that can be used for paper, wood, pottery, cloth, Styrofoam®, yarn, felt, glitter and more. It sets fast, provides a strong bond and dries clear.

Titebond HiPURformer Advanced Bonding System

The HiPURformer Advanced Bonding System offers three adhesives, all of which are waterproof, provide strong, permanent bonds and reduce the need for clamping or bracing. For many applications, the system can eliminate the use of nails or staples, reducing time and money in filling, sanding and staining repair marks.

Complete HiPURformer Kit includes:

One cartridge of WW30	Adhesive applicator base (charger)
One cartridge of WW60	Detachable power cord
One cartridge of MP75	Instruction manual and product brochure
Adhesive applicator	A durable, weatherproof carrying case

Titebond WW30 HiPURformer Polyurethane Hot Melt Adhesive

Titebond WW30 is the adhesive component of this unique and innovative system. This adhesive is specifically designed for wood and wood-composite applications. It offers a low viscosity and a faster set time, making it ideal for more rapid operations. With a fast set time, it eliminates the need for nails, staples, screws and other mechanical fasteners (in most applications).

Titebond WW60 HiPURformer Polyurethane Hot Melt Adhesive

Titebond WW60 is the adhesive component of this unique and innovative system. This thicker formulation is designed for wood and wood-composite projects and is ideal for application where gap filling properties are needed. With a fast set time, it eliminates the need for nails, staples, screws and other mechanical fasteners (in most applications), yet it is ideal for assembly applications where longer open times are desired.

Titebond MP75 HiPURformer Polyurethane Hot Melt Adhesive

Titebond MP75 is the adhesive component of this unique and innovative system. This special adhesive is extremely versatile and designed for use on a wide variety of materials. With a fast set time, it eliminates the need for nails, staples, screws and other mechanical fasteners (in most applications), yet it is ideal for assembly applications where longer open times are desired.

Titebond MP300 HiPURformer Polyurethane Hot Melt Adhesive

Titebond MP300 is the adhesive component of this unique and innovative system. This special adhesive is extremely versatile and designed for use on a wide variety of materials. The slower set time allows for precise application on intricate assemblies. MP300 eliminates the need for nails, staples, screws and other mechanical fasteners in many applications.

Titebond Instant Bond

Titebond Instant Bond is a two-part bonding system that takes between 5 – 15 seconds to set and 30 – 60 seconds for initial cure. It provides a strong, permanent bond and is ideal for hard to reach joints or surface areas that are difficult to clamp. Designed primarily for wood and wood products, this adhesive is also very effective on a wide variety of materials and substrates.

Titebond Instant Bond - Thin

The thin viscosity product offers the fastest assembly time of 5 seconds and an initial cure speed of 3 seconds. It is ideal for repairing hair line cracks and small defects in wood, as well as repairing loose veneer edges. It can also be used as a finish. While Titebond Instant Bond Activator can be used to further reduce set times, it is not required for producing strong, tight fitting joints.

Titebond Instant Bond – Medium

The medium viscosity product offers an assembly time of 7 seconds and an initial cure speed of 5 seconds. In addition to typical bonding applications, it is ideal for filling knots and voids in wood, adhering pen tubes to blanks for pen turning applications, and for soaking end-grain to prevent splitting.

Titebond Instant Bond – Thick

The thick viscosity product offers an assembly time of 10 seconds and an initial cure speed of 8 seconds. It is ideal for bonding end-grain in a miter joint application, quick assembly of jigs and fixtures, adhering turning blocks to scrap blocks on a faceplate for immediate use.

Titebond Instant Bond – Gel

The gel viscosity product offers the longest assembly time of 30 seconds and an initial cure speed of 20 seconds. It is ideal for gap-filling applications, gluing porous and odd-shaped surfaces and various cabinet making applications, such as pre-bonding moldings to install as one unit.

Titebond Instant Bond – Activator

Instant Bond Activator is used to accelerate the curing of all Titebond Instant Bond Adhesives. The Activator is especially effective for applications involving large gaps, very porous wood, acidic surfaces or in low humidity conditions. It is a heptane-based solvent that will not mar finishes or damage plastics.

Titebond Neoprene Plus Contact Cement

Titebond Post-forming Neoprene Plus Contact Cement is a high-quality, fast drying, heat resistant adhesive that allows post-forming, and bonds decorative laminates, veneer, hardboard, leather, rubber and flexible metal to most common building materials. It offers a high-strength, immediate bond, that allows for immediate machining. Titebond Neoprene Plus Contact Cement is environmentally superior and contains no ozone-depleting chemicals. Unlike solvent-based contact cements, it is nonflammable, VOC compliant, has no offensive odor and cleans up with water. Neoprene Plus is the ideal choice in response to local fire codes, insurance requirements and general risk of fire. Titebond Post-forming Neoprene Plus Contact Cement is available
in both neutral/clear and blue/green.

Titebond Extend

Titebond Extend Wood Glue is a slower setting version of Titebond Original Wood Glue. It offers superior performance in a broad range of applications, including edge and face gluing. It is particularly useful in complex operations such as curved railings and other assemblies that require more time to align. Titebond Extend develops a bond stronger than wood itself, offers excellent sandability and is unaffected by finishes. It is compatible with all common species of wood, as well as particleboard, MDF, plywood and other porous materials.

Titebond II Extend

Titebond II Extend Wood Glue combines weatherproof performance (ANSI Type II water-resistance) with a slower speed of set. It is ideal for exterior applications that involve more complex assemblies. It also provides a translucent glue line, offers excellent sandability and is unaffected by finishes. Titebond II Extend offers superior performance on all common wood species, particleboard, MDF, plywood and other porous materials. In addition, it is compatible for use with Hot Press and radio frequency (R-F) gluing systems.

Titebond Melamine Glue

Titebond Melamine Glue is designed for bonding wood, particleboard, MDF and other porous substrates to synthetic materials such as melamine, vinyl and HPL as well as metals. It offers a fast initial tack, yet has a longer open time that allows for the accurate alignment of working materials. Titebond Melamine Glue is a water-based adhesive that is nonflammable, has low odor, dries clear and cleans up with water. Its thicker formulation offers fewer runs and drips, making it easier to use and more effective for precise assemblies.

Titebond White Glue

Titebond White Glue is an exceptionally strong, economical white glue that sets faster than most other comparable glues. Its versatile formula is ideal for general woodworking applications, as well as many other porous and semi-porous materials. Titebond White Glue provides a strong initial tack and sets fast to reduce clamp time. It provides a translucent glue line, offers excellent sandability and is unaffected by finishes. Titebond White Glue is easy to use, non-toxic and cleans up with water.

Titebond Doweling Glue

Titebond Doweling Glue is specifically designed for use with automatic doweling equipment. Its low viscosity (1500 cps.) allows the appropriate flow through feed lines and injectors of most U.S.-made doweling machinery. Titebond Doweling sets fast to reduce assembly time, offers excellent strength and provides a translucent glue line. It is formulated for use on solid woods, particleboard, MDF, plywood and other porous materials.

Titebond Doweling Glue L.V.

Titebond Doweling Glue L.V. is designed for use with automatic doweling equipment. Its low viscosity (140 cps.) allows the appropriate flow through the narrow feed lines and injectors of European-made doweling machinery. Titebond Doweling Glue L.V. sets fast to reduce assembly time, offers excellent strength and provides a translucent glue line. It is formulated for use on solid woods, particleboard, MDF, plywood and other porous materials.

Titebond Cold Press for HPL

Titebond Cold Press for HPL is a high-quality, economical alternative to contact cement for large-scale flat laminating. It is specifically formulated for cold press laminating of High Pressure Laminates and backed veneers to solid woods, particleboard, MDF, plywood and other porous materials. Titebond Cold Press is also suitable for most veneer and panel-on-frame applications. It offers a moderate speed of set, a translucent glue line and contains none of the harmful or corrosive fumes typical of most contact cements.

Titebond Cold Press for Veneer

Titebond Cold Press for Veneer is a high-quality, economical alternative to contact cement for large-scale bonding of veneers to flat surfaces. It is specifically formulated for cold press laminating of wood to solid woods, particleboard, MDF, plywood and other porous materials.
Titebond Cold Press offers a moderate speed of set, a translucent glue line and contains none of the harmful or corrosive fumes typical of most contact cements. It also prevents bleed-through on open-grained and unbacked wood veneers.

Super Titebond

Super Titebond Wood Glue is a high-quality, professional woodworking glue that offers superior sandability and solvent-resistance. It develops a bond stronger than wood and provides a longer working time than traditional aliphatic resin glues. Super Titebond resists stress imposed by heat and moisture during the production of panels, squares and other wood parts. This makes it the ideal choice for edge and face gluing as well as other woodworking operations.

Titebond II Fluorescent Glue

Titebond II Fluorescent can help any woodworker achieve professional-looking results. It provides a strong initial tack and fast speed of set to reduce clamp time. It also develops bonds stronger than wood, offers excellent sandability and is unaffected by finishes. Titebond II Fluorescent contains a dye that, when viewed under a black light, enables woodworkers to inspect the glue line and assist in the cleanup process. It is ideal for most porous materials, is easy to use and cleans up with water.

Titebond Quickset 2000

Quickset 2000 is a water-based adhesive designed to bond HPL to wood-based substrates. It can be used in a variety of ways including continuous heated-panel laminating systems, pinch roll and dead stacking, or limited lay-up time cold-press operations. Quickset 2000 is a fast setting adhesive that is suitable for post-forming applications when it is sprayed or applied inline with a post-former and immediately processed. It offers high green strength and high tensile strength.

Physical characteristics of Titebond Glues

Titebond Product	Type	% solids	Color wet/dry	Clean-up	VOC	pH	Viscosity	Freeze/ Thaw Stable
III Ultimate	proprietary polymer	52%	tan/light brown	water when wet, sand when dry	5.6 g/l	2.5	4200 cps	yes
II Premium	crosslinking PVA	48%	honey ream/ yellow	water when wet, sand when dry	13.7 g/l	3.0	4000 cps	yes
Original	aliphatic resin	46%	yellow/ yellow	water when wet, sand when dry	10.7 g/l	4.0	3200 cps	yes
Polyurethane	polyurethane	100%	brown/tan	mineral spirits when wet, scrape or sand when dry	0 g/l	n/a	8500 cps	yes
II Dark	crosslinking PVA	48%	light brown/brown	water when wet, sand when dry	13.7 g/l	3.0	4000 cps	yes
Molding & Trim	PVA	60%	beige/ translucent beige	water when wet, sand when dry	9.8 g/l	4.8	36500 cps	yes
Liquid Hide	natural animal protein	52%	amber/ translucent	water when wet, water when dry	0 g/l	6.5	4000 cps	yes
Home/School	PVA	46%	white/clear	water when wet, sand when dry	10.7 g/l	4.8	6500 cps	yes
WW30	polyurethane	100%	translucent/ white	scrape when cool	0 g/l	n/a	7600 cps *	n/a
WW60	polyurethane	100%	translucent/ white	scrape when cool	0 g/l	n/a	12000 cps *	n/a
MP75	polyurethane	100%	translucent/ white	scrape when cool	0 g/l	n/a	9500 cps *	n/a
MP300	polyurethane	100%	translucent/ white	scrape when cool	0 g/l	n/a	11000 cps *	n/a
Instant Bond Thin	cyanoacrylate	100%	clear/ translucent	Use acetone	20 g/L	n/a	5 cps	n/a
Instant Bond Medium	cyanoacrylate	100%	clear/ translucent	Use acetone	20 g/L	n/a	120 cps	n/a
Instant Bond Thick	cyanoacrylate	100%	clear/ translucent	Use acetone	20 g/L	n/a	2400 cps	n/a
Instant Bond Gel	cyanoacrylate	100%	clear/ translucent	Use acetone	20 g/L	n/a	60000 cps	n/a
Extend	aliphatic resin	42%	yellow/ yellow	water when wet, sand when dry	3.1 g/l	4.8	3500 cps	yes
II Extend	crosslinking PVA	48%	off white/ cream	water when wet, sand when dry	4.1 g/l	3.0	3500 cps	yes
Melamine	specialized PVA	59%	white/clear	water when wet, sand when dry	2.3 g/l	4.0	12000 cps	no
White Glue	PVA	45%	white/ translucent	water when wet, sand when dry	10.5 g/l	4.7	5600 cps	yes
Doweling	PVA	51%	white /translucent	water when wet, sand when dry	10.2 g/l	4.5	1500 cps	yes
Doweling LV	PVA	43%	white/ translucent	water when wet, sand when dry	9.6 g/l	4.7	140 cps	yes
Cold Press for HPL	PVA	42%	off white/ translucent	water when wet, sand when dry	3.2 g/l	4.5	4500 cps	yes
Cold Press for Veneer	PVA	42%	tan/ dark brown	water when wet, sand when dry	7.1 g/l	4.9	4500 cps	yes
Super Titebond	aliphatic resin	44%	cream/ translucent yellow	water when wet, sand when dry	10.7 g/l	4.5	4500 cps	yes
II Fluorescent	crosslinking PVA	48%	honey ream/ yellow	water when wet, sand when dry	13.7 g/l	3.0	4000 cps	yes
Quickset 2000	PVA/ethylene copolymer emulsion	62.5%	Light blue/translucent	water when wet, sand when dry	9.47 g/l	4.5	4350 cps	no

Performance and use characteristics of Titebond Glue

Titebond Product	Strength at room temp	% wood failure at room temp	Strength at 150°F	% wood failure at 150°F	Chalk Temp	Open/closed assembly time
III Ultimate	4000 psi	57%	not available	not available	47°F	10/15
II Premium	3750 psi	72%	1750 psi	6%	55°F	5/10
Original	3600 psi	77%	1600 psi	10%	50°F	5/10
Polyurethane	3500 + psi	60%	3000 + psi	50%	n/a	10/10
II Dark	3750 psi	72%	1750 psi	6%	55°F	5/10
Molding & Trim	3000 psi	7%	650 psi	0%	50°F	5/10
Liquid Hide	3591 psi	72%	3207 psi	59%	n/a	10/15
Home/School	n/a	n/a	n/a	n/a	60°F	5/5
WW30	1360 psi	n/a	n/a	n/a	n/a	.5/.5
WW60	1480 psi	n/a	n/a	n/a	n/a	1/1
MP75	900 psi	n/a	n/a	n/a	n/a	1.25/1.25
MP300	1016 psi	n/a	n/a	n/a	n/a	5/1
Instant Bond Thin	Between 2800 and 4200 psi depending on substrate tested	n/a	n/a	n/a	n/a	5 seconds
Instant Bond Medium	Between 2800 and 4200 psi depending on substrate tested	n/a	n/a	n/a	n/a	7 seconds
Instant Bond Thick	Between 2800 and 4200 psi depending on substrate tested	n/a	n/a	n/a	n/a	10 seconds
Instant Bond Gel	Between 2800 and 4200 psi depending on substrate tested	n/a	n/a	n/a	n/a	30 seconds
Extend	3510 psi	81%	3120 psi	61%	40°F	7.5/10
II Extend	3844 psi	48%	1820 psi	6%	60°F	7.5/10
Melamine	339 psi *	n/a	n/a	n/a	35°F	5/10
White Glue	3550 psi	50%	1600 psi	15%	50°F	5.10
Doweling	3650 psi	68%	1250 psi	1%	50°F	5/5
Doweling LV	2711 psi	32%	1890 psi	0%	50°F	5/10
Cold Press for HPL	2711 psi	32%	1890 psi	1%	50°F	5/10
Cold Press for Veneer	2508 psi	6%	656 psi	0%	50°F	5/10
Super Titebond	3976 psi	85%	3090 psi	75%	40°F	5/10
II Fluorescent	3750 psi	72%	1750 psi	6%	55°F	5/10
Quickset 2000	n/a	n/a	n/a	n/a	35°F	5/5

Trouble shooting

Cold Press Laminating

Problem: **Total delamination with little or no substrate failure**

- Possible Cause: Pre-cure (no glue transfer)
  Recommendation: Increase glue spread
- Possible Cause: Low pressure (poor contact)
  Recommendation: Increase pressure
- Possible Cause: Short press time
  Recommendation: Increase pressure period

Problem: **Spotty bond**

- Possible Cause: Uneven surfaces
  Recommendation: Calibrate cores to uniform thickness and/or increase pressure
- Possible Cause: Worn Spreader Rolls
  Recommendation: Replace or re-groove rolls

Problem: **Glue bleeds through face veneers**

- Possible Cause: Excessive glue spread
  Recommendation: Reduce glue spread
- Possible Cause: Excessive pressure
  Recommendation: Reduce pressure
- Possible Cause: Wrong adhesive type
  Recommendation: Call Technical Support for a recommendation

Problem: **Telegraphing of core defects or banding**

- Possible Cause: Excessive pressure
  Recommendation: Reduce pressure
- Possible Cause: Uneven or variable thickness
  Recommendation: Re-sand core
- Possible Cause: Foreign material on core
  Recommendation: Pre-clean core

Problem: **Warpage of panels**

- Possible Cause: Excessive or unequal spread
  Recommendation: Reduce spread and make sure spread is equal on both sides
- Possible Cause: Unbalanced construction
  Recommendation: Check grain orientation & number of plies
- Possible Cause: Excessive moisture in wood
  Recommendation: 6-8% moisture content recommended

Problem: **Brilliant white on glue squeeze-out and/or glue line**

- Possible Cause: Chalking caused by low temperature
  Recommendation: Raise temperature of plant, wood and adhesive above minimum use temperature of adhesive

Hot Press Laminating

Problem: **Spotty bonds**

- Possible Cause: Low spread
  Recommendation: Increase adhesive spread
- Possible Cause: Uneven core thickness
  Recommendation: Calibrate cores to uniform thickness
- Possible Cause: Low pressure
  Recommendation: Increase pressure
- Possible Cause: Cold spots in platen
  Recommendation: Check temperature with surface thermometer

Problem: **Glue bleeds through face veneers**

- Possible Cause: Excessive spread
  Recommendation: Reduce adhesive spread
- Possible Cause: Excessive pressure

Recommendation: Reduce pressure

- Possible Cause: Wrong adhesive type
  Recommendation: Call Technical Support for a recommendation

Problem: **Steam blisters**

- Possible Cause: Excessive spread
  Recommendation: Reduce adhesive spread
- Possible Cause: High moisture content of wood
  Recommendation: 6%-8% moisture content recommended
- Possible Cause: High press temperature
  Recommendation: Reduce temperature

Problem: **Warpage of panels**

- Possible Cause: Excessive spread
  Recommendation: Reduce adhesive spread
- Possible Cause: Unequal spread
  Recommendation: Make sure that top and bottom spread are equal
- Possible Cause: High moisture content of wood
  Recommendation: 6%-8% moisture content recommended
- Possible Cause: Unbalanced construction
  Recommendation: Check grain orientation
- Possible Cause: High press temperature
  Recommendation: Reduce platen temperature

Radio Frequency Edge Gluing

Problem: **Undercured joint/glue line still wet**

- Possible Cause: Low power
  Recommendation: Increase power
- Possible Cause: Short cure cycle
  Recommendation: Increase cycle time
- Possible Cause: No pressure
  Recommendation: Check filler boards and pressure system
- Possible Cause: High moisture content of wood
  Recommendation: 6-8% moisture content recommended
- Possible Cause: Improper catalyst mix
  Recommendation: Contact Technical Support
- Possible Cause: Generator malfunction
  Recommendation: Contact equipment repair company

Problem: **Cured joint-weak bonds**

- Possible Cause: Slightly undercured
  Recommendation: Check power and time settings
- Possible Cause: Incorrect pressure
  Recommendation: Check edge pressure
- Possible Cause: Irregular or burnished surfaces
  Recommendation: Check surface preparation
- Possible Cause: Improper moisture content of wood
  Recommendation: 6-8% moisture content recommended

Problem: **Panel open on ends**

- Possible Cause: Poor stock preparation
  Recommendation: Check quality of gluing surface/end fit
- Possible Cause: Pressure shoes overlapping on next panel
  Recommendation: Check and correct if necessary
- Possible Cause: Shrinkage between time of surfacing and pressing
  Recommendation: 6-8% moisture content, 30% minimum elative humidity and glue within 24 hours of preparation

Problem: **Burning in joints**

- Possible Cause: Power too high

Recommendation: Reduce power

- Possible Cause: Improper catalyst level
  Recommendation: Contact Technical Support
- Possible Cause: Surface irregularities
  Recommendation: Check surface preparation
- Possible Cause: Excessive spread
  Recommendation: Reduce glue spread
- Possible Cause: Long assembly time
  Recommendation: Press within five minutes
- Possible Cause: High edge pressure
  Recommendation: Reduce edge pressure

Problem: **Black glue lines**

- Possible Cause: Iron contamination in adhesive
  Recommendation: Isolate and eliminate contact source of wet adhesive with iron or steel

Edge and Face Gluing

Problem: **Weak joints with little or no wood failure**

- Possible Cause: Poor stock machining
  Recommendation: Check for mechanical malfunction, check adjustment of equipment and make sure blades are sharp
- Possible Cause: Burnished surfaces
  Recommendation: Increase feed rate on moulder/jointer and sharpen or replace cutter blades
- Possible Cause: Undercured or frosted joints caused by low temperature
  Recommendation: Raise plant and stock temperatures
- Possible Cause: Undercured or frosted joints caused by short clamp time
  Recommendation: Increase clamp time
- Possible Cause: Undercured or frosted joints caused by high moisture content
  Recommendation: 6-8% moisture content for wood
- Possible Cause: Undercured or frosted joints caused by thick glue lines
  Recommendation: Check part fit and/or increase clamp pressure

Problem: **Splits and/or open joints on ends of panels**

- Possible Cause: High moisture content
  Recommendation: 6-8% moisture content recommended for the wood
- Possible Cause: Dry conditions in plant
  Recommendation: 30% minimum relative humidity. Use end sealer

Problem: **Wood failure only over part of surface**

- Possible Cause: Uneven pressure applied to top or bottom only
  Recommendation: Apply pressure to top and bottom equally
- Possible Cause: Uneven pressure due to improper clamp spacing
  Recommendation: Apply pressure near ends and 8-12" apart
- Possible Cause: Uneven pressure due to poor machining
  Recommendation: Make sure that surfaces are flat and square
- Possible Cause: Uneven glue application
  Recommendation: Coverage must be even over entire surface

Problem: **Weak joints with wood failure along glue line**

- Possible Cause: Grit of abrasive too coarse
  Recommendation: 60 grit or higher recommended
- Possible Cause: Dull saw blades
  Recommendation: Sharpen blades

Problem: **Black glue lines**

- Possible Cause: Iron contamination in adhesive
  Recommendation: Isolate and eliminate contact source of wet adhesive with iron or steel

Problem: **Brilliant white on glue squeeze-out and/or glue line**

- Possible Cause: Chalking caused by low temperature

Recommendation: Raise temperature of plant, wood and adhesive above minimum use temperature of adhesive

Assembly Gluing

Problem: Weak Joint

- Possible Cause: Loose part fit
  Recommendation: Part should fit snugly but not require undue assembly force
- Possible Cause: Joint design (dowels too short, etc.)
  Recommendation: Redesign joint
- Possible Cause: Glue setting too quickly/too slowly
  Recommendation: Contact Technical Support
- Possible Cause: Insufficient glue coverage
  Recommendation: Apply uniform coating of glue to all parts of joint
- Possible Cause: Burnished surfaces
  Recommendation: Sharpen cutter blades
- Possible Cause: Overspray of finish on gluing surface
  Recommendation: Remove finish before gluing
- Possible Cause: Undercured or frosted glue lines due to low temperature
  Recommendation: Raise plant, wood, and adhesive temperature
- Possible Cause: Undercured or frosted glue lines due to short clamp time
  Recommendation: Increase clamp time
- Possible Cause: High moisture content
  Recommendation: 6-8% moisture content recommended for the wood

Problem: Black glue lines

- Possible Cause: Iron contamination in adhesive
  Recommendation: Isolate and eliminate contact source of wet adhesive with iron or steel

Problem: Brilliant white on glue squeeze-out and/or glue line

- Possible Cause: Chalking caused by low temperature
  Recommendation: Raise temperature of plant, wood and adhesive above minimum use temperature of adhesive

Polyurethane Hot Mel Assembly Gluing

Problem: Little or no transfer of adhesive to one or both joint surfaces

- Possible Cause: Low temperature in plant or substrates
  Recommendation: Increase temperature of plant and substrates to 65-70°F (20°C)
- Possible Cause: Low application temperature
  Recommendation: Check heating element of gun
- Possible Cause: Excessive moisture in plant or on substrates
  Recommendation: Reduce relative humidity in shop, if possible (30-40%RH is ideal). Try to maintain a constant moisture content in porous substrates (6-8% generally recommended)
- Possible Cause: Adhesive setting too quickly
  Recommendation: Increase temperature of plant and substrates to 65-70°F (20°C) or contact Technical Support
- Possible Cause: Poor adhesion to substrate(s)
  Recommendation: Contact Technical Support

Problem: Adhesive setting too quickly

- Possible Cause: Gun temperature too low
  Recommendation: Check heating element of gun
- Possible Cause: Plant temperature too low
  Recommendation: Increase temperature of plant and substrates to 65-70°F (20°C)
- Possible Cause: Adhesive too fast
  Recommendation: Contact Technical Support

Problem: Adhesive setting too slowly

- Possible Cause: Gun temperature too high

Recommendation: Check heating element of gun

- Possible Cause: Plant temperature too high
  Recommendation: Decrease plant temperature to about 65°F (19°C)
- Possible Cause: Adhesive too slow
  Recommendation: Contact Technical Support

Problem: **Adhesive difficult to extrude from gun**

- Possible Cause: Gun temperature too low
  Recommendation: Check heating element of gun
- Possible Cause: Insufficient warm-up time
  Recommendation: Allow cartridge to heat for 13-15 minutes in the gun
- Possible Cause: Cured adhesive in tip
  Recommendation: Clear tip with drill or 6 penny nail
- Possible Cause: Cured adhesive in tube
  Recommendation: Use adhesive within 28 days after first opening cartridge. Keep end of cartridge sealed when not in use

Problem: **Lumps or discoloration in adhesive**

- Possible Cause: Excessive humidity
  Recommendation: Keep end of cartridge sealed when not in use.
- Possible Cause: Excessive temperature
  Recommendation: Reduce temperature if needed
- Possible Cause: Excessive time at elevated temperature
  Recommendation: Use as quickly as possible. Do not keep at high temperature for longer than is needed.
- Possible Cause: Long storage period
  Recommendation: Check expiration date on the foil wrapper

Some machining and related properties of selected domestic hardwoods

Kind of wood[a]	Planing: perfect pieces (%)	Shaping: good to excellent pieces (%)	Turning: fair to excellent pieces (%)	Boring: good to excellent pieces (%)	Mortising: fair to excellent pieces (%)	Sanding: good to excellent pieces (%)	Steam bending: unbroken pieces (%)	Nail splitting: pieces free from complete splits (%)	Screw splitting: pieces free from complete splits (%)
Alder, red	61	20	88	64	52	—	—	—	—
Ash	75	55	79	94	58	75	67	65	71
Aspen	26	7	65	78	60	—	—	—	—
Basswood	64	10	68	76	51	17	2	79	68
Beech	83	24	90	99	92	49	75	42	58
Birch	63	57	80	97	97	34	72	32	48
Birch, paper	47	22	—	—	—	—	—	—	—
Cherry, black	80	80	88	100	100	—	—	—	—
Chestnut	74	28	87	91	70	64	56	66	60
Cottonwood[b]	21	3	70	70	52	19	44	82	78
Elm, soft[b]	33	13	65	94	75	66	74	80	74
Hackberry	74	10	77	99	72	—	94	63	63
Hickory	76	20	84	100	98	80	76	35	63
Magnolia	65	27	79	71	32	37	85	73	76
Maple, bigleaf	52	56	80	100	80	—	—	—	—
Maple, hard	54	72	82	99	95	38	57	27	52
Maple, soft	41	25	76	80	34	37	59	58	61
Oak, red	91	28	84	99	95	81	86	66	78
Oak, white	87	35	85	95	99	83	91	69	74
Pecan	88	40	89	100	98	—	78	47	69
Sweetgum[b]	51	28	86	92	58	23	67	69	69
Sycamore[b]	22	12	85	98	96	21	29	79	74
Tanoak	80	39	81	100	100	—	—	—	—
Tupelo, water[b]	55	52	79	62	33	34	46	64	63
Tupelo, black[b]	48	32	75	82	24	21	42	65	63
Walnut, black	62	34	91	100	98	—	78	50	59
Willow	52	5	58	71	24	24	73	89	62
Yellow-poplar	70	13	81	87	63	19	58	77	67

[a]Commercial lumber nomenclature.
[b]Interlocked grain present.

(*From "Wood Handbook", General Technical Report 113, U.S. Department o Agriculature*

Grouping of some domestic and imported woods according to average heartwood decay resistance

Resistant or very resistant	Moderately resistant	Slightly or nonresistant
Domestic		
Baldcypress, old growth	Baldcypress, young growth	Alder, red
Catalpa	Douglas-fir	Ashes
Cedar	Larch, western	Aspens
Atlantic white	Pine, longleaf, old growth	Beech
Eastern redcedar	Pine, slash, old growth	Birches
Incense	Redwood, young growth	Buckeye
Northern white	Tamarack	Butternut
Port-Orford		Cottonwood
Western redcedar		Elms
Yellow	Pine, eastern white, old growth	Basswood
Cherry, black		Firs, true
Chestnut		Hackberry
Cypress, Arizona		Hemlocks
Junipers		Hickories
Locust,		Magnolia
Black[a]		Maples
Honeylocust		Pines (other than those listed)[b]
Mesquite		Spruces
Mulberry, red[a]		Sweetgum
Oaks, white[b]		Sycamore
Osage orange[a]		Tanoak
Redwood, old growth		Willows
Sassafras		Yellow-poplar
Walnut, black		
Yew, Pacific[a]		
Imported		
Aftotmosia (Kokrodua)	Andiroba	Balsa
Angelique[a]	Avodire	Banak
Aparnate (Roble)	Benge	Cativo
Azobe[a]	Bubinga	Ceiba
Balata[a]	Ehie	Hura
Balau[b]	Ekop	Jelutong
Courbaril	Keruing[b]	Limba
Determa	Mahogany, African	Meranti, light red[b]
Goncalo alves[a]	Meranti, dark red[b]	Meranti, yellow[b]
Greenheart[a]	Mersawa[b]	Meranti, white[b]
Ipe (lapacho)[a]	Sapele	Obeche
Iroko	Teak , young growth	Okoume
Jarrah[a]	Tornillo	Parana pine
Kapur		Ramin
Karri		Sande
Kempas		Sepitir
Lignumvitae[a]		Seraya, white
Mahogany, American		
Manni		
Purpleheart[a]		
Spanish-cedar		
Sucupira		
Teak, old growth[a]		
Wallaba		

[a]Exceptionally high decay resistance.
[b]More than one species included, some of which may vary in resistance from that indicated.

(*From "Wood Handbook", General Technical Report 113, U.S. Department o Agriculature*

Shrinkage values of domestic woods

Species	Shrinkage[a] (%) from green to ovendry moisture content		
	Radial	Tangential	Volumetric
Hardwoods			
Alder, red	4.4	7.3	12.6
Ash			
Black	5.0	7.8	15.2
Blue	3.9	6.5	11.7
Green	4.6	7.1	12.5
Oregon	4.1	8.1	13.2
Pumpkin	3.7	6.3	12.0
White	4.9	7.8	13.3
Aspen			
Bigtooth	3.3	7.9	11.8
Quaking	3.5	6.7	11.5
Basswood, American	6.6	9.3	15.8
Beech, American	5.5	11.9	17.2
Birch			
Alaska paper	6.5	9.9	16.7
Gray	5.2	—	14.7
Paper	6.3	8.6	16.2
River	4.7	9.2	13.5
Sweet	6.5	9.0	15.6
Yellow	7.3	9.5	16.8
Buckeye, yellow	3.6	8.1	12.5
Butternut	3.4	6.4	10.6
Cherry, black	3.7	7.1	11.5
Chestnut, American	3.4	6.7	11.6
Cottonwood			
Balsam poplar	3.0	7.1	10.5
Black	3.6	8.6	12.4
Eastern	3.9	9.2	13.9
Elm			
American	4.2	9.5	14.6
Cedar	4.7	10.2	15.4
Rock	4.8	8.1	14.9
Slippery	4.9	8.9	13.8
Winged	5.3	11.6	17.7
Hackberry	4.8	8.9	13.8
Hickory, true			
Mockernut	7.7	11.0	17.8
Pignut	7.2	11.5	17.9
Shagbark	7.0	10.5	16.7
Shellbark	7.6	12.6	19.2
Holly, American	4.8	9.9	16.9
Honeylocust	4.2	6.6	10.8
Locust, black	4.6	7.2	10.2
Madrone, Pacific	5.6	12.4	18.1
Magnolia			
Cucumbertree	5.2	8.8	13.6
Southern	5.4	6.6	12.3
Sweetbay	4.7	8.3	12.9
Maple			
Bigleaf	3.7	7.1	11.6
Black	4.8	9.3	14.0
Red	4.0	8.2	12.6
Silver	3.0	7.2	12.0
Striped	3.2	8.6	12.3
Sugar	4.8	9.9	14.7
Oak, red			
Black	4.4	11.1	15.1
Laurel	4.0	9.9	19.0
Northern red	4.0	8.6	13.7
Pin	4.3	9.5	14.5
Scarlet	4.4	10.8	14.7
Southern red	4.7	11.3	16.1
Water	4.4	9.8	16.1
Willow	5.0	9.6	18.9
Oak, white	4.4	8.8	12.7
Bur	5.3	10.8	16.4
Oak, white—con.			
Chestnut			
Live	6.6	9.5	14.7
Overcup	5.3	12.7	16.0
Post	5.4	9.8	16.2
Swamp, chestnut	5.2	10.8	16.4
White	5.6	10.5	16.3
Persimmon, common	7.9	11.2	19.1
Sassafras	4.0	6.2	10.3
Sweetgum	5.3	10.2	15.8
Sycamore, American	5.0	8.4	14.1
Tanoak	4.9	11.7	17.3
Tupelo			
Black	5.1	8.7	14.4
Water	4.2	7.6	12.5
Walnut, black	5.5	7.8	12.8
Willow, black	3.3	8.7	13.9
Yellow-poplar	4.6	8.2	12.7
Softwoods			
Cedar			
Yellow	2.8	6.0	9.2
Atlantic white	2.9	5.4	8.8
Eastern redcedar	3.1	4.7	7.8
Incense	3.3	5.2	7.7
Northern white	2.2	4.9	7.2
Port-Orford	4.6	6.9	10.1
Western redcedar	2.4	5.0	6.8
Douglas-fir,			
Coast[b]	4.8	7.6	12.4
Interior north[b]	3.8	6.9	10.7
Interior west[b]	4.8	7.5	11.8
Fir			
Balsam	2.9	6.9	11.2
California red	4.5	7.9	11.4
Grand	3.4	7.5	11.0
Noble	4.3	8.3	12.4
Subalpine	2.6	7.4	9.4
White	3.3	7.0	9.8
Hemlock			
Eastern	3.0	6.8	9.7
Mountain	4.4	7.1	11.1
Western	4.2	7.8	12.4
Larch, western	4.5	9.1	14.0
Pine			
Eastern white	2.1	6.1	8.2
Jack	3.7	6.6	10.3
Loblolly	4.8	7.4	12.3
Lodgepole	4.3	6.7	11.1
Longleaf	5.1	7.5	12.2
Pitch	4.0	7.1	10.9
Pond	5.1	7.1	11.2
Ponderosa	3.9	6.2	9.7
Red	3.8	7.2	11.3
Shortleaf	4.6	7.7	12.3
Slash	5.4	7.6	12.1
Sugar	2.9	5.6	7.9
Virginia	4.2	7.2	11.9
Western white	4.1	7.4	11.8
Redwood			
Old growth	2.6	4.4	6.8
Young growth	2.2	4.9	7.0
Spruce			
Black	4.1	6.8	11.3
Engelmann	3.8	7.1	11.0
Red	3.8	7.8	11.8
Sitka	4.3	7.5	11.5
Tamarack	3.7	7.4	13.6

[a]Expressed as a percentage of the green dimension.
[b]Coast type Douglas-fir is defined as Douglas-fir growing in the States of Oregon and Washington west of the summit of the Cascade Mountains. Interior West includes the State of California and all counties in Oregon and Washington east of but adjacent to the Cascade summit. Interior North includes the remainder of Oregon and Washington and the States of Idaho, Montana, and Wyoming.

(*From "Wood Handbook", General Technical Report 113, U.S. Department o Agriculature)*

Shrinkage for some woods imported into the United States[a]

Species	Shrinkage[b] from green to ovendry moisture content (%)			Location[c]
	Radial	Tangential	Volumetric	
Afrormosia (*Pericopsis elata*)	3.0	6.4	10.7	AF
Albarco (*Cariniana* spp.)	2.8	5.4	9.0	AM
Andiroba (*Carapa guianensis*)	3.1	7.6	10.4	AM
Angelin (*Andira inermis*)	4.6	9.8	12.5	AM
Angelique (*Dicorynia guianensis*)	5.2	8.8	14.0	AM
Apitong (*Dipterocarpus* spp.)	5.2	10.9	16.1	AS
Avodire (*Turreanthus africanus*)	4.6	6.7	12.0	AF
Azobe (*Lophira alata*)	8.4	11.0	17.0	AM
Balata (*Manilkara bidentata*)	6.3	9.4	16.9	AM
Balsa (*Ochroma pyramidale*)	3.0	7.6	10.8	AM
Banak (*Virola* spp.)	4.6	8.8	13.7	AM
Benge (*Guibourtia arnoldiana*)	5.2	8.6	13.8	AF
Bubinga (*Guibourtia* spp.)	5.8	8.4	14.2	AF
Bulletwood (*Manilkara bidentata*)	6.3	9.4	16.9	AM
Caribbean pine (*Pinus caribaea*)	6.3	7.8	12.9	AM
Cativo (*Prioria copaifera*)	2.4	5.3	8.9	AM
Ceiba (*Ceiba pentandra*)	2.1	4.1	10.4	AM
Cocobolo (*Dalbergia retusa*)	2.7	4.3	7.0	AM
Courbaril (*Hymenaea courbaril*)	4.5	8.5	12.7	AM
Cuangare (*Dialyanthera* spp.)	4.2	9.4	12.0	AM
Degame (*Calycophyllum candidissimum*)	4.8	8.6	13.2	AM
Determa (*Ocotea rubra*)	3.7	7.6	10.4	AM
Ebony, East Indian (*Diospyros* spp.)	5.4	8.8	14.2	AS
Ebony, African (*Diospyros* spp.)	9.2	10.8	20.0	AF
Ekop (*Tetraberlinia tubmaniana*)	5.6	10.2	15.8	AF
Gmelina (*Gmelina arborea*)	2.4	4.9	8.8	AS
Goncalo alves (*Astronium graveolens*)	4.0	7.6	10.0	AM
Greenheart (*Ocotea rodiaei*)	8.8	9.6	17.1	AM
Hura (*Hura crepitans*)	2.7	4.5	7.3	AM
Ilomba (*Pycnanthus angolensis*)	4.6	8.4	12.8	AF
Imbuia (*Phoebe porosa*)	2.7	6.0	9.0	AM
Ipe (*Tabebuia* spp.)	6.6	8.0	13.2	AM
Iroko (*Chlorophora excelsa* and *C. regia*)	2.8	3.8	8.8	AF
Jarrah (*Eucalyptus marginata*)	7.7	11.0	18.7	AS
Jelutong (*Dyera costulata*)	2.3	5.5	7.8	AS
Kaneelhart (*Licaria* spp.)	5.4	7.9	12.5	AM
Kapur (*Dryobalanops* spp.)	4.6	10.2	14.8	AS
Karri (*Eucalyptus diversicolor*)	7.8	12.4	20.2	AS
Kempas (*Koompassia malaccensis*)	6.0	7.4	14.5	AS
Keruing (*Dipterocarpus* spp.)	5.2	10.9	16.1	AS
Lauan, light red and red (*Shorea* spp.)	4.6	8.5	14.3	AS
Lauan, dark red (*Shorea* spp.)	3.8	7.9	13.1	AS
Lauan, white (*Pentacme contorta*)	4.0	7.7	11.7	AS
Limba (*Terminalia superba*)	4.5	6.2	10.8	AF
Macawood (*Platymiscium* spp.)	2.7	3.5	6.5	AM
Mahogany, African (*Khaya* spp.)	2.5	4.5	8.8	AF
Mahogany, true (*Swietenia macrophylla*)	3.0	4.1	7.8	AM
Manbarklak (*Eschweilera* spp.)	5.8	10.3	15.9	AM
Manni (*Symphonia globulifera*)	5.7	9.7	15.6	AM
Marishballi (*Licania* spp.)	7.5	11.7	17.2	AM
Meranti, white (*Shorea* spp.)	3.0	6.6	7.7	AS
Meranti, yellow (*Shorea* spp.)	3.4	8.0	10.4	AS
Merbau (*Intsia bijuga* and *I. palembanica*)	2.7	4.6	7.8	AS
Mersawa (*Anisoptera* spp.)	4.0	9.0	14.6	AS
Mora (*Mora* spp.)	6.9	9.8	18.8	AM
Obeche (*Triplochiton scleroxylon*)	3.0	5.4	9.2	AF
Ocota pine (*Pinus oocarpa*)	4.6	7.5	12.3	AM
Okoume (*Aucoumea klaineana*)	4.1	6.1	11.3	AF
Opepe (*Nauclea* spp.)	4.5	8.4	12.6	AF
Ovangkol (*Guibourta ehie*)	4.5	8.2	12	AF
Para-angelim (*Hymenolobium excelsum*)	4.4	7.1	10.2	AM
Parana pine (*Araucaria angustifolia*)	4.0	7.9	11.6	AS
Pau Marfim (*Balfourodendron riedelianum*)	4.6	8.8	13.4	AM
Peroba de campos (*Paratecoma peroba*)	3.8	6.6	10.5	AM
Peroba Rosa (*Aspidosperma* spp.)	3.8	6.4	11.6	AM
Piquia (*Caryocar* spp.)	5.0	8.0	13.0	AM
Pilon (*Hyeronima* spp.)	5.4	11.7	17.0	AM
Primavera (*Cybistax donnell-smithii*)	3.1	5.1	9.1	AM
Purpleheart (*Peltogyne* spp.)	3.2	6.1	9.9	AM
Ramin (*Gonystylus* spp.)	4.3	8.7	13.4	AS
Roble (*Quercus* spp.)	6.4	11.7	18.5	AM
Roble (*Tabebuia* spp. Roble group)	3.6	6.1	9.5	AM
Rosewood, Brazilian (*Dalbergia nigra*)	2.9	4.6	8.5	AM
Rosewood, Indian (*Dalbergia latifolia*)	2.7	5.8	8.5	AS
Rubberwood (*Hevea brasiliensis*)	2.3	5.1	7.4	AM
Sande (*Brosimum* spp. Utile group)	4.6	8.0	13.6	AM
Sapele (*Entandrophragma cylindricum*)	4.6	7.4	14.0	AF
Sepetir (*Pseudosindora* spp. and *Sindora* spp.)	3.7	7.0	10.5	AS
Spanish-cedar (*Cedrela* spp.)	4.2	6.3	10.3	AM
Sucupira (*Diplotropis purpurea*)	4.6	7.0	11.8	AM
Teak (*Tectona grandis*)	2.5	5.8	7.0	AS
Wallaba (*Eperua* spp.)	3.6	6.9	10.0	AM

[a]Shrinkage values were obtained from world literature and may not represent a true species average.
[b]Expressed as a percentage of the green dimension.
[c]AF is Africa; AM is Tropical America; AS is Asia and Oceania.

(*From "Wood Handbook", General Technical Report 113, U.S. Department o Agriculature)*

TABLE OF EQUILIBRIUM MOISTURE CONTENT VALUES AT VARIOUS TEMPERATURES AND HUMIDITIES

Wet Bulb Lowering In Degrees Fahrenheit

Dry Bulb Temperature in Degrees Fahrenheit

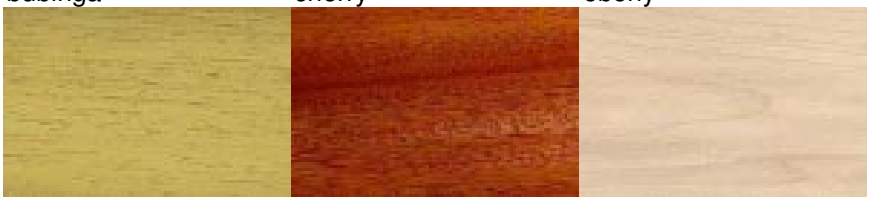
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
40	83 17.6	75 14.8	68 12.9	60 11.2	52 9.9	45 8.6	37 7.4	29 6.2	22 5.0	15 3.5	8 1.9																	
45	85 18.3	78 15.6	72 13.7	64 12.0	58 10.7	51 9.5	44 8.5	37 7.5	31 6.5	25 5.3	19 4.2	12 2.9	6 1.5															
50	86 19.0	80 16.3	74 14.4	68 12.7	62 11.5	56 10.3	50 9.4	44 8.5	38 7.6	32 6.7	27 5.7	21 4.8	16 3.9	10 2.8	5 1.5													
55	88 19.5	82 16.9	76 15.1	70 13.4	65 12.2	60 11.0	54 10.1	49 9.3	44 8.4	39 7.6	34 6.8	28 6.0	24 5.3	19 4.5	14 3.6	9 2.5	5 1.3											
60	89 19.9	83 17.4	78 15.6	73 13.9	68 12.7	63 11.6	58 10.7	53 9.9	48 9.1	43 8.3	39 7.6	34 6.9	30 6.3	26 5.6	21 4.9	17 4.1	13 3.2	9 2.3	5 1.3	1 0.2								
65	90 20.3	84 17.8	80 16.1	75 14.4	70 13.3	66 12.1	61 11.2	56 10.4	52 9.7	48 8.9	44 8.3	39 7.7	36 7.1	32 6.5	27 5.8	24 5.2	20 4.5	16 3.8	13 3.0	8 2.3	6 1.4	2 0.4						
70	90 20.6	86 16.2	81 16.5	77 14.9	72 13.7	68 12.5	64 11.6	59 10.9	55 10.1	51 9.4	48 8.8	44 8.3	40 7.7	36 7.2	33 6.6	29 6.0	25 5.5	22 4.9	19 4.3	15 3.7	12 2.9	9 2.3	6 1.5	3 0.7				
75	91 20.9	86 18.5	82 16.8	78 15.2	74 14.0	70 12.9	66 12.0	62 11.2	58 10.5	54 9.8	51 9.3	47 8.7	44 8.2	41 7.7	37 7.2	34 6.7	31 6.2	28 5.6	24 5.1	21 4.7	18 4.1	15 3.5	12 2.9	10 2.3	7 1.7	4 0.9	1 0.2	
80	91 21.0	87 18.7	83 17.0	79 15.5	75 14.3	72 13.2	68 12.3	64 11.5	61 10.9	57 10.1	54 9.7	50 9.1	47 8.6	44 8.1	41 7.7	38 7.2	35 6.8	32 6.3	29 5.8	26 5.4	23 5.0	20 4.5	18 4.0	15 3.5	12 3.0	10 2.4	7 1.8	5 1.1
85	92 21.2	88 18.8	84 17.2	80 15.7	76 14.5	73 13.5	70 12.5	66 11.8	63 11.2	59 10.5	56 10.0	53 9.5	50 9.0	47 8.5	44 8.1	41 7.6	38 7.2	36 6.7	33 6.3	30 6.0	28 5.6	25 5.2	23 4.8	20 4.3	18 3.9	15 3.4	13 3.0	11 2.4
90	92 21.3	89 18.9	85 17.3	81 15.9	78 14.7	74 13.7	71 12.8	68 12.0	65 11.4	61 10.7	58 10.2	55 9.7	52 9.3	49 8.8	47 8.4	44 8.0	41 7.6	39 7.2	36 6.8	34 6.5	31 6.1	29 5.7	26 5.3	24 4.9	22 4.6	19 4.2	17 3.8	15 3.3
95	92 21.3	89 19.0	85 17.4	82 16.1	79 14.9	75 13.9	72 12.9	69 12.2	66 11.6	63 11.0	60 10.5	57 10.0	55 9.5	52 9.1	49 8.7	46 8.2	44 7.9	42 7.5	39 7.1	37 6.8	34 6.4	32 6.1	30 5.7	28 5.3	26 5.1	23 4.8	22 4.4	20 4.0
100	93 21.3	89 19.0	86 17.5	83 16.1	80 15.0	77 13.9	73 13.1	70 12.4	68 11.8	65 11.2	62 10.6	59 10.1	56 9.6	54 9.2	51 8.9	49 8.5	46 8.1	44 7.8	41 7.4	39 7.0	37 6.7	35 6.4	33 6.1	30 5.7	28 5.4	26 5.2	24 4.9	22 4.6
110	93 21.4	90 19.0	87 17.5	84 16.2	81 15.1	78 14.1	75 13.3	73 12.6	70 12.0	67 11.4	65 10.8	62 10.4	60 9.9	57 9.5	55 9.2	52 8.8	50 8.4	48 8.1	46 7.7	44 7.5	42 7.2	40 6.8	38 6.6	36 6.3	34 6.0	32 5.7	30 5.4	28 5.2
120	94 21.3	91 19.0	88 17.4	85 16.2	82 15.1	80 14.1	77 13.4	74 12.7	72 12.1	69 11.5	67 11.0	65 10.5	62 10.0	60 9.7	58 9.4	55 9.0	53 8.7	51 8.3	49 7.9	47 7.7	45 7.4	43 7.2	41 6.8	40 6.6	38 6.3	36 6.1	34 5.8	33 5.6
130	94 21.0	91 18.8	89 17.2	86 16.0	83 14.9	81 14.0	78 13.4	76 12.7	73 12.1	71 11.5	69 11.0	67 10.5	64 10.0	62 9.7	60 9.4	58 9.0	56 8.7	54 8.3	52 8.0	50 7.8	48 7.6	47 7.3	45 7.0	43 6.8	41 6.6	40 6.4	38 6.1	37 5.9
140	95 20.7	92 18.6	89 16.9	87 15.8	84 14.8	82 13.8	79 13.2	77 12.5	75 11.9	73 11.4	70 10.9	68 10.4	66 10.0	64 9.6	62 9.4	60 9.0	58 8.7	56 8.4	54 8.0	53 7.8	51 7.6	49 7.3	47 7.1	46 6.9	44 6.6	43 6.4	41 6.2	40 6.0
150	95 20.2	92 18.4	90 16.6	87 15.4	85 14.5	82 13.7	80 13.0	78 12.4	76 11.8	74 11.2	72 10.8	70 10.3	68 9.9	66 9.5	64 9.2	62 8.9	60 8.6	58 8.3	57 8.0	55 7.8	53 7.5	51 7.3	49 7.1	48 6.9	46 6.7	45 6.4	43 6.2	42 6.0
160	95 19.8	93 18.1	90 16.2	88 15.2	86 14.2	83 13.4	81 12.7	79 12.1	77 11.5	75 11.0	73 10.6	71 0.1	69 9.7	67 9.4	65 9.1	64 8.8	62 8.5	60 8.2	58 7.9	57 7.7	55 7.4	53 7.2	52 7.0	50 6.8	49 6.7	47 6.4	46 6.2	44 6.0
170	95 19.4	93 17.7	91 15.8	89 14.8	86 13.9	84 13.2	82 12.4	80 1.8	78 11.3	76 10.8	74 10.4	72 9.9	70 9.6	69 9.2	67 9.0	65 8.6	63 8.4	62 8.0	60 7.8	59 7.6	57 7.3	55 7.2	53 6.9	52 6.7	51 6.6	49 6.4	48 6.2	47

TO USE CHART: Obtain wet and dry bulb readings. Subtract wet bulb reading from dry bulb reading. Find dry bulb on left margin of chart and follow across chart to column where figure at top corresponds with the difference between wet and dry readings. At point of intersection, the black figure gives relative humidity in percent and the red figure gives equilibrium moisture content.

THE FRANKLIN GLUE COMPANY
2020 BRUCK STREET
COLUMBUS, OHIO 43207

acajou | ash | beech

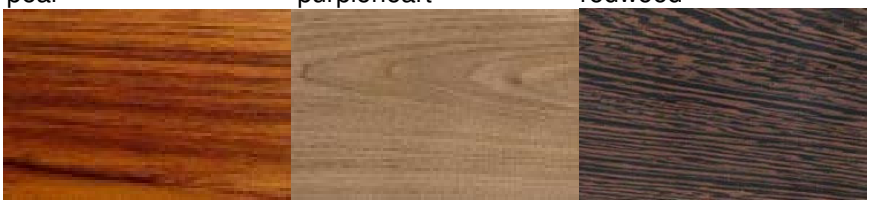
bubinga | cherry | ebony



iroko | mahogany | maple

oak, red | oak, white | padauk

pear | purpleheart | redwood



teak | walnut | wenge