

TECHNICAL DATA ON WOOD TYPES



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1. **Directions for Good Gluing on Wood**

For best results with Gorilla Glue, note the following.

In order to use the glue, wood pieces should:

- Have a similar moisture content.
- Have a similar structure, density and mechanical behavior
- Be prepared at the same time

To prepare surfaces for gluing, make sure they are:

- Straight and even to obtain close contact between the work pieces
- Not “compressed” by machining (looks shiny)
- Able to absorb glue
- Free of oil, dust and other impurities
- Freshly prepared to limit oxidization of the natural resin/oil content of the wood

Moisture of Content of wood varies:

- Most kiln-dried wood is 8 to 10%
- The glue reaction in the glue line will accept moisture content in the range of 10 to 20 %
- When gluing open grain wood, wood with up to 25% moisture content may be controllable

For wood with low moisture content (less than 10%), you must:

- Spray water on the surface to be glued without soaking the wood
- Leave time for the moisture to distribute before applying the glue
- Apply glue soon after dampening an open grained wood
- Sand the moistened surface lightly before applying glue on closed grain wood or a high-density wood types in order to remove any oil/ resin emulsion and to create a larger glueable surface
- Leave some time after dampening a closed grain wood or high-density wood types to allow surplus water to evaporate
- Be careful, because by adding water, the open time may be reduced quite a bit
- Remember: moisture does not speed up the curing process but allows for a chemical reaction to take place

Clamping pressure and clamping time:

- Varies according to wood structure and density, and may vary from job to job and from wood type to wood type
- Is usually 1 kg/cm² to 7 kg/cm² for softwoods
- Is usually 5 kg/cm² to 15 kg/cm² for hardwoods
- Clamping pressure should always be adjusted to secure close contact, and always be sufficient to secure minimum or no foam building in the glue line
- Clamping pressure must be distributed evenly over the glue line area
- Clamping time is always defined at 68°F
- Generally, clamping time has expired when the foam pressed out from the glue line feels dry and somewhat crisp
- Foam in a glue line has no structural strength whatsoever, and must not be considered as a gap filler



Curing:

- Gorilla Glue Stronger-Faster formula
Glue joint should be 80% cured within 1-2 hours, but for best results, leave for 24 hours
- Gorilla Glue fast curing, dries white formula
Glue joint should be 80% cured within 30-60 minutes, but for best results, leave for 24 hours
- Maximum water resistance of the glue line occurs after 5 to 7 days at 68°F

Curing time varies according to:

- Moisture content in the wood
- Wood temperature
- Room temperature
- Moisture content in the room
- Applied volume of glue
- Density and cell structure of the wood

2. Soft Woods

Specifications for different softwood types are listed below. The following information and recommendations are based on the wood being kiln dried, and do not relate to air dried – or wood not mechanically stabilized.

Wood Type	Density or Particular Type	Notes
Bald cypress	Density: 450/550 kg/m ³	Easy to machine, stable when dried, may contain some resin pockets. Should glue well.
Cedar	----	About 27 different cedar species around the world: North American types are Western-Red & Southern-White. Most Cedar types growing in North America glue well. Standard preparations.
	Western-Red	Be careful when gluing. Difficult to machine properly. Requires sharp cutters. Compresses easily, which may be a hazard for gluing, as the compressed wood will expand at a later time, harming wood close to the glue line.
	Southern-White	Easy wood type to machine, stable for gluing, almost no resin problems. Should glue well.
Douglas Fir / Oregon Pine	75/650 kg/m ³	Very stable after drying, but may release resin when processed, so sand surface lightly before gluing. High water resistance gluing possible. Should glue well.
Hemlock, Western, Eastern, Hemlock Spruce	450/650 kg/m ³	Creates no gluing problems, may contain some resin so may need to be sanded.
Larch	600/750 kg/m ³	Contains quite a lot of natural resin/oil. Glue right after preparation. Tends to twist if work pieces have noticeable difference in moisture content. If gluing cannot be done right after machining, sand surfaces lightly before applying glue. Be careful using water spray as Larch tends to expand fast under influence of water. Should glue well.
Pine	----	For most Pine types (except Yellow Pine) use water carefully and if dampening is required, apply water to one surface only. All pine types contain natural resin/oil, but glue well because of the open cell structure.
	Yellow Pine (Ponderosa Pine)	High oil content which tends to liquify easily. Wipe the surface with solvents before gluing. May need to extend clamping time.
Redwood	400/600 kg/m ³	Usually no problems with resin, lightly sand work pieces if they are left for more than 24 hours after machining. Should glue well.
Spruce (general)	----	Gluing on knots can be difficult. Lightly sand before gluing as the surfaces tend to be compressed (shiny) from machining. Should not need to moisten the wood as kiln dried spruce should normally hold about 12% moisture. Apply the correct clamping pressure in order to avoid compression of the wood fibre. Should glue well in general.

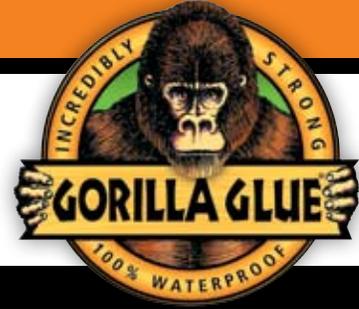


General comments for softwood species:

- Color can vary from almost white (the sapwood) to deep red/brown (the heartwood). This means that the color of the glue lines will show differently. Glue lines in laminates of sapwood will tend to show dark, on heartwood almost invisible.
- Bond strength on knots is less on heartwood, simply because the cell structure of the knots is so dense that the glue is unable to penetrate into the knots. Sanding helps.
- Many knots in sapwood of spruce and pine are called 'dead knots' as they are surrounded by overgrown bark, and they tend to loosen during machining and gluing. Gorilla Glue generally will not be able to secure loose knots.
- So-called "red-knots" are normally not a problem for gluing, as the cell structure is open and glueable. Take care because the natural oil/resin content around the "red-knots" may be very high and well spread. Do not use solvents to remove oil/resin on spruce/pine as the solvents tend to get trapped in the wood. Lightly sand if the work pieces are left longer than 24 hours before gluing.

3. Hard Woods

Wood Type	Density or Particular Type	Notes
Afrormosia	650/850 kg/cm ²	Difficult to process, but good for wood turning. When kiln dried, tends to "shell dry" which may cause difficulties for gluing after machining. Remove shell before gluing. Contains some oil/resin, so sand lightly especially if surface is "shiny".
Alder (red/white)	500/800 kg/m ³	Good wood type for gluing. Can be stored up to 2 weeks at 68°F after machining and before gluing. If left for a longer time, sand lightly before gluing. The color of White Alder will cause the glue line to show dark, and because of the cell structure it may look like the glue is penetrating into the wood structure. This is normally not a problem with Red Alder.
Ashwood	500/750 kg/m ³	Glues very well, stable and twists very little. Machining preparations must be carried out carefully as the difference in hardness and size between the year rings may cause difficulties when sanded. Heart wood (brownish) glues as well as sapwood. Due to the very light color of the sapwood, the glue line will show as a dark line. It is important to provide correct clamping pressure (10-12 kg/cm ²) to secure the closest contact possible. On heartwood, the natural brownish color will cause the glue line to be almost invisible.
Balsa (Corkwood)	120/300 kg/m ³	Wood loses nearly two thirds of its weight from wet to kiln dried state, but has stable volume. Difficult to machine and sand, but glues well. Glue spread may be almost double due to the open cell structure. As Balsa must be protected from blue stain, the wood is normally treated with paraffin, which must be removed before gluing.
Basswood	400/600 kg/m ³	Shrinks a lot from green to dried stage, but stable after drying. Machines and glues well, no problem with oil/resin. Due to differences in colors, match the wood together before gluing, as most Basswood is used for "imitations" of other wood types as it accepts stains/colors well.
Beech	550/800 kg/m ³	Shrinks when altered from wet to kiln dried, and high risk of cracks and twists in the dried wood. Glues well, but requires high clamping pressure. If "false hardwood" is caused by fungi, gluing is pretty difficult as the cell structure absorbs the glue unevenly. If the "false hardwood" is natural, gluing is not a problem.
Birch	450/800 kg/m ³	Birch is good for machining, sanding and staining. May twist as a result of kiln drying. Difficult wood type to glue. Prepare both surfaces well, apply glue to both surfaces, and allow plenty of time for the glue to penetrate into the wood cell structure. Clamping pressure is dependent on the wood itself, but should normally be in the range of 8-12 kg/cm ² . Due to the light color of the wood, the glue line tends to show as a dark line. In low density Birch, the glue may tend to penetrate across the glue line.
Boxwood	800/900 kg/cm ² Venezuela Boxwood (8 different types of this family)	Boxwood is in very small supply, cut from small logs. Main uses are for tooling, handles, woodturning and cutting. Strong and durable and glues well in dry conditions. Wood tends to crack and twist during kiln drying. Often difficult to prepare for gluing as the surface tends to be "polished". Sand lightly before gluing. Allow for extended open time and clamping time.



3. Hard Woods (continued)

Wood Type	Density or Particular Type	Notes
Brazilwood (Pernambuco)	1000/1250 kg/m ³	Brazilwood is stable after drying and very hard, but glues well. Apply glue to both sides, and allow a minimum of 4 hours clamping time at 68°F. Moisten the surfaces for approximately 4 hours before glue is applied.
Bahiawood,	----	Two different wood species, but often supplied as “Rosewood” together. Biggest difference Parawood (Rosewood) is that “Parawood” (Amazon Rosewood) changes color if exposed to strong light. Brazilwood, Bahiawood and Parawood all contain natural oils/resins, and gluing must take place quickly after preparation. Glues well.
Bubinga	800/950 kg/cm ²	Sapwood not gluable. Difficult to glue because of its closed cell structure. Almost impossible to open the cell structure by wiping surfaces with solvents, and the glue line tends to show rather thick and becomes somewhat brittle due to poor glue penetration. Apply glue on thinly and apply high clamping pressure in order to help the glue penetrate. Most African hard wood species contain filled pores to some degree, which usually require careful preparation. Sand before glue is applied.
Cherry (American & Canadian Black Cherry)	550/650 kg/m ³	All cherry species contain some liquid natural resin, as well as pockets of resin, which may cause some problems with machining and gluing. The resin crystallises to some degree during kiln drying. Cherry glues well, but the surfaces must be “oil free” before glue is applied. Lightly sand to remove any oil and allow any loose fibre from the surface to oxidize. Glue bond is very strong, and the glue line is similar to the wood itself.
Chestnut	550/650 kg/m ³	Chestnut dries slowly and tends to contain “pockets” with high moisture content after drying, which may cause some differences in glue reaction or in foaming while the glue is curing. Stable without wrapping or shrinkage. Machines well. Sand lightly before glue is applied. Be careful using any iron containing material with the wood/ glue, as it may cause the wood to turn “blue” (discoloration). High clamping pressure recommended at 68°F.
Cocobolo	Approx. 1100 kg/m ³	Difficult to glue due to very poor glue penetration. Prepare well due to the oil in the wood. We recommend seeking an alternative to polyurethane glue. Grandillo and Ebony have similar technical specifications to Cocobolo and should be treated carefully before gluing with Gorilla Glue or any other reactive glue type. For these wood types, wood thermoplastic glues are best although they give a flexible glue line.

4. Common Woods Commercially Available in North America

Wood Type	Density or Particular Type	Notes
Elm (White Elm, North America)	500/800 kg/m ³	Very nice to work with, machines, sands, glues easily. Not sensitive to clamping pressure, standard clamping time recommended. If left too long after machining, sand lightly before glue is applied.
Tigerwood	800/1050 kg/m ³	Difficult to machine, hard and difficult to dry. Can be a bit difficult to glue, especially if density of work pieces varies greatly. That will cause the glue to penetrate into the lower density work piece, leaving less glue for the heavier piece. Always sand lightly before glue is applied.
Hickory	750/850 kg/m ³	Shrinks a lot during drying and tends to warp a lot. Hickory wood is one of the best wood types for handles and shafts etc., and is widely used in industry. Generally glues well, but even though the natural oil content is quite low, it may cause problems as the resin tends to form “pockets” which can be difficult to locate. Be



4. Common Woods Commercially Available in North America (continued)

Wood Type	Density or Particular Type	Notes
Hickory (continued)	750/850 kg/m ³	careful applying water. Hickory is normally kiln dried to 12%. If moisture content is lower, water may be applied, but with great care before gluing, as the wood tends to expand/contract quite a lot when influenced by moisture. Corner assemblies, tongue and groove joints may be difficult to stabilise as the glue lines tend to become to inflexible when cured. For that kind of joint, a good quality PVAC glue is recommended. If glue, so sand before applying glue, and glue quickly after machining. The heartwood requires higher clamping pressure than the sapwood. Even though Hickory is native to North America, an Asian wood type, Bang-Lang, may be imported in competition to Hickory. This is a hardwood species, which looks and performs very much like Hickory, and can be used as a substitute to ash and oak as well.
Ipè	950/1300 kg/m ³	Dries well, does not shrink much. Difficult to machine, tends to splinter and requires tungsten-tipped tools for a good result. The wood dust is an irritant and a protective facemask should be used when working this wood. Sanding before gluing as the machined surfaces will usually look 'shiny' with closed wood cell structure. Always moisten the wood before applying the glue and allow up to 3 to 4 hours at 68°F for stabilizing. Ipè is a very dense wood, and can be very 'oily' and is therefore often difficult to glue. We always recommend gluing up a test piece before proceeding. It is not sensitive to water used for moisturizing. Clamping pressure may be adjusted in accordance with how heavy/dense the wood appears in each case. For very heavy pieces of Ipè laminations, clamping time can be quite long (at least 24 hours).
Kingwood	950/1150 kg/m ³	Only the heartwood can be used. Beautiful wood species but only available in small supply from small logs. Difficult to glue due to the fact that the pores are filled with resin, which is difficult to remove. This wood type is generally used as solid pieces only. We do not encourage gluing, as it will alter the grain/color "look" of the wood. Glue as laminate only and in short length. Difficult to moisten the wood properly, and gluing result may be somewhat uncertain.
Mahogany	— South America/Central America Africa Philippine Mahogany White/ Red Lauan	<p>Mahogany in general comes from three major sources (listed below). The main difference is basically the natural resin content/oil content of the various species.</p> <p>The "American" types mostly relate to "Honduras Mahogany", but approximately four other species fall under the same category: Tabasco Mahogany, Aguano Mahogany, Caoba Mahogany, Peru Mahogany and some lesser-used types. In spite of the natural oil content in all the wood species, they all glue well, machining is not a problem, and preparation is easy. They are not very sensitive to moisturising before gluing. Standard clamping pressure and clamping times.</p> <p>African types have higher oil content to American types, requiring careful preparation. Tend to accept less moisture.</p> <p>These types are mostly used for plywood and "lower" grade mahogany furniture, flooring, panelling, etc. They have "Mahogany look" but a courser structure. Glue well, and normally not sensitive to moistening. The natural resin content may be found in "pockets" which may cause some gluing problems, as the resin tends to "bleed" into the glue line during curing. Using a solvent to clean up before glue is applied is normally not a problem. Make sure the solvent evaporates completely before glue is applied.</p>
Ironwood	—	There are two species of ironwood, and both are almost impossible to glue without professional tools and glues. We recommend for professional use only.



4. Common Woods Commercially Available in North America (continued)

Wood Type	Density or Particular Type	Notes
Maple	Hard Maple (550/750 kg/m ³)	The surface tends to be shiny when machined. Sand before gluing. Maple accepts only light moistening. Sanding after moistening is also recommended. Requires high clamping pressure at 68°F.
	Silver Maple (Acer Saccharinum)	Has a slightly lower density, but requires the same care and preparation as “Hard Maple” for gluing. Please note that the color of the cured glue line may be a problem for some applications, as the glue line always show brownish, and it may look like the glue is penetrating across the glue line into the wood.
Meranti	---	Can be compared with Philippine Mahogany, and is normally considered a Mahogany type. Density is the same range as Lauan, and the biggest difference is a higher oil content, which requires careful preparation for gluing. Meranti is somewhat sensitive to solvents, use alcohol for cleaning up any oxidized oil on the surfaces.
Oak	---	All Oak types contain acid, and the pH-value in the wood is low, which may lead to a poor gluing result without careful preparation. All Oak types require high clamping pressure and extended clamping time. Sand with a course grade paper (grit 80) before glue is applied. Moistening is recommended in most cases.
African Paduok	675/800 kg/m ³	Loses color over time. May cause gluing problems due to oil “lumps” spreading over the planed surface. Dries well, stable after drying. Sand well. Apply glue right after machining. Use high clamping pressure, and extended clamping time.
Camwood	900/1050 kg/m ³	Camwood requires careful preparation, extended clamping time and high clamping pressure.
Purpleheart	900/1150 kg/m ³	Contains a lot of resin/oil, surfaces to be glued must be very fresh, and all oil/resin in the surfaces must be either sanded or cleaned with solvents before glue is applied. The wood is stable after drying, and wood should be moistened. Use double-sided application as standard. Due to variations in density, clamping pressure must be controlled carefully. (Purpleheart is the same as Amaranth).
Rosewood (Jacaranda) (A number of types from all over the world are called Palisander or Rosewood)	750/900 kg/m ³	Examples include Rio-Palisander, Guatemala Palisander, Para Palisander, Cabiuna Palisander, Honduras Rosewood, and Ostindian Rosewood (Palisander). The general characteristics are more or less the same. High resin/oil content, machines pretty well, stable when dried. Careful preparation before gluing required, if required clean surfaces with alcohol (not solvents). Allow all alcohol to evaporate before gluing, then sand carefully. Apply standard clamping pressure and clamping time. Due to possible penetration of the wood oil into the glue lines, maximum stability and strength of the glue line may take up to 24 hours to be reached. The term alcohol for use in removing any oil/resin from a prepared wood surface, is specified as normal “Household denatured alcohol of approximately 40–60% concentration.” This means when applying alcohol, you are, at the same time, applying water to the wood. In many cases, this volume of water will be enough to “moisten” the wood sufficiently for adjusting moisture content in the surface for the glue to react.
Satinwood	650/800 kg/m ³	Glues well, machines well, does not shrink much during drying. Gluing may be a problem due to a high mineral content. Do not use solvents or alcohol on Satinwood at all, as the natural pigment in the wood will dissolve readily, which may discolor the whole work piece. Sanding may help.



4. Common Woods Commercially Available in North America (continued)

Wood Type	Density or Particular Type	Notes
Sycamore	600/800 kg/m ³	Both sapwood and heartwood are used, and look like Beachwood and Maple in structure and strength. Dries well, machines well and glues well like Beachwood. Requires high clamping pressure. Same preparations and care should be taken as when working with Maple. Glue lines may appear slightly discolored and may look like the glue is penetrating cross-wise into the wood.
Teak	600/800 kg/m ³	Machines quite well, quite tough on tools due to the high mineral content. Dries well, but absorbs water poorly, so moistening is difficult. Any water applied will stay on the surface, and will evaporate before water gets into the wood cell structure. Teak glues well, but it is important that surfaces are freshly prepared. If a prepared surface is left too long, even sanding the surface will not be enough to secure a good glue bond, as the natural oil content may crystallise, sealing off the cells completely, leaving no possibility for the glue to form a proper bond. Do not use alcohol or solvents on Teak at all.
Walnut (Black Walnut) (American)	600/700 kg/m ³	This is a nice wood to machine and glue. Should cause no problems at all. No special preparations.
Poplar (Whitewood or Yellow poplar)	350/550 kg/m ³	Glues well. The glue consumption may double due to the open grain texture, and low density of the wood. Alcohol and solvents should not be used at all.

5. Difficult to Glue - or Glue with Care

Sapupira	South America	Very oily wood type
Angelin	Central America	Very closed cell structure "wets poorly"
Granadillo	Tropical Central America	Very closed cell structure "wets poorly"
Partrice	Tropical Central America	Difficult to machine "wets" poorly
Saberwood	Tropical America	Never stops sweating oil

6. Gluing Boards and Plywood

Gluing boards is a completely different to solid wood gluing. When gluing solid wood creating a proper glue line is a critical factor. When gluing boards creating a closed contact may be difficult. Board gluing is basically specified by the nature of the surface (coarse or closed), area size and moisture. Plywood will normally contain approximately 10% to 14% moisture. Particle board, OSB, Wafer boards, etc. will normally contain between 6% to 10% moisture. Melamine board (or other over laid boards) will normally contain 6 to 10 (12%) moisture.

The following general rules apply:

- For Boards (not treated in any way): glue only on a clean surface, free of any dust, oil, etc. Apply the glue "in stripes", approximately 1/2 inch apart. If required, apply a spray of moisture on the other surface. Put under clamping pressure within the assembly time available. Same applies for both plywood and particle board.
- Melamine board: Possible to glue single faced melamine to another board, provided one of the surfaces is able to absorb water and glue. Very difficult to glue two faces (melamine to melamine), as there is no open structure to absorb the glue. Bonds well to melamine, but it is important to have an open cell structure to absorb the glue during the curing reaction.
- If you have to glue melamine boards face to face, both surfaces must be sanded carefully, in order to secure open structure.
- All glued boards already contain a lot of glue. This existing glue oxidizes over time, and moisture content may vary quite a lot. Even if a board looks clean and nice, it is recommended to sand before applying glue. Clamping pressure may be varied, depending of the purpose of the job, anywhere from approximately 1 kg/cm² to 5 kg/cm².

7. Gluing Painted Items

For gluing one painted piece to another, sanding to clear wood is the only way to come close to something that looks like a proper glue line. Any kind of paint applied to wood poorly adheres to the cell structure. The glue creates what may appear to be a very strong bond into the paint, but sooner or later the bond between the paint and the wood will fall apart.

8. Gluing Finished Items

Standard preparations. Do not over-apply glue and be very careful of squeeze-out. While wet; squeeze out can be removed with a dry cloth and/or paint thinner. Cured glue can only be removed with chisel, scraper, or sand paper.