A question frequently posed is "Can I thin WEST SYSTEM® epoxy so it will flow or penetrate easier?" The answer to that question is "yes, but not without consequences." Many of the advantages of thinning epoxy are offset by disadvantages in other areas of epoxy performance.

There is a perception that epoxy needs to penetrate deeply into wood to be effective. Sometimes this is true, but most of the time it is not. Some common misconceptions are that deep penetration of epoxy 1) makes rotted wood as strong as new, 2) increases adhesion, and 3) makes wood more waterproof.

1) Rotted wood impregnated with epoxy does not make the damaged wood as good as new. Deep penetration of epoxy into rotted wood will make the wood hard, but it will not restore its original strength. This is not important if the rotted material is non-load bearing. A rotted door threshold does not need to be strong, just hard. However, when the wood fibre is damaged, wood loses its ability to carry loads and unless the fibre is replaced, it will not regain its full strength. A rotted deck beam or sailboat mast needs more than epoxy consolidation to return the wood to its original load carrying capacity.

2) Adhesion, in all but the highest density wood, is not enhanced by deep penetration of the glue into the wood. Research performed at the Forest Products Laboratory showed that adhesion to birch was increased slightly by using thinned epoxy. In lower density wood species like Douglas fir, the weak link is the cross grain strength of the wood. The strength of the wood, the amount of surface area and the adhesive ability of the glue determine the strength of a glue joint. Most types of wood glue do not penetrate deeply, yet, if used properly, they can exceed the grain strength. Epoxy is no exception.

3) Water resistance of a piece of wood is not enhanced by deep penetration. Wrapping wood in plastic makes a pretty good waterproof seal without any penetration at all. Likewise, an epoxy coating on the surface is more water-resistant than a thinned epoxy coating that has penetrated deeply into the wood because, in most instances, the epoxy thinned with solvent is porous.

Thinning epoxy with solvent

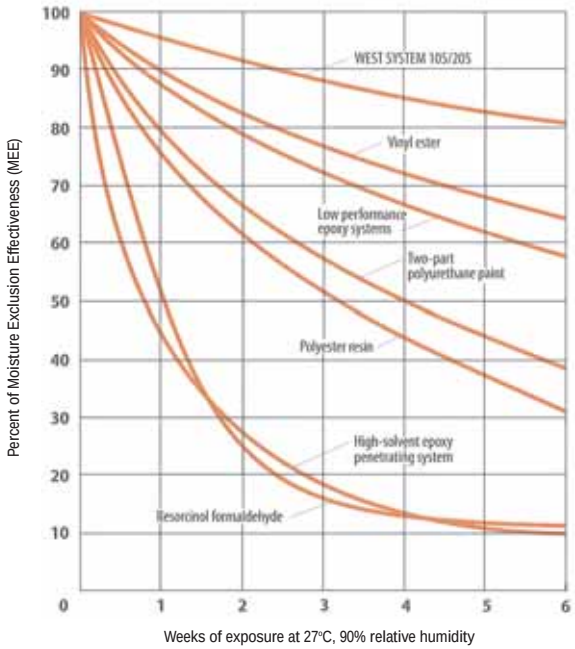
Adding solvent is the quick, simple method of thinning epoxy, but the strength and moisture resistance of the cured epoxy are drastically affected. Below are some of the effects adding solvent has on WEST SYSTEM® brand epoxy. We have selected acetone and lacquer thinner because they are commonly available.

• Adding a small amount of one of these solvents has a significant effect on the viscosity of the epoxy. For example, adding 5% lacquer thinner makes about a 60% reduction in viscosity.

• Adding 5% lacquer thinner to epoxy reduces the epoxy's compressive strength by 35% - a big hit in mechanical properties of WEST SYSTEM® brand epoxy. The addition of more than 5% solvent results in an excessively flexible cured material. Thinning epoxy with solvent causes enough loss of strength that it cannot be recommended to use as a structural adhesive.

• Adding a volatile solvent extends the pot life and cure time of epoxy and jeopardizes the reliability and predictability of cure. Additionally, with slow rate of cure, it takes longer before work can be sanded.

• Adding volatile solvent may cause shrinkage of the cured epoxy. Applying thinned epoxy in large, confined areas (like consolidating a large pocket of rotted wood) is likely to trap some of the solvent.



Adding solvent comprises the moisture resistance of cured epoxy

In thick applications, the epoxy cures very quickly and not all of the solvent has time to evaporate before the epoxy hardens. Over time, the solvent works its way out and as this happens, the cured epoxy shrinks and in many instances cracks.
Shrinkage also causes print through. You may have a surface sanded smooth only to have the resin shrink. This shrinking often reveals the texture of the substrate. Shrinkage can continue to be a problem until all the trapped solvent works its way out of the cured epoxy.

• Adding solvents, especially acetone, alters the colour of the cured epoxy. While the effects are not immediate, adding acetone to epoxy causes the colour to change from slightly amber to very dark amber.

• Adding solvent to epoxy may damage the substrate. Many materials (Styrofoam™ for example) are not attacked by epoxy but may be attacked by the solvent used to thin the epoxy.

• Adding volatile solvent to WEST SYSTEM® epoxy has some adverse health and safety effects. WEST SYSTEM® brand epoxy components are non-flammable, but the chance of fire or explosion goes up in proportion to the amount of solvent you add. The vapours of many volatile solvents are hazardous to your health and proper ventilation is mandatory to prevent inhaling harmful quantities of them.

• Adding solvent to epoxy to enhance fibreglass wet-out will result in more “drain out” of the resin on a vertical surface. The fabric will wet-out quickly but it may become resin starved when too much epoxy runs out of the fabric.

In general, ATL does not recommend thinning epoxy with solvents.

Viscosity can be reduced by warming the epoxy without affecting the physical characteristics of the cured resin. Contact ATL Composites for specific details.

ATL Composites have a large range of laminating, coating, toughened and adhesive epoxy systems, including low viscosity systems. Please contact ATL for specific applications.

ATL composites

ATL composites Pty Ltd
Tel (+61) 7 5563 1222
Fax (+61) 7 5563 1585
info@atlcomposites.com
www.atlcomposites.com