

WATER RESISTANCE OF EPOXY COATINGS

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With Cost Analysis

Epoxy coatings are claimed to be the most water resistant protective coatings commonly available, and therefore most suited to sealing and preservation of wood in timber and timber composite boats. Perhaps confusing for general users they come in two forms, very thin solvent based coatings which are claimed to penetrate the timber to considerable depth, and rather more viscous solvent free or 'high solids' epoxies. The question is : how relatively effective are these two types of products ?

To test this we have measured the rate of water loss through thin wall cardboard tubes coated with the relevant products. The tubes (40 mm diameter, 0.75 mm thick) were thoroughly coated internally, excess was drained out, and the bottom end was sealed. The epoxies were allowed to set and cure fully for 5 days before filling with water and covered to prevent evaporation from the top surface (see Figure 1). Any penetration of water through the coating would show as a loss of depth in the tube as the water evaporated from the porous surface of the cardboard.



Figure 1 – Test set up for Solvent Free Epoxy

Loss of water depth was measured over time, and showed a surprisingly significant penetration of water through the solvent based epoxy as shown at Figure 2. The test was repeated using a single cardboard tube cut into lengths, one for each product type, to ensure there was no difference arising from different cardboard tubes, and identical results were obtained. There was a small rate of water penetration through the high solids epoxies which appeared to stabilise over a period of 3 – 4 weeks. No differences were evident between the different brands of high solids epoxies.

It is clear that solvent based epoxy fails to present anything like the same water resistance as the high solids types. A possible reason for this is due to their high solvent/low epoxy resin formulations. According to their published MSDS's Everdure contains 63% solvent by volume (55% solvent by weight), while Norseal contains 60% solvent by volume (53.3% by weight). Therefore each coat will apply less than half the amount of resin delivered by the solvent free epoxies.

To test this theory, two additional coats were applied to the solvent based epoxy tubes after completion of the first tests, making 4 and 6 coats respectively. Both solvent based products now performed much better with the added coating thickness, but still not as well as the solvent free epoxies.

A further complication results from their penetration into the porous structure of the cardboard surface. (In some cases the liquid penetrated right through the cardboard). The solvents in the mixture become trapped in the pores and cannot evaporate away quickly enough before the epoxy cures. This then leaves a porous film which is more readily penetrated by water. The greater variability of the observations from different tests with solvent based epoxies is probably due to this uncontrollable factor.

Products tested were:

High Solids Epoxies

- Bote-Cote 1 coat
- Bote-Cote/TPRDA 1 coat plus Bote-Cote 1 coat (manufacturer's recommendation)
- West Epoxy 1 coat
- West Epoxy 2 coats (manufacturer's recommendation)

Solvent based Epoxies

- Norseal 2 coats (manufacturer's recommendation).
- Everdure 4 coats (manufacturer's recommendation).

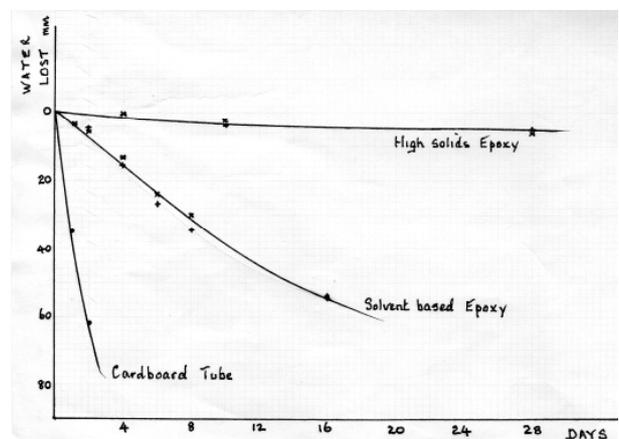


Figure 2 – Test Results from Initial Test

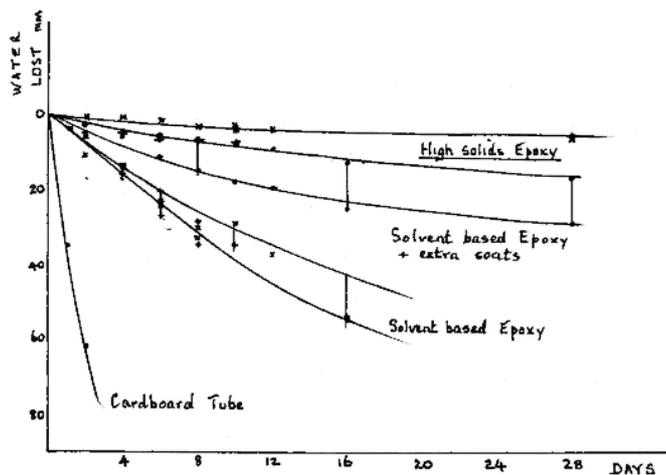


Figure 3 – Test Results from 2nd Round of Tests

Use of solvent based epoxies for timber coating would display a similar problem, more exacerbated for light weight more porous timbers, while less critical for heavy dense timbers. A reasonable conclusion would be that solvent based products should only be applied to non-porous surfaces, which is consistent with the widespread use of epoxy paints as very effective protective coatings for steel.

The practical value of solvent based penetration coatings for timber seems questionable. The common statement by users “you can see it being absorbed” should actually be “I can see more than 60% of my money going up in smoke”, since the solvent will eventually evaporate away. Many more coats are required to deliver water resistance approaching the solvent free epoxies, with the residual porosity in the remaining coating layer still able to permit some water penetration, which all leads on to a very unsatisfactory end result.

Can solvents be used for thinning epoxy coatings ? Yes, certainly, provided two precautions are observed:

- 1 only a very volatile solvent such as acetone is used, and
- 2 The thinned mix is only applied to an already sealed or non-porous surface.

Thinning epoxies is especially useful when laminating fiberglass or other fabrics, to accelerate absorption of the resin into the fibre bundles. These precautions are to ensure that all the solvent evaporates away quickly, and well before the epoxy starts to cure. Porosity is the death of any protective coating !

Cost Analysis Bote Cote Verses Everdure

For ease of calculation an area of 6 sq. Metres has been selected and Recommended Retail Prices used to develop a cost analysis table as representative area to be coated. A labour cost of \$80.00 per hour has been used and common tasks to both processes not calculated such as sanding before initial coating. If the timberwork will be clear coated then three (3) coats of Bote Cote Epoxy Resin with TPRDA added for the first coat should be used.

- Note:** -
1. The Everdure / International HT 9000 combination should not be used for clear coating as it will yellow off even with a Clear Urethane coating applied.
 2. If painting the Epoxied finish there is additional saving using Bote Cote as standard or FAST Hardener can be used instead of Non-Yellowing Hardener.

Task	Bote Cote Materials Cost	Bote Cote Labour Cost	Everdure / Epiglass Material Cost	Everdure Labour Cost
1 Coat timber with 3 coats of Bote Cote @ 6m ² per litre = 1 x 3 litre kit (\$97.00) + 250ml TPRDA (\$11.95) & 3 x 230mm roller skins. (\$7.50)	\$116.45	3 x 1 hour = \$240.00		
3 Coat timber with 4 coats of Everdure @ 10m ² per litre = 1 x 2 Ltr kit (\$89.90) + 1 x 1 Ltr kit (\$51.90) + 1 Ltr Epoxy Thinners (\$33.95) & 4 x 230mm roller skins. (\$10.00)			\$175.75	4 x 1 hour = \$320.00
4 Sand cured Everdure for sealing coats of Epoxy – consumables and power @ 4% labour cost.			\$25.60	2 hours = \$160.00
5 Apply two coats of EPIGLASS HT9000 Epoxy @ 8m ² per litre = 2 x 1.33 Ltr kits (\$75.90 x 2) & 2 x 230mm roller skins. (\$5.00)			\$156.80	2 hours = \$160.00
Total Cost Seal 6m² Timber with Bote Cote	\$136.45 + \$240.00 = \$376.45			
Total Cost Seal 6m² Timber with EVERDURE / EPIGLASS HT9000 Epoxy			\$358.15 + \$640.00 = \$998.15	