

SECTION VIII - PAINTING AND FINISHING

Over the years nearly half of the technical service questions we've asked involve painting and varnishing epoxy coatings. More than anything else this has been the area that has caused most people trouble. We have solved these problems by developing our own paint and clear finish system for epoxy resin surfaces - more on this later.

Epoxy surfaces may be coated either with opaque paints or finished with clear varnishes. The epoxy surface accepts finishes like any other non-porous surface except that it is chemically active to certain materials because of unreacted amines on the surface and throughout the epoxy matrix.

All outside epoxy surfaces exposed to sunlight must be protected from degradation by the ultraviolet rays (UV) in sunlight. This is the invisible short wave length portion of sunlight that causes sunburn. The long-term effect of UV on unprotected epoxy is a dulling of the clear film, followed by chalking and, finally, film cracking and delamination.

The initial effects of UV degradation on most epoxies start after about six months of intense tropical sunlight on horizontal surfaces. Total breakdown will occur after about fifteen months under these same conditions.

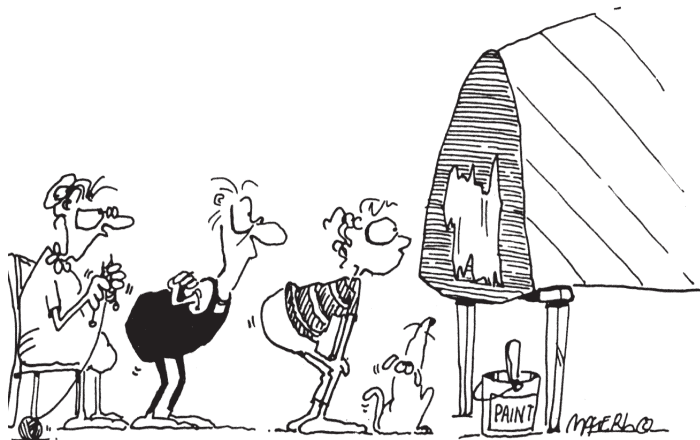
Bright finished boats should be finished with a clear coating that contains a UV inhibitor. This inhibitor is sacrificial so the coating must be periodically renewed if the epoxy is to be protected. When the clear protective coating starts to look dull it's time to refinish. Old coatings are removed by sanding or are chemically stripped with strong solvents. Test patch an inconspicuous area to make sure that the solvent used does not attack the epoxy base. Solvents and removers containing methylene chloride will soften and etch epoxy surfaces. Don't use these. Be sure to observe the usual precautions when working with these solvents.

Opaque paints do not allow the passage of UV light, offering the best protection of the epoxy coating. A primer coat prior to painting over epoxy is quite beneficial because it provides a uniform color base and is easier to sand than epoxy resin. It is generally not necessary to use a primer in order for a suitable top-coat to adhere to sanded epoxy resin. Do the crosshatch adhesion test described below to check for adhesion.

Besides antifouling paint, two broad classes of coatings are commonly used as boat paints. These are "one part" alkyd and modified alkyd enamels commonly called "oil base paints" and two part linear polyurethane(LPU) paints. Two-part epoxy based top coats have fallen into disfavor due to their tendency to chalk. Two-part epoxy primers are recommended as high build sanding base primers for LPU paints, however. Some advocate the use of water-thinned latex paints. While these products bond well to coarsely sanded epoxy they are quite soft and do not wear well on boats.

Be sure that you are getting what you expect when purchasing a marine paint. Paints sold in marine stores today are often a triumph of marketing over technology. Remember the adage: "The big print giveth while the small print taketh away." It is not un-

common to see the pretty face on a paint can staring back at you screaming, "Buy me! I am a one part polyurethane". Yet, when you read the back of the can you find that the ingredients state that it contains polyurethane safflower alkyd resin or some other modified alkyd. If it says alkyd anywhere on the can then it is an alkyd NOT a polyurethane. True polyurethanes (often referred to as LPU paints) are two-part and cost several times what an alkyd costs. If the ingredients are not specified on the can, then ask for an MSDS on the paint - that should provide information on the type of paint you're about to buy.



Alkyd enamels and related one part paints and varnishes are easy to work with but may not properly dry on epoxy resins. They may be brushed, rolled or sprayed and dry to a glossy film that is easy to refinish. Their main drawback as a finish is that they are softer than LPU paints and chalk slowly over a period of time.

LPU paints dry very hard with excellent gloss, are not degraded by sunlight and wear very well. Their main drawback is that they require immaculate surface preparation and can be tricky to apply. Solvent based LPU paints contain some very toxic materials. Consult and understand the MSDS if you plan to use these materials. Solvent based LPU paints can turn dull when curing if the humidity is too high.

Because of the ultra high gloss of LPU paints any imperfection in the substrate will show in the finished coating. The tendency of the alkyd paints to dull to a semi-gloss finish over time can hide some of the flaws that might otherwise mar an LPU finish. However, if your project is perfect and you are willing to spend the time and care required to use LPU paints the results can be spectacular.

Use any color you want so long as it is light. If you paint a wood boat with a dark color and use it in the summer sun you are going to experience a number of problems. First, you'll get "print through". This is the telegraphing of the cloth weave or wood grain pattern to the glossy painted surface. Second, you'll see what appears to be shrinkage of the epoxy resin (microballoon putty over screw holes, for example.) This is caused by the expansion and contraction of the wood fiber due to changing

moisture content rapidly aggravated by excess heat soaked up by your darkly painted boat. Finally, the useful life of the boat will be shorter.

Test patches are advisable prior to painting or varnishing over an epoxy coating. These test patches will give you a feel for how the various coating materials handle and point out any possible incompatibility problems prior to them becoming a disaster all over your boat.

To do a test patch, coat a small area with the painting system selected to make sure that each paint layer dries properly and adheres well to its substrate. One reason for doing this is that epoxy resins, despite sanding and long cure time remain chemically active to certain components of alkyd paint and varnish systems. Generally, epoxy primers and LPU paints are compatible with epoxy resin coatings and may even chemically bond. However, some of the alkyd enamels and other one part paints and varnishes may not properly dry on epoxy resin coatings. The free unreacted amine in the epoxy resin coating interferes with the action of the metallic driers in some of these paints. If this happens the paint may surface dry but remain soft and tacky next to the epoxy resin surface.

A similar chemical phenomenon occurs between the amines in epoxy hardeners and the peroxide catalyst used in polyester and vinyl ester resins and primers. The amines inhibit the action of the peroxide catalyst, preventing cure at the interface. For this reason, it is not possible to "gel coat" finish cured epoxy without specialty barrier coats and it is very risky to use peroxide cured polymers directly over cured epoxy resins. Besides, gel coats don't look all that good when applied to a male form. Their best use is against a polished female mold. For the same reason you should not use polyester based putties over an epoxy.

Be sure to follow the paint manufacturer's instructions when doing the test patch. With the exception of the high build two-part epoxy primers, all finish paint systems should be applied thinly. Thick coats will not dry properly and may take weeks to "through dry". Temperature and humidity play an important role in the speed of alkyd paint drying. The higher the temperature and lower the humidity, the faster the drying.

You can gauge drying by digging your fingernail into your test patch and scratching. If the paint film is still soft below its surface then it has not finished drying. A dry film is hard all the way through. A simple test called the crosshatch adhesion test will show how the new layer bonds to the substrate. Do this test only on paint that has dried thoroughly. To do this test take an industrial razor blade and score the surface with a set of 8 parallel lines about an eighth of an inch apart. Score a similar set at 90 degrees from and crossing the first set. The finished lines look like a giant tic-tac-toe grid. Take some clear packaging adhesive tape and press the sticky side into the grid leaving a tail. Press the tape hard with the back of your fingernail. Grab the tail and jerk the tape off the grid. Examine both the tape and the grid for paint adhesion failures. Except for the grid lines on the tape, no paint should come off on the tape. If it does then you have an adhesion problem and it WILL show up on your boat most likely in the form of paint blisters. Better select a different substrate/top coat combination and test it.

Once you are satisfied that there are no system compatibility or adhesion problems then you can paint your project with confidence.

By now you are probably wondering why we don't just give you a list of what paint brands you can use. We would if we could but because paint makers are free to modify their formulations without notifying System Three Resins we will not recommend a specific brand of paint. The batch we test might have changed by the time information about our results gets to you. It is not possible for us to keep up with all the different brands and lot numbers.

We recommend the use of System Three water reducible epoxy primer and water reducible LPU finish coats. They work, there are no adhesion problems, they thin and clean up with water, they spray, brush or roll, there is no solvent smell so you can use them indoors. These products are extremely durable and fully compatible with System Three epoxy products. Consult the paint literature on our website (www.systemthree.com) or ask for it by mail.

