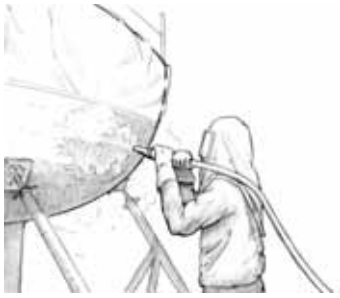
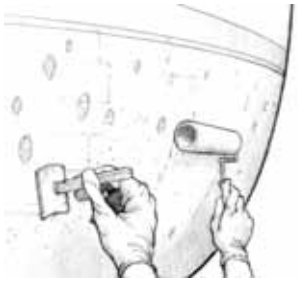
GELCOAT BLISTERS

A GUIDE TO OSMOSIS REPAIR





Contents

WEST SYSTEM® BRAND

GELCOAT BLISTERS

A GUIDE TO OSMOSIS REPAIR

Repairing of fibreglass boats following osmosis damage with WEST SYSTEM ® Brand epoxy.

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GOUGEON

Section 1 Introduction

WEST SYSTEM epoxy has been used successfully to repair and protect thousands of boats with gelcoat blister problems. Our recommendations are based on over thirty years experience in the formulation of quality marine epoxies, coupled with extensive laboratory and field-testing. However, the causes of osmotic blistering are complex and may sometimes occur whatever the quality and nature of the hull construction. Because of this and an often unknown hull construction history there is no guarantee that any treatment will be successful.

There are many variables that affect the formation of blisters and numerous factors contributing to a lasting repair from thorough preparation and adequate drying to repairing and coating the hull – but, nevertheless, we firmly believe that WEST SYSTEM epoxy offers one of the best solution for the repair and prevention of osmosis.

We strongly recommend that a qualified Marine Surveyor is engaged to survey the hull prior to treatment and, if considered necessary, to specify and supervise repairs. It is vitally important that all aspects of the treatment process are carried out strictly in accordance with the instructions. Whilst we are always ready to provide assistance and advice through our technical helpline, we do not supervise the work of your contracted repairer and Wessex Resins and Adhesives Ltd cannot take that responsibility.

There are three compelling reasons to use an epoxy rather than a polyester resin or any other material to combat gelcoat blistering. Epoxy is more effective as a moisture barrier, has greater resistance to hydrolysis and is a better structural adhesive

Gougeon Brothers Inc., has developed a test method which determines the moisture exclusion ability of coating materials. For many years, identical samples tested with various coatings have been examined and the relative effectiveness of each coating as a moisture barrier determined. This research has shown that WEST SYSTEM Brand epoxy has a much higher resistance to moisture than most other coatings – a critical characteristic in reducing moisture permeability through the resin matrix which could result in gelcoat blistering and/or interlaminate failure. On a more practical viewpoint, over a five year period, a record was kept at Wessex Resins of the boats which were treated for osmosis throughout Europe using the WEST SYSTEM materials and techniques. Of the many hundreds of boats treated with WEST SYSTEM epoxy products, less than 5% subsequently required further work to completely eliminate the gelcoat blistering problem.

WEST SYSTEM epoxy has an exceptional service history in the marine field and the high mechanical and chemical stability of epoxy, coupled with extremely good moisture resistance properties, makes WEST SYSTEM epoxy an excellent choice to combat gelcoat blistering.

Section 2 The Problem of Gelcoat Blisters

Osmosis

Any boat represents a substantial investment. Maintenance problems unique to polyester/glass reinforced boats, particularly the hull, can threaten your investment as well as detract from its performance and appearance. Many of these problems can be intimidating but, with the correct materials and technique, they are not difficult to solve. Probably the most significant and damaging problem that confronts the owner of a polyester /glass boat is osmosis and, if allowed to continue, gelcoat blistering can eventually cause structural delamination.

What is Osmosis?

Very simply, the problem is primarily caused by moisture penetrating the gelcoat and entering the laminated structure. However, moisture can also enter the laminate from the inside of the hull through cracks or other structural flaws. This moisture reacts with the water soluble chemicals, creating an acidic solution which has a greater density than sea water on the outside of the hull. This creates a differential pressure and since water will not compress, blisters form on the outer side of the gelcoat.

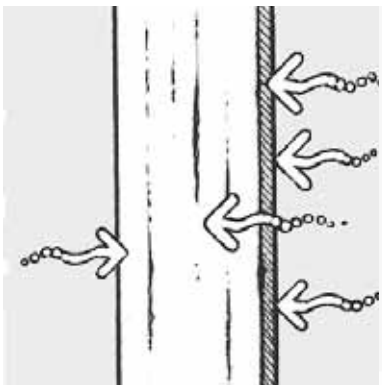

Figure 2.1. A relatively sound laminate will experience less moisture migration than a laminate with voids containing solutes.

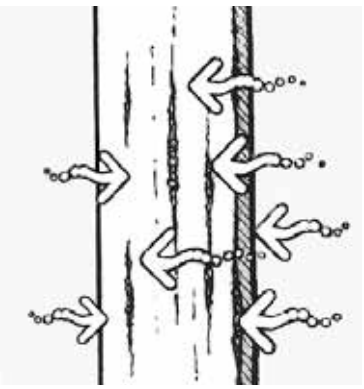

Figure 2.2. As the level of solutes increases, the rate of permeation accelerates.

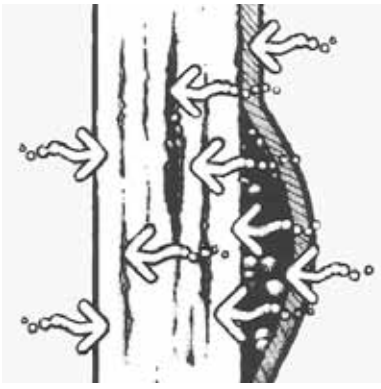

Figure 2.3. As osmotic pressure increases, blisters between the laminate and the gelcoat begin to form.

2.1 Factors affecting blister formation

The chemical stability of the polyester resin and the permeability of the laminate are the key factors affecting the durability of the fibreglass hull. The common thread is the ease with which water moisture can enter the laminate and alter the chemistry of the resin matrix.

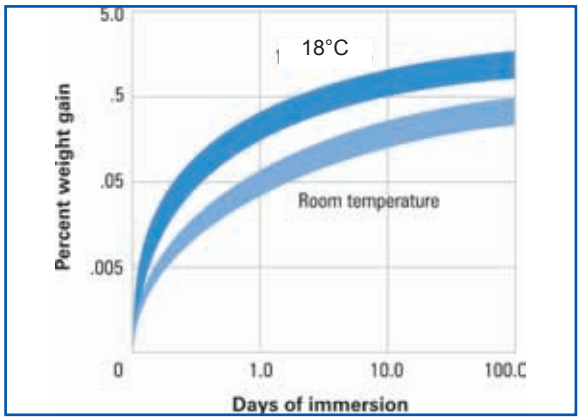

Figure 2.4. The susceptibility of a laminate to moisture permeation tends to increase with higher ambient temperatures.

2.1.1 Permeability

When cured, the unsaturated polyesters used in laminating resins and gelcoats are not waterproof. They are quite permeable and will allow water to migrate through the cured resin at a consistent, predictable rate. The permeability of polyester matrices involves two major factors.

a) Gelcoat thickness – the thickness of the gelcoat is an important element in the diffusion of water through the membrane.

b) Temperature – the warmer the ambient temperature, the higher the rate of permeation. Thus, boats in the Mediterranean or the Caribbean are more likely to have problems than those in Northern Europe.

2.1.2 Voids

A prime cause of blister formation is the distribution of voids in the laminate. When water accumulates in these voids, the formation of blisters is initiated. The acidic fluid that develops may eventually begin to hydrolyse the surrounding polyester laminate.

2.1.3 Hydrolysis

The presence of water with unreacted resin components in the laminate produces an acidic solution which, in turn, can cause a breakdown of some ester linkages that make up the majority of bonds in polyester laminates. This chemical reaction is called hydrolysis.

Water passing through the gelcoat into voids breaks down more of the unsaturated polyester chains which then allows more water to pass into the laminate. This one-sided movement of water into the laminate is osmosis and the process, in effect, feeds on itself, creating more blisters between the gelcoat and laminate or in the laminate itself.

Section 3 WEST SYSTEM epoxy for repair and coating

Moisture within the laminate is accepted as the common denominator in the gelcoat blister equation. At some moisture level, dependent upon the composition of the laminate and ambient temperature, the osmotic process is triggered. Obviously, therefore, measures taken towards minimising osmotic problems would be to thoroughly dry the laminate, keeping the interior of the boat as dry as possible and providing a water-resistant barrier coating.

3.1 Secondary bonding

There is one other compelling reason to use an epoxy rather than polyester resin. Polyester resins perform well during the manufacture of a structure when the layers of resin and glass reinforcement are bonded and cured together i.e. a primary bond. However, problems can occur when trying to bond polyester resin to a previously cured laminate as is necessary in osmosis repair i.e. a secondary bond.

WEST SYSTEM epoxy overcomes this problem and forms a superior chemical and mechanical bond with the cured polyester in secondary bonding applications. Indeed, the epoxy repair may be stronger than the original structure. Moisture exclusion effectiveness, hydrolysis resistance and bonding capability are the major considerations in choosing a barrier coating. In addition, cost, ease and practicality of application, availability and safety are extremely important issues and all these aspects are available with the WEST SYSTEM Brand epoxy.`

Section 4 Hull Preparation

This section covers the procedure for removing damaged gelcoat and laminate and preparing a hull for drying, filling, fairing, and final moisture barrier coating.

4.1 Evaluating blister damage

Blisters are most apparent when the boat is pulled from the water. However, the blisters tend to shrink quite rapidly once the boat is out of the water and can disappear in a day or two, only to reappear when the boat returns to the water. Clean off the marine growth and abrade the bottom with 80-grit sandpaper. Damage may range from a few isolated blisters to the entire underwater area of a hull peppered with thousands of small blisters.

Isolated minor blisters can be opened individually, thoroughly cleaned and aggressively abraded before the cavities are filled and faired. This method has worked well, especially on older boats where it is often the case that little damage exists beyond the apparent blisters.

Extensive damage on newer boats, however, probably indicates a major problem. In these cases the gelcoat should be completely removed. This eliminates the obvious damage and, subsequently, the gelcoat is replaced by the epoxy barrier coat. This is an excellent option if time and funds allow, even though the blistering is not yet serious. Furthermore, removing the gelcoat allows the laminate to dry more rapidly as it is now exposed to the atmosphere. Thorough drying is an extremely important part of the repair and must not be rushed.

4.2 Isolated or minor blistering

In some instances, good results have been reported when localised blisters have been opened, cleaned, dried and subsequently coated with unthickened epoxy, filled with thickened epoxy and then coated again with unthickened epoxy. Remember, however, that even though the localised problem may have been remedied, blistering and delamination may be occurring unnoticed in other parts of the hull. A more thorough approach would be to assume osmosis is extensive and that a complete hull treatment is necessary to overcome the problem.

Figure 4.1. A variable speed drill with a countersink bit can be used to open blisters while providing good depth control

4.3 Extensive blister damage

Grinding, sandblasting or peeling are options to remove the gelcoat and abrade the entire hull in one operation. Each method has advantages and disadvantages but each operation will almost certainly create ridges and depressions in the hull surface which need to be “smoothed out” or “faired” at a later stage. See Section 6 - Fairing the hull

4.3.1 Grinding

Great care must be taken when grinding as it is so easy to leave the hull uneven and in need of extensive fairing. The operation also creates a lot of dust and a potential health hazard.

a) Prepare the work area to protect against dust hazards especially when antifouling is to be removed. Adopt safe waste management practices.

b) Clean the hull of marine growth and contaminants such as grease or oil.

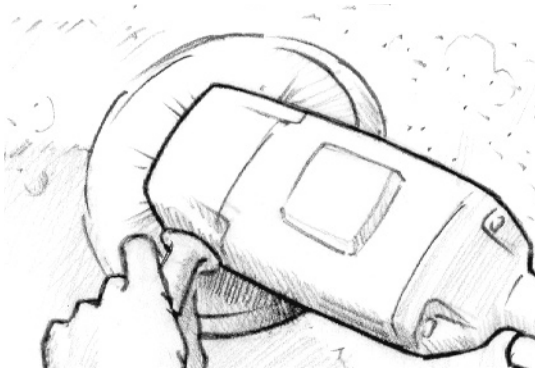

Figure 4.2. Use an electric polisher with an 200mm foam sanding pad to open blister cavites or remove gelcoat

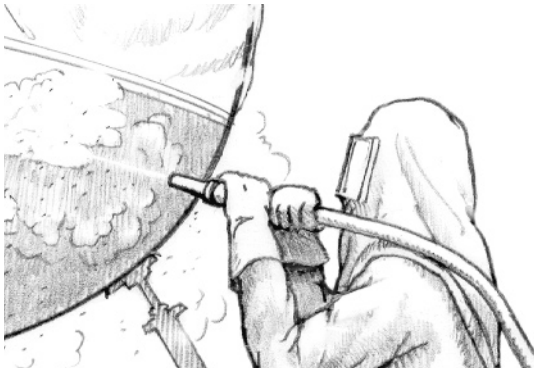

Figure 4.3. Sandblasting is a common method of opening blisters and abrading the hull

4.3.2 Sandblasting

This method is also a potential health problem because of the airborne dust generated. Antifouling paint must be removed before sandblasting as failure to do so may result in small particles of paint becoming embedded in the laminate. This may create subsequent bonding problems.

Do not drive gelcoat particles into the softer, underlying laminate nor remove excessive quantities of the laminate. Remove between 90% and 95% of the gelcoat by sandblasting and then complete the process by sanding. After the gelcoat is removed, inspect the laminate for delamination and any further damage; sound the hull for voids.

4.3.3 Gelcoat peelers

Peelers are designed around a cutting head that shaves the gelcoat to the appropriate depth and leaves a smooth surface requiring little or no fairing. It is essential to lightly sandblast or sand a peeled hull to roughen the smooth substrate thereby providing a good bonding surface. Inspect the laminate for delamination or other damage.

4.3.4 Sounding the hull

Wet or delaminated areas will sound dull or flat when rapped with a small mallet. Dry, solid laminate will have a sharp sound. By tapping the hull in a regular pattern, isolated problem areas can be detected. Blistering or delamination within the laminate may affect the structural integrity of the hull and must be repaired.

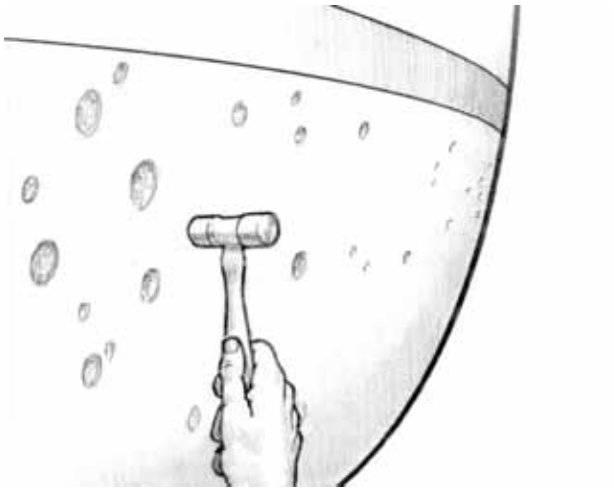

Figure 4.4. Sounding the hull will reveal interlaminate voids

4.4 Exposing interlaminate damage

The deeper or more widespread the delamination, the more serious the structural problem. If sounding or visual inspection reveals voids below the outer layer of laminate, exposing these voids will allow the laminate behind the voids to dry out more thoroughly before repairs can be made.

It is essential to remove the damaged layer back to sound laminate and, when the hull is dry, replace these laminations with layers of epoxy and glass. The outer layer of chopped strand mat is not considered a structural layer. We strongly recommend professional advice is sought to determine the extent of damage to the hull. Having determined the necessary laminate thickness to ensure the structural integrity of the hull is replaced, the repair can be carried out using WEST SYSTEM epoxy with 446g/m^2 biaxial glass cloth.

Section 5 Drying the laminate

Perhaps the most crucial step of the repair process for a boat that has blistered is drying the hull. The procedure for drying the hull is:-

a) With the gelcoat and any unsound laminate removed, wash the hull with warm, fresh water or steam clean and allow to dry.

b) Record the moisture content of the hull in a number of places - at least 16 different locations each side of the hull - and mark the position of these readings. Monitor the drying process regularly by checking the moisture content of the hull at the same locations. To assist the drying process, store the boat under cover and, if necessary, tent the hull. Infra-red heaters can be used to accelerate and therefore shorten the drying cycle but it is essential that such heaters are at least one metre away from the hull. Severe laminate damage can be caused if the heaters are in closer proximity and it is imperative that the surface temperature of the hull never exceeds 50°C – beyond this temperature, permanent damage may be caused to the hull.

Figure 5.1. Drying the hull can be accelerated by tenting the hull with a plastic skirt taped just above the waterline.

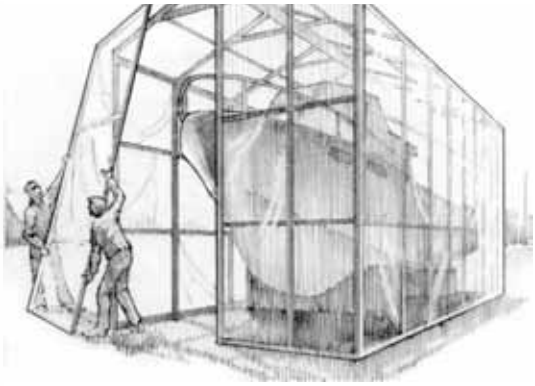

Figure 5.2. For yards repairing many boats, a drying shed built of timber and plastic (similar to a greenhouse) can free up valuable shop space.

c) During the drying process the hull must be flushed with fresh water and scrubbed or steam cleaned at regular intervals. This washing removes any salts/contamination and glycol which may have leached to the surface during the drying process. Any contamination will block the pores reducing the moisture flow and therefore hindering the drying cycle. The frequency of washing depends on the drying speed, since contaminants will be left on the surface at a faster rate when the hull dries quickly. If an aggressive, accelerated drying method is adopted, washing every 48 hours is be appropriate. If a passive method is used in a cooler or humid climate, wash once every seven days. In a warmer, drier region, wash more regularly.

d) Once the laminate has been dried and a consistent moisture level is recorded on all “spot” locations, switch off any heaters and either steam clean or flush and scrub the hull with warm, fresh water before drying with clean paper towels. Allow to dry naturally for a few days. Check the moisture content again to ensure that the laminate is dry, and, if necessary, wash and reheat. Before commencing the epoxy coating, ensure there is no condensation on the hull.

From our experience and as a guide, the relative scale readings which should ensure that the moisture content of the hull is below 2% are as under:

Sovereign: **4 or below on Scale A**

Tramex Skipper **Below 5 on Scale 1; Below 40 on Scale 2**

5.1 Drying the interior

Moisture can penetrate the laminate just as easily from the interior as through the exterior and the bilge is often overlooked when drying the hull. Ensure that all water is pumped from the bilge which should be subsequently flushed with clean water. Empty the bilge again using sponges to remove all water. Provide adequate ventilation within the boat – open all hatches, cabinets and floor boards to allow free air circulation. To accelerate drying, install fans, heaters or a dehumidifier in the boat and, in addition, empty all water tanks.

Section 6 Fairing the hull

With the hull dry and any structural repairs to the laminate completed, final fairing can be easily accomplished with WEST SYSTEM epoxy and low density fillers. Fairing may be necessary in only small sections but, if insufficient care was taken in removing the gelcoat, a significant fairing project may be required.

1. Prepare the surface of the hull by abrading any lumps or ridges and removing all dust from the area(s) to be faired, using clean clothes and/or WEST SYSTEM 850 solvent if necessary.

2. Wet out the surface(s) to be faired with a resin/hardener mix and allow this to reach its initial cure or “green stage” to avoid sagging of the fairing compound.

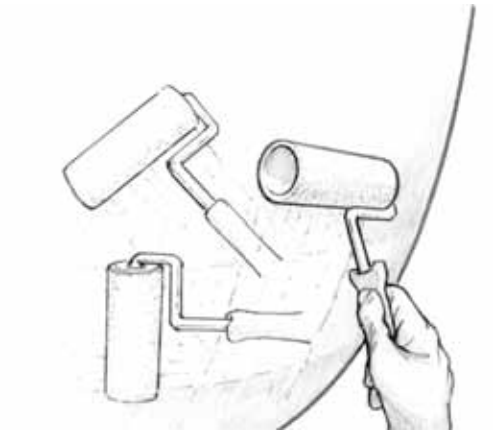

Figure 6.1 Wet out the surface with resin/hardener mix. to avoid sags, allow the wet-out coat to gel before applying fairing compound.

3. Prepare a fairing mix with WEST SYSTEM epoxy and either 407 Low Density filler or 410 Microlight filler and blend in filler until it becomes a non-sagging “peanut butter” consistency. **Note:** The thicker the fairing mix, the easier it will be to sand when cured.

4. Trowel the thickened mix into the wetted surface with a plastic squeegee, working it into all voids and depressions.

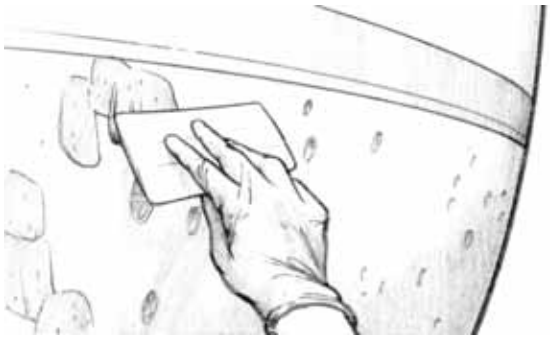

Figure 6.2 Use a squeegee to apply fairing compound, and slightly overfill the area. Shape the mix to blend with the surrounding contour.

5. Use the squeegee to smooth the filled epoxy as close as possible to the desired profile to avoid excessive sanding after the mix has cured. It is important to fill the low areas to just above the “fair level” so the fairing compound can be sanded to the required contour after cure.

6. Use a custom batten or long board to help shape larger areas. After over-filling the area with a squeegee, slowly drag the batten over the area while bending it to the contour of the surrounding profile.

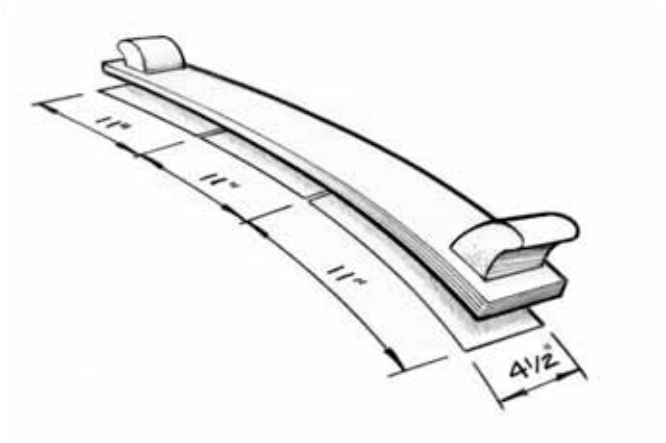

Figure 6.3 On large areas, use a batten to shape the compound after applying it with a squeegee. Batten and long boards should be made to dimensions that suit the specific curvature.

7. After the fairing compound has cured, the low areas have now become high areas. Sand these areas down to the requisite level using first 80 grit paper and subsequently finer grades as necessary.

8. Continue to check for fairness whilst sanding and fill and sand any low areas as many times as necessary.

9. Before continuing the treatment ensure the surfaces are thoughly cleaned to remove all contaminants such as sanding dust etc.

Section 7 Barrier coating

After preparing and drying the hull and repairing all laminate damage, the next operation is to apply the moisture barrier. A coating thickness of epoxy in excess of 600 microns is recommended for good protection and can be applied with six coats of WEST SYSTEM epoxy.

7.1 Preparation

A major objective when applying multiple coats of epoxy is to avoid the necessity of sanding between coats. This is only possible if all the coats are applied on the same day or if each coat is applied before the previous coat has reached its initial cure stage.

Begin to apply a coat as soon as the previous coat has reached its initial cure phase and has solidified enough to support the weight of the next coat without sagging. The time between initial cure and final cure will vary with the choice of hardener and the ambient temperature. If there is little control over the working temperature, choose a hardener that allows the work to be completed at a comfortable pace.

7.1.1 Planning for one-day coating

A six coat application of epoxy on a small 6m to 9m (20 to 30 ft) hull should be a manageable one-day operation for two people. If coating a larger hull or if help is limited, sanding between coats can still be avoided. Rather than applying a few coats to the entire hull on day one and the remaining coats on day two, it is better to apply all six coats to one side of the hull on day one and six coats to the other half of the hull on day two. Larger hulls may be divided into as many one-day operations as is convenient for the applicators and the particular working conditions. Only a 75 to 100mm overlap between one-day coating areas needs to be sanded instead of the entire previous coat.

7.2 Applying the barrier coat

7.2.1 The First Coat.

The following guidelines for applying the six coats of WEST SYSTEM epoxy in one day have been used very successfully in many professional boat yards and by amateur sailors who decided to carry out the work themselves. The first coat of epoxy is applied without additives for maximum penetration or “keying” onto the surface - additives are added to the second and following coats. Ideally, apply the first coat within 24 hours of the final sanding.

a) The afternoon/evening prior to the day of the osmosis treatment, check that the hull is fully prepared and ready for the coating operation to commence early the next morning. Remove any remaining sanding dust with a brush or vacuum. Mask the hull at the waterline with electricians tape or good quality masking tape. Ensure all materials and tools required for the coating operation are available and that the resin and hardener temperature is elevated to about 25°C

b) Temperature in the workshop or tented area should not be less than 18°C at 0830 hours and should rise as the day proceeds to between 20°C and 23°C by lunchtime. It is essential that the first application commences by 0900 hours to ensure the “one-day” coating area is fully treated with the requisite number of coats.

c) Prepare a batch of 105 Resin with 205 or 206 Hardener. Do not exceed 8 depressions of the resin pump and 8 depressions of the hardener pump which will produce about 260g of epoxy. **Stir the mix thoroughly (for 2-3 min)** and pour into a roller pan immediately after mixing.

d) Apply this resin/hardener mix to the hull, spreading out the epoxy to a thin even film using WEST SYSTEM 790 or 800 Foam Roller Covers. Continue applying the epoxy, overlapping small coverage areas until the batch is used.

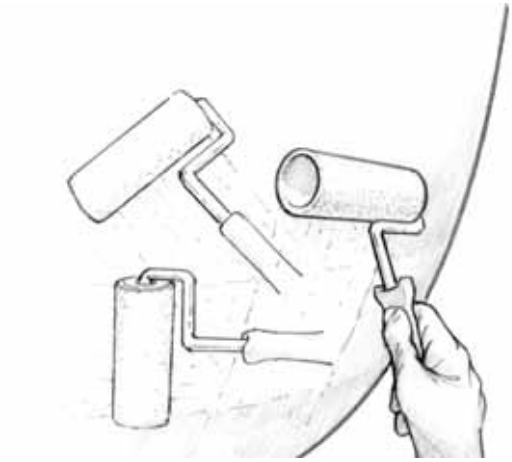

Figure 7.1. Apply a thin, even film of epoxy with a foam roller.

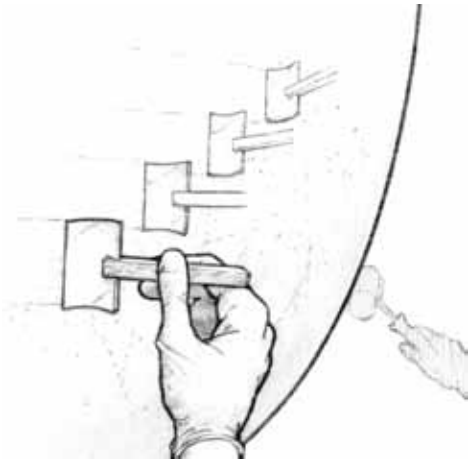

Figure 7.2. Tip off the fresh coat of epoxy with a foam roller brush to reduce bubbles and roller marks.

e) Tip off the freshly coated area with a foam roller brush before applying the next batch of epoxy. Drag the foam roller brush lightly over the surface in long overlapping strokes in one direction to remove roller marks and air bubbles in the coating. The thinner the coating, the smoother the finish after tipping off. It is important that air bubbles are removed before the epoxy begins to cure as air entrapment significantly reduces moisture exclusion ability.

Roller Cover Brushes

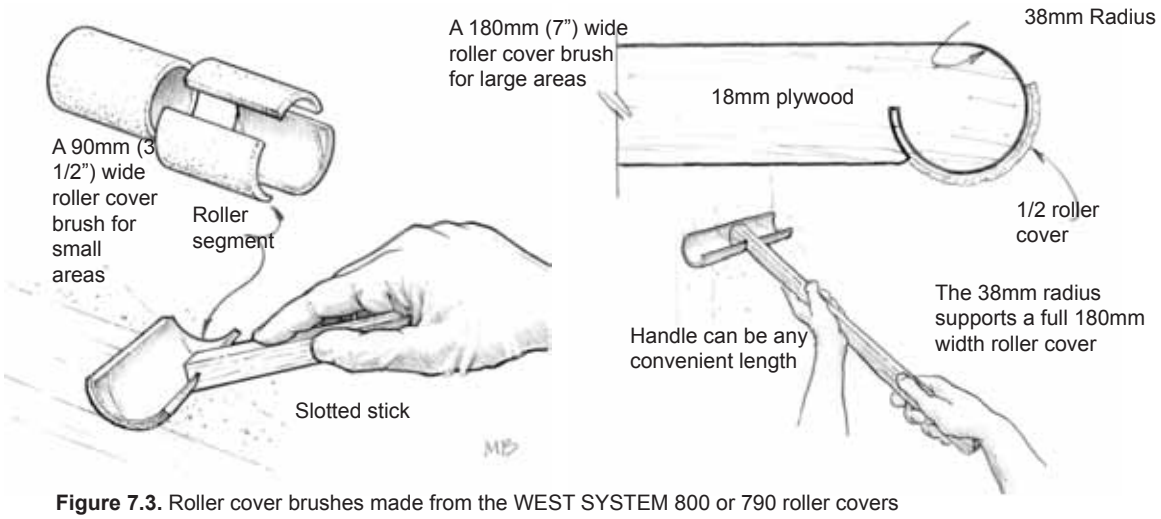

Figure 7.3. Roller cover brushes made from the WEST SYSTEM 800 or 790 roller covers

f) Continue rolling and tipping off batches.

g) If using 205 standard hardener, at room temperature the first coat will be touch dry within 75 and 90 minutes

7.2.2 Build Up Coats

The second coat can be applied as soon as the first coat of epoxy has reached its initial cure. To avoid sanding between coats, the second coat must be completed before the first coat reaches its final cure. In most cases, by the time the epoxy has been applied to the entire hull or to that section of the hull which has been selected as the "one day" coating area, the first epoxy priming coat should be ready for the next coat. **All build up coats have a 20% to 25% addition of 422 Barrier Coat Additive blended into the resin/hardener mix.**

Note: -To obtain a reasonably accurate addition of the filler, prepare a 260g batch of WEST SYSTEM epoxy (8 depressions of both the resin and hardener pumps) and, after blending, add 3 full tablespoons of 422 Barrier Coat Additive to the epoxy mixture and stir thoroughly.

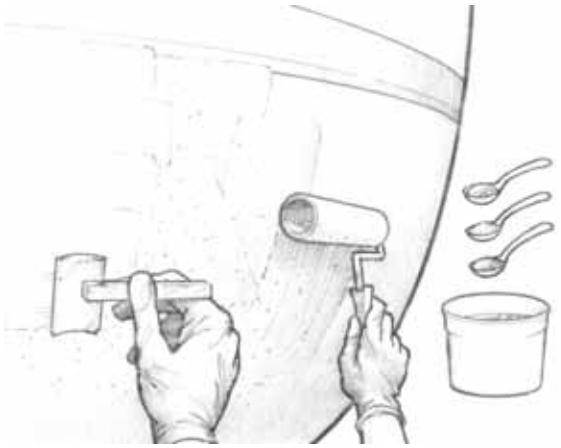

Figure 7.4. Add 422 Barrier Cat Additive to the second and remaining coats to increase moisture exclusion effectiveness and abrasion resistance.

Alternatively, the correct quantity of Barrier Coat Additive can be regularly achieved by weighing 55g of the additive into a paper cup and then cutting the cup down to the level of the powder. This technique is much preferred as it will ensure an accurate and consistent weight of filler is added to the epoxy mix and the "measuring" operation will be quicker.

a) Apply this mixture as before, tipping off each batch of epoxy with a foam roller brush. Tip off each coat in a direction perpendicular to the previous coat i.e. 1st horizontal, 2nd vertical, 3rd horizontal, etc.

b) Repeat this process for the remaining five coats of epoxy/barrier coat additive.

c) To ensure the area selected is coated in one day, the first three coats of the operation should be applied by 1300 hours. The final three coats can easily be applied during the afternoon as the film thickness of epoxy builds and the hull warms, thus reducing the curing cycle. If everything goes to plan, the work should be completed by 1800 hours. Timing is based on temperatures being maintained within 18°C - 23°C as detailed in 7.2 (b). Temperatures below this level will cause longer cure times and the coating programme will need to be extended.

d) WEST SYSTEM 425 Copper Compound may be used in the final coat instead of the barrier coat additive. The inclusion of this filler does not reduce the moisture exclusion effectiveness of the epoxy and provides the additional advantage of excellent back-up anti-fouling characteristics. The mix cures to a dark red-brown colour.

Very occasionally, pinholes may appear after two/three coats. If this occurs apply the fourth coat and allow to become touch dry. Use a WEST SYSTEM 808 Squeegee to force a filled mix of epoxy/422 Barrier Coat Additive, mixed to a mayonnaise consistency, into the pinholes. Allow this to become touch dry before continuing with the application of the barrier coats. Please note, to ensure a fair finish is achieved on the hull, it may be necessary to allow the filled mix to cure overnight, abrade with coarse 120 grit paper and clean the hull before completing the final two barrier coats. Contact our Technical Helpline for further advice.

7

7.3 Anti-fouling Paint

Allow the final coat of epoxy to cure for at least 24 hours. Wash the epoxy surface with clean water and then abrade with a 150-grit "wet and dry" to remove the amine blush and to smooth the surface. Use caution when sanding; remove only the irregularities in the top coating and **do not abrade through the top coating.** Remove sanding dust and immediately apply the chosen anti-fouling paint or primer. Follow the paint manufacturer's instruction for the paint and primer being used.

7.4 Recommendations for Blister Prevention

Considerable time, effort and money have been invested to thoroughly dry and, if necessary, repair the hull before applying the epoxy barrier coat and the anti-fouling paint. To help protect your investment and further reduce the possibility of blistering, we strongly recommend you follow the two additional proposals discussed below.

7.4.1 Keep the Interior Dry

a) Ensure the bilge is as dry as possible. Moisture can enter the laminate from the inside as easily as it does from the outside.

b) Check for leaks in water, waste and fuel tanks. Empty water and waste tanks during the off season to prevent condensation on tank surfaces.

c) Keep the engine sump free of oil that may seal moisture in the laminate. Soak up large amounts of oil and clean with a degreasing agent or detergent cleaner.

d) Ensure adequate ventilation throughout the hull. Provide air movement through lockers, engine compartments and behind liners, cabin soles, tanks, etc. In areas of wide temperature and humidity variation, condensation will occur, especially on the cool hull surface below the water line. Use passive or electric ventilators, with a flexible vent hose if necessary, to draw moisture from dead air spaces and/or install louvres/vents in panels that trap air and moisture against the hull.

7.4.2 Maintaining the Barrier Coat

a) Haul the boat from the water and inspect the bottom annually. Check for scrapes or damage to the epoxy barrier coat. Repair and re-coat as necessary to maintain a continuous minimum 600 micron coat

b) If possible, store the boat out of the water during the off season.

c) Avoid an excessive build-up of anti-fouling paint and remove old anti-fouling before applying new paint.

d) When sanding or high-pressure cleaning the anti-fouling paint, take care not to remove the epoxy barrier coat.

e) After several years of use – normally four or five – apply one or two fresh coats of epoxy as necessary to maintain the recommended thickness of barrier coat. Thoroughly sand the bottom, completely removing the anti-fouling paint and apply additional coats of epoxy/barrier coat additive as described earlier in this section. Do not use chemical strippers to remove the anti-fouling as these contain aggressive solvents, which may soften the epoxy barrier coat.

Estimates are based on a moderate displacement sailboat. For full keel boats or power boats, add approximately 10% to the product quantity estimates. Quantities assume a 6-coat epoxy build-up. It will be found to be more economical to purchase supplies in larger quantities. The actual usage may vary. Use either 407 Low Density or 410 Microlight Filler for filling and fairing.

Product		Length of Boat				
		6,0 m	7,5 m	9,0 m	10,5 m	13,75 m
		10 m^2	20 m^2	30 m^2	40 m^2	50 m^2
Epoxy (weight of resin + hardener)		10+2	15+3	25+5	30+6	35+7
301 Mini Pump Set		1	1	1	1	1
407 Low Density Filler	1	150g	150g	300g	300g	300g
407 Low Density Filler	2	450g	1,0 kg	2,1kg	2,4 kg	3,7 kg
407 Low Density Filler	3	1,0 kg	2,1kg	3,7kg	5,0kg	7,5kg
410 Microlight	1	50g	100g	150g	200g	250g
410 Microlight	2	200g	400g	800g	1,0kg	1,5kg
410 Microlight	3	400g	800g	1,5kg	2,0kg	3,0kg
422 Barrier Coat Additive		1,5kg	3,0kg	4,0kg	6,0kg	6,0kg
800B Roller Covers		12	18	24	36	42
801BRoller Frames		2	4	6	6	8
802 Roller Pans		2	4	6	6	6
804 Mixing Sticks		box	box	box	box	box
805 Mixing Pots		4	6	8	10	12
808-2 Squeegees	1	0	0	0	0	0
808-2 Squeegees	2	2	2	2	4	4
808-2 Squeegees	3	4	4	4	4	4
820 Resin Removing Cream		250ml	250ml	500ml	500ml	500ml
832 Gloves		12 pr	12 pr	18 pr	18 pr	24 pr

A

Bottom Condition

1. No blistering; minor filling required,
2. Moderate blisting; minor filling required,
3. Severe blistering; extensive fairing required.

Publications

002-950 WEST SYSTEM® Technical Manual
The primary guide to safety, handling and the basic techniques of epoxy use. Includes a complete description of WEST SYSTEM epoxy resin, hardeners, fillers, additives, reinforcing materials, tools, supplies and publications.

002 The Gougeon Brothers on Boat Construction
This book is a must for anyone building a boat or working with wood and WEST SYSTEM epoxy. Includes extensive chapters on composite construction techniques, materials, lofting, safety and tools, with many illustrations, diagrams and photographs.

002-970 Wooden Boat Restoration & Repair
An illustrated guide to restore the structure, improve the appearance, reduce the maintenance and prolong the life of wooden boats with WEST SYSTEM epoxy. Includes information on dry rot repair, structural framework repair, hull and deck planking repair, hardware installation with epoxy and protective coating.

002-550 Fibreglass Boat Repair & Maintenance
A complete guide to repair fibreglass boats with WEST SYSTEM Epoxy. Includes illustrated procedures for structural reinforcement, deck and hull repair, hardware installation, keel repair and teak deck installation..

002-150 Vacuum Bagging Techniques
A step-by-step guide to vacuum bag laminating, a technique for clamping wood, core materials and synthetic composites bonded with WEST SYSTEM Epoxy. Discusses theory, moulds, equipment and techniques used to build composite structures.

002-740 Final Fairing & Finishing
Techniques for fairing wood, fibreglass and metal surfaces. Includes fairing tools, materials and a general guide to finish coatings.

Videos

002-894 Fibreglass Repair with WEST SYSTEM Brand Epoxy
A guide to structural repair on fibreglass boats. Covers repairs to cored and non-cored panels and how to apply gelcoat over epoxy repairs. VHS–20 min.

002-896 Gelcoat Blister Repair with WEST SYSTEM Brand Epoxy
A guide for repairing and preventing gelcoat blisters on fibreglass boats. Includes an analysis of the factors contributing to blister formation and steps for preparation, drying, repairing and coating for moisture protection. VHS–16 min.

002-550 Gelcoat Blister: A Guide To Osmosis Repair

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