1998 - #3 (FALL)

DIY boat owner

the MARINE MAINTENANCE MAGAZINE

Features

Columns

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CURRENTS

Emergency Repairs Defined

I just received back issue 1997-#1. The "Quick Fix" chart on page 38 shows various products for emergency repairs above and below the waterline. The Marine-Tex product is incorrectly shown as not being recommended for below waterline repairs. This product is, in fact, an excellent choice for below waterline repairs. Unfortunately, the error now makes me suspect of the rest of the data contained in the chart.
Peter Dyer, *Pocket Rocket*, Mystic, Conn.

The criterion for below waterline emergency applications in this article was for products that have the ability to be applied while the boat is in the water. It's not an emergency repair if you need to first haul the boat. There's an asterisk beside the heading "Below WL" and a footnote marked with an asterisk on the left side at the bottom of the page that states: "Can be applied with boat in the water." We do try to be 100% technically accurate and in this instance, we are correct.

SPARE PARTS

Yeoman Exchange Program

Until December '98, Yeoman is offering owners of its original ChartKit the chance to trade in units and receive a US$100 discount off the price of a new Yeoman Sport (US$699) laptop model, or Navigator Pro (US$779). Upgraded versions of both units are also available with radar plotting and/or an internal full-functioning 12 channel GPS. Contact Yeoman at (410) 263-7335, fax to (410) 263-8318 or send an email to yeomangrp@aol.com.

Tartan Replacements

DIY reader Joe Palmer wrote us about his company that may be a good resource for owners of classic Tartan sailboats. Any Tartan produced before 1989 and now out of production is considered (at least for Palmer's purposes) a "classic." Formerly manager of Tartan's Customer Service Department, when the sailboat manufacturer ceased production in 1990 he founded with Tartan's cooperation the Customer Service Company to provide original replacement parts from the original Tartan Marine tooling. To obtain a copy of his 90-page parts catalog contact him at 203 River St., Grand River, OH 44045; Tel: (800) 486-7245 in the U.S. only, or email to jopalmer@classicsailboat.com.

Engineered Findings

Small Parts Inc. stocks a collection of specialty, hard-to-find materials and tools. Some of the less common items you'll find in the company's 448-page catalog include an adhesive measuring tape, nylon machine screws, pocket screw checker, cloth self-sticking wire markers, luminous paint, portable saw horse, black phenolic (resin) instrument boxes, tool magnetizer, step drills and stainless one-ear clamps. Materials inventory includes aluminum brass, bronze and stainless steel bar, rod and sheet stock, fasteners including stainless steel Torx, O-rings in every available size and more! The 34-year-old company is located at 13980 N.W. 58th Court, P.O. Box 4650, Miami Lakes, FL 33014-0650; Tel: (800) 220-4242 or (305) 558-1038, Fax: (800) 423-9009, Email: smlparts@ small-parts.com or visit its website at www.smallparts.com.

TALKBACK Q&A

Stalling on Shifting

Q: I have a '88 Doral Cavalier with 4.3L V-6 205 hp MerCruiser with an Alpha 1 outdrive. When I put the engine in reverse and give it gas it stalls, then when I shift from reverse to forward, it doesn't always engage. Is this adjustable or is major transmission work needed?
Colin Johnson, Kitchener, Ont.

A: What you most likely have is a failed shift-shaft seal. The shift cable is seizing up because the seal is gone, allowing water into that cavity causing galvanic corrosion and the symptoms you are experiencing. This isn't a very expensive job, seals and cable cost about $65, but it's a time-consuming one. You'll need to purchase a replacement bell housing shift-shaft seal and replacement assembly — it's a more robust updated version than the original. You'll also need a new thru-transom or intermediate shift cable. This repair should be addressed immediately. If it goes unchecked, you'll have major sterndrive damage.
— *Steve Auger, Mercury Marine*

Faulty Fuel Gauge

Q: I have a '89 Sea Ray 280 Sundancer with twin 260-hp MerCruisers and a single 454L (120gal) fuel tank. When I fill the tank, the gauge pegs way past full and stays there until I tap the gauge or 1/4 to 1/2 of the fuel is used. Any suggestions on what is wrong and how to fix it?
Chuck Schumacher, Fish-N-Fun, *Chicago, Ill.*

A: If you need to tap the gauge it probably has suffered stray current corrosion damage. Replacement of the gauge is recommended which is normally replaced with the corresponding sender. However, you can install a gauge only, then have your sender recalibrated so it's compatible. Exposed fuel vapors can be fatal, so we suggest having your dealer handle this job.
— *Steve Auger, Mercury Marine*

Prep and Paint for Keels

Q: We recently hauled our 6.9m (23') Hunter sailboat for the summer and it's sitting on the hard in Palmetto, Fla. After four years in saltwater, rust is bleeding through the bottom paint that remains on the fixed wing keel. We've scraped and power washed the barnacles and growth off the bottom. Other than sanding and wire brushing, is there another method to remove the rust and scale from the keel? Should a primer coat of Rustolium or red lead be applied to the keel prior to painting with bottom paint? Also, the previous owner painted the vinyl boot top with bottom paint. Is there a product that would remove the paint from the boot top without damaging it?
W. G. Trent, Barrie, Ont.

A: According to Kevin Milne of Marskeel Technology, the keel must be brought to a bright, clean, abraded surface before painting. To do this, have the keel blasted with baking soda or sand, or grind the keel using a 17.7cm (7") angle grinder with a 36-grit resin fiber disc. Shroud the hull with plastic to minimize dust and wear a respirator and protective clothing when grinding. Immediately after grinding, wipe the keel to remove residue with a solvent wash, such as Interlux 202. Apply one coat of Interprotect 2000E, 3M Marine Water Barrier Coating or other epoxy or vinylester underwater barrier coating to the bare metal within one hour of surface preparation and allow at least a four-hour drying time under normal conditions. Apply an underwater fairing compound, if required, then finish with three to four coats of your chosen barrier coating. When repainting the bottom, the paint should ideally extend 7.6cm (3") above the waterline. We're not aware of any product that will remove paint from vinyl striping; your only solution is to restripe. We'd like to hear from readers or manufacturers who have a solution.
— *Jan Mundy*

Troubleshooting Bennett Tabs

Q: I need a primer on Bennett trim tabs. The port tab no longer operates and when I removed the line from the power unit, no fluid comes out of the outlet. Any assistance as to this specific problem would be greatly appreciated.
David Mazurik, Jo-Lo, Marblehead, Ohio

A: Tom McGow of Bennett Marine suggests that you first isolate the cause of the fault then conduct a series of tests. Is the unit receiving a solid 12 volts? Low voltage will sometimes cause the solenoids to not open, preventing the tabs from moving even though the pump motor is running. Remove the wires

from the helm control and touch together as follows: orange (positive), blue, red — port trim tab down; orange, blue, green — starboard trim tab down; orange, blue, red, green — both trim tabs down; orange, yellow, red — port trim tab up; orange, yellow, green — starboard trim tab up; orange, yellow, red, green — both trim tabs up. If the trim tabs function correctly for each wire grouping then the switch is at fault. Also note that any loose or missing screws on the back of the switch (whether a wire is connected there or not) can cause the pump to malfunction. This test may also be done right at the pump by substituting a "hot" lead for orange. There is usually a connector to the wire harness within a foot or so of the pump. You want to check this connection for corrosion. You may wish to cut the connector off on the pump side and try the test on bare wires. If you suspect corrosion on the wire connector near the pump, cut it out, test as above and reconnect using butt splices. Check to see if there is an inline relay on the wiring harness near the hydraulic power unit. If there is, it's an Interrupter Relay (IR1000). It prevents the system fuse from blowing if you try to actuate one trim tab up and the other down at the same time. After you test as outlined above, try removing the relay from the wiring harness and retest the unit. If it works the IR1000 will need to be replaced. If you conclude the problem is in the pump, contact McGow at 954/427-1400. Bennett Trim Tab Systems carry a five-year warranty and offers a trade in program for units out of warranty.

Raising a Drowned Outboard

Q: My runabout with two outboards, a 9hp and 60 hp, sank in clean fresh water and was recovered in a couple of days. Are there some guidelines to dry out, clean up and restart an outboard following such an event?
John Honekamp, Sea Gypsy, *Richland, Iowa*

A: According to Steve Auger of Mercury Marine, if your engine has been out of water for any longer than three days, it's probably scrap. When resurfacing a submerged outboard, you must be prepared to service the engine as soon as it hits the air. You'll need to get the water out of the fuel system and cylinders, and dry out the starter motor. Use a fresh fuel supply, install new spark plugs, start the engine, bring it up to operating temperature and run for 1/2 hour to evaporate any trapped moisture. Use a double-oil mixture to protect the engine (i.e. 24:1 instead of normal 50:1) then get it to an authorized dealer. Ideally, service must be done within 90 minutes of resurfacing the engine or you may have cylinder wall damage that is non-repairable. Most of the damage and corrosion that takes place is caused by oxygen. Best to leave it on the bottom of the lake until you're ready to service the engine.

INFORMATION HOTLINE

Need help with a problem? Unable to find information on products or do-it-yourself projects?

DIY TALKBACK is a special reader service that makes available to you the resources of marine industry experts on topics such as boat repair, engines, trailers, electricity, plumbing, electronics, sails, maintenance and more.
Send your questions via mail or E-mail. Include your name, boat name and home port in all correspondence.

MAIL:
TalkBack — DIY Boat Owner,
.P.O. Box 22473
Alexandria, VA 22304

E-MAIL: info@diy-boat.com

TECH TIPS

TAMPER-PROOF FASTENERS: Replace Phillips and slot-head fasteners with Torx which requires special star-headed screwdrivers, or Robertson heads (square), a Canadian invention and a rarity in the U.S.

A SCREW LOOSE: To prevent fasteners from becoming loose from vibration, place a drop of Loctite on screws or bolt threads. For a more permanent fix, coat fasteners with epoxy glue before installing them.

RAGS FOR REPAIRS: When painting, gluing or preparing surfaces for repair, don't use rags cleaned with fabric softeners since they may contain silicones that can corrupt your work.

BREATHING SPACE: When covering a boat with a tarp, first toss the fenders overboard, then tie the cover or tarp over them. This will hold the tarp slightly away from the hull and ensure the necessary ventilation to retard mildew without leaving the cover dangerously loose. Use cloth fender covers to prevent paint ruboff on painted hulls.
Bill Lindsey, Hollywood, Fla.

OVERCOATING ANTENNAS: To protect hands and gear from fiberglass radio antennas that have cracked and splintered with age, cover the antennas with PVC sailboat rigging cable, available in many diameters.

SEACOCK INS AND OUTS: It's a good idea to frequently open and close all seacocks to ensure valves are working freely. So you don't miss any and you know their location in an emergency, add the placement of all seacocks to your boat plan...you know, the sketch you keep in your log book that shows routing of wiring, plumbing, etc.

FUEL SPILL CLEAN-UP: Use a solution of white vinegar, water and dishwashing detergent to clean diesel fuel or kerosene spills from bilges and floorboards. Dab fabrics with a sponge dipped in straight vinegar.

WATER ABSORBER: Adding a stabilizer to fuel doesn't remove water caused by condensation or bad fuel. It's good preventative medicine to add a bottle of gas-line antifreeze to the fuel tank at the beginning and end of every season and more often if the fuel source is suspect.

OILING BRONZE: Clean bronze that has turned green with a clear teak oil. It will not only remove the tarnish easily, but tends to retard further tarnishing for months afterwards.
Bill Lindsay, Hollywood, Fla.

LINE ORGANIZER: Keep mooring lines tidy with a heavy-duty, self-tying plastic tie available at garden supply centers.

ANNE-MARIE HENDRY

Disclaimer: DIY boat owner takes no responsibility for any comments appearing in this section.

***Tech Tips welcomes contributions from readers. If you have a boat-tested tip you'd like to share, send complete information along with your name, boat name and home port to:* Tech Tips DIY Boat Owner, P.O. Box 22473, Alexandria, VA 22304. You can also email it to info@diy-boat.com.**

DIY PROJECTS

THE BUDGET BIMINI

This lightweight, easy-to-build cover support protects your boat in the off-season and is easily adapted to fit most cockpit configurations.

By Ryc Rienks

Materials and Tools

12mm (1/2") PVC pipe in lengths to 1.8m (6')
PVC elbows, tee-fittings and angles.
Pipe cement
Machine screws or cotter pins
Tarp
Hacksaw
File
Drill and bits
Fast-curing filler

As the days shorten and the weather turns, the sights and sounds at the marina go through a subtle change. The music of stereos is replaced by the chiming of halyards against masts, boats now wrapped in blue plastic tarps and only occasionally do you find owners on the docks, stopping by to check on their boats.

For several seasons I went through the standard routine: go to the marina, dump the pockets of water from the tarp, retie as necessary, go below and clean up the little puddles of water the tarp was supposed to keep out and then leave, secure in the knowledge that all the proper rituals had been observed for another week.

The real shocker to me came when I lifted the tarp and found that the progress of time and the motion of the boom had allowed the tarp to chafe through my sail cover. Granted, it was an old sail cover and had been patched numerous times, but a sail cover is not cheap. Worse yet, what if the mainsail had been damaged? I knew I had to find a way to improve the tarping process, so pencil in hand I went to work. What I came up with follows.

To create a fairly rigid self-supporting structure that would drain well, I borrowed a page from history and used the "Conestoga" configuration, an arched framework supporting a tarp. To keep the framework light and rustproof, I used 12mm (1/2") PVC pipe and tee-fittings. The plastic pipe flexes, is easy to cut and supported by a variety of fittings that serve as connectors. Starting with five pieces of pipe, 1.5m (60") long and two tee-fittings, I created a large H-shaped assembly.

Using a hacksaw, I cut a slot in the four remaining tee-fittings (**Figure 1**), enlarging the cut with a file so the slot snapped onto the lifelines. When the slot faces outward the support arm tension holds everything in place **(Figure 2**). Since this was in a development stage, the legs of the H assembly were forced into the tee-fittings, not glued.

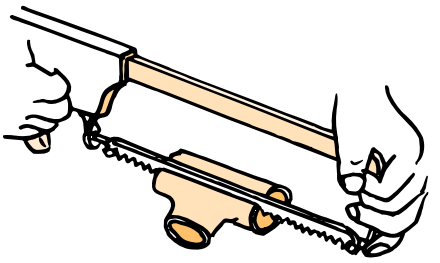
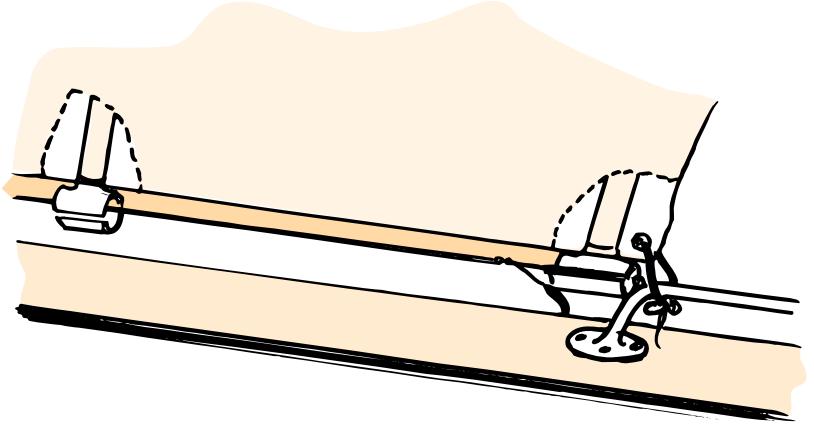


Figure 1

The first attempt was the Over-The-Boom setup (**Figure 3**). I found that by supporting the framework ends on the lifelines I would have the needed clearance over the boom while providing standing headroom under the tarp. Most importantly, it provided shoulder room as well. The initial assembly was floppy but adequate once the tarp was in place and cinched down. This is a good place for a taut-line hitch or other adjustable hitch as it will allow for adjustment of tension and the centering of the tarp.



ANNE-MARIE HENDRY

Figure 2

If you are setting this up on a powerboat with tubular railings around the afterdeck, you might need to cut larger slots in the tee-fittings, removing say 1/3 to 1/2 of the base piece to allow lashing each end to the railing.

This is a system that responds well to experimentation. Initially, I was uncertain how to orient the tarp, where to run the ties, which frame configuration would provide the best coverage while standing up to winter winds and whether I could rig the cover and operate the boat from under it during the rainy months. In actual fact, I was so involved in experimentation that I never got around to gluing it together. This made it possible to use the same pieces in several configurations including the next, the Under-The Boom setup.

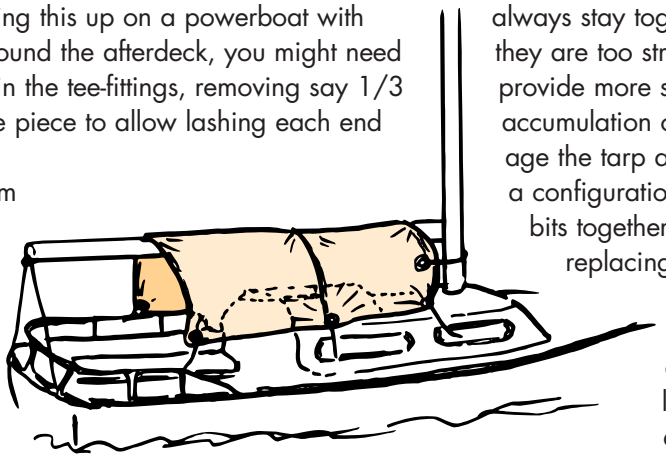
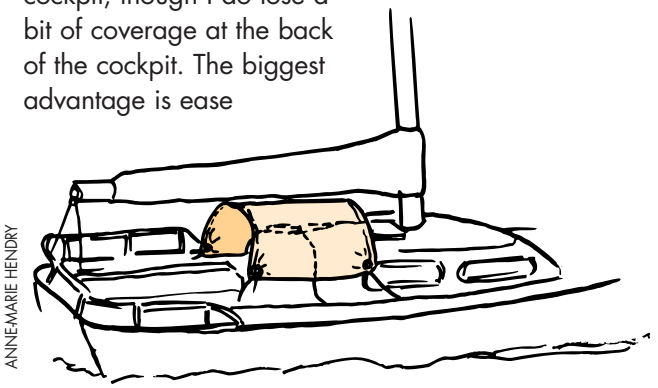


Figure 3

The Under-The-Boom variation (**Figure 4**) allows easier access through the lifeline gate and into the cockpit, though I do lose a bit of coverage at the back of the cockpit. The biggest advantage is ease of setup and the ability to leave it up while underway. The companionway is well protected from the rain and with my long tiller I have a sort of pilothouse/dodger arrangement that has done well on long voyages in the rain as well as in hot, sunny weather.



ANNE-MARIE HENDRY

Figure 4

To use the framework under the boom I removed the back two end clips and stuck the aft end of the support hoop tube into the top of my genoa winches where the handle goes. The forward support hoop clips are snapped onto the inside edge of the genoa track and can be slid into position. Once there is tension on the assembly they stay in place just fine.

In summary I have to admit that the frame did not always stay together, and the tee-fittings do break if they are too stressed. On the other hand, the supports provide more space under the tarp and prevent the accumulation of large pools of water that can damage the tarp and flood the boat. Once you achieve a configuration you like, you can always glue all the bits together. Should a fitting break and need replacing, they cost little. If they are glued on, all you need to do is cut off the stub. You'd only be shortening that leg by about one inch. Another method of locking the pieces together would be to drill a small hole and machine screw together or use cotter keys as assembly pins. The ability to disassemble the structure, reducing it to a small bundle of tubing and a folded tarp, means a lot on a smaller vessel where space is always at a premium.

Choose a style and assembly method that satisfies you. But if you wish to protect your boat and yourself inexpensively, you will find this approach paying for itself in comfort and utility.

A former musician, custom knife-maker, teacher and writer, Ryc Rienks lives with his wife aboard a Cascade 36, currently berthed in San Francisco.

ShopTalk

BRIGHTWORK BLUES

Patience, preparation, technique and frequent touch-ups are the key factors to a professional-looking varnish job.

By Wayne Redditt

There is nothing quite as satisfying as a professional varnish job and success is easily within reach of the dedicated do-it-yourselfer if you remember a couple of simple rules. Namely, that patience is everything and preparation is the most important part of everything else.

Varnish is an ongoing commitment and the job will never be completed. Renewal is constant, which may make you decide to paint your brightwork instead of varnishing.

If you decide to stick with the varnish, there are three steps to be undertaken. The first two fall into the prep category and the third is actual finishing. Prior to these steps make sure you do the normal pre-prep things, such as removing and labeling hardware.

Removal of the Old Finish

Removing the old finish is done by one of three ways: a heat gun, chemical strippers or abrasives. The heat gun works very nicely once you've mastered the art. Practice on something expendable before you work on your brightwork. It should require only a matter of seconds before the old varnish is soft enough to be scraped. Use a paint or cabinet scraper, not a putty knife. Pull the scraper towards you, along the direction of the grain. Paint scrapers require constant sharpening in order to work effectively. Use a file to renew the edge, matching the original bevel angle. Don't do this job on the boat or you'll embed iron particles in the deck, which subsequently rust.

Chemical strippers are usually nasty chemicals. Some newer strippers on the market use citrus oils as the active ingredient but I have found these to work more slowly. [A test of Safest Stripper by 3M Marine appears in an upcoming issue — Ed.] Whatever brand you choose, protect the boat by masking areas

not to be stripped and wear gloves, protective clothing and an appropriate respirator. Read the directions carefully. Strippers work best when they are applied as a thick gooey layer that isn't allowed to dry out. Remove the stripped finish with a nylon bristle brush or bronze wool. Capturing the residue is an important aspect of using a chemical stripper and requires some forethought. Small parts should be done in a part's washer if possible. Larger permanent structures will require a different tactic. Please don't wash the stuff into the lake.

Scraping with the heat gun is my favored method, scraping without the heat gun preferable to sanding, and abrasives my last choice for finish removal but sometimes there is no other way. Avoid belt sanders and angle grinders as they always create more work than they save. The greatest addition to your sanding arsenal is an electric random orbital sander. It removes material in a hurry and doesn't leave heel marks or gouges. Sandpaper changes are fast when coupled with 3M's Hookit sanding disks and most can be purchased with dust collectors as an integral part of the sander.

Prep Sanding

Once the wood is stripped of the old finish it must be prepped for finishing. Mask off areas that are not to be sanded and repair any splits or gouges in the woodwork before proceeding. Varnish will not fill in cracks. Use epoxy mixed with sawdust (or sanding dust) of the same species of wood to fill in cracks and splits.

Most boat woods do not need sanding to a fine grit before varnishing. Cabinet woods like maple may need prepping with 32-grit sandpaper before coating, but teak and mahogany rarely need sanding beyond 120 to 150 grit. Use aluminum oxide or white silicon carbide sandpaper, not garnet. If fairing is required, cross-sand first with 60 grit, remove the scratches with 80 grit sanding along the grain, then finish with 120 grit with the grain. Make sure there are no cross-scratches left anywhere or these will be clearly visible once varnished. Use a troublelight held at an angle to the surface to check for any cross-scratches.

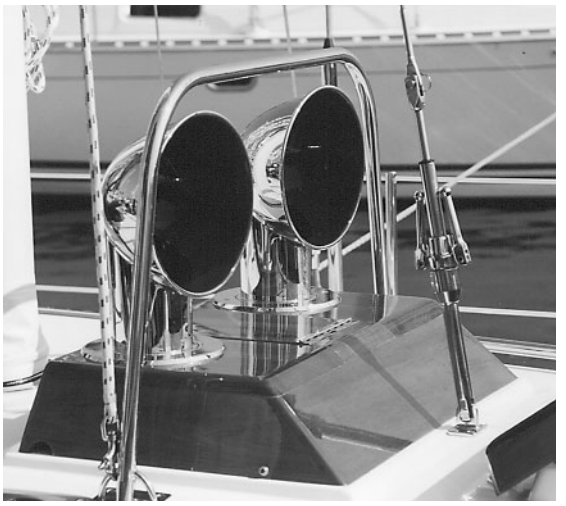
It's possible to use the random orbital sander for the initial prep

sanding, but always finish by hand sanding. Use blocks to back up your abrasive. Rubber 1/4- and 1/2-sheet blocks are available at most hardware or automotive stores. You can make your own blocks from a piece of softwood if needed. Never, sand without a block.

Varnishing

Prior to applying any finish, vacuum the surface and use a good quality tack rag to remove all traces of dust. When vacuuming, use the brush attachment to avoid scratching the surface.

The initial coat should be thinned. Most manufacturers indicate on the container's label the maximum that the varnish should be thinned, although you can usually get away with thinning it even more for the first coat. I usually start with varnish thinned 50:50 for the first coat on bare wood. Within an hour, recoat with a 75:25 mixture to achieve the "sealing" that pros often refer to. The next day, use a cabinet scraper or 120-grit paper to knock down the nibs. Apply the next coat of varnish thinned 10%. Wait a day, then sand with 240-grit dry paper. Use a tack rag to remove dust before each coat. This is the time to fill all deep gouges with color-matched wood filler. When cured, sand the filler level. All coatings will now be at full strength. Repeat the sand-tack-varnish ritual for six coats, waiting a day between applying and sanding. Make sure you use a sanding block to back up your paper. Apply the next two coats, switching to wet sanding between coats with 400-grit paper. If all goes well, you will have a perfect finish after eight coats.



Brushing technique is important for a successful job. The two critical steps are coverage without sagging and speedy work to prevent dry edges. The former requires that you apply enough varnish to produce good thick consistent coverage without runs or sags.

To achieve coverage, quickly spread a brush full of varnish using random strokes on the area you are working. Once the brush starts to run dry, go back over the area you have just done with a "tipping" motion — use light pressure to level the varnish and remove brush strokes, usually in the direction of the wood grain. Reload your brush and starting in an area that is unvarnished, brush on the varnish, slightly extending into the previously varnished area slightly. Work quickly so the overlapped area maintains a wet edge. Keeping this edge wet is one of the more important varnishing techniques that come with experience. If you are working in direct sunlight or on a really hot day, the varnish will begin to dry more quickly and the wet edge will be difficult to keep. It may be necessary to employ an assistant. One person puts the varnish on, while the other "tips" the varnish. A combination of foam rollers and brushes works particularly well for tandem varnishing of large surfaces.

Dust-free varnish surfaces are nearly impossible to achieve, due to the long drying time of the product. So do your best, enjoy your varnish work, and don't fret about the odd dust speck.

Wayne Redditt teaches boatbuilding, repair and restoration at Georgian College's Marine Technology-Recreation course in Orillia, Ont. Inquiries directed towards this column are welcome. Send your comments or questions via mail, fax or e-mail, attention ShopTalk.

LAY-UP AFLOAT

Most powerboats and sailboats made of fiberglass, ferro-cement, steel or wood can handle a cold winter in the water provided the boat is properly prepared and protected from ice buildup. Follow these guidelines to winter your boat afloat.

By Paul and Sheryl Shard

After cruising year round in the sunny south it was hard for us to imagine sailing again in northern latitudes where the prime boating season is three summer months at best. But on a recent visit home to Toronto, Ont., we talked to a group of hardy (some say crazy) boaters that actually winter afloat in the ice and snow and enjoy the benefits of boating all year too. We learned there are definite advantages to leaving your boat in the water for a northern winter if you find the right harbor and set your boat up properly for the weather.

JAN MUNDY

"I would go to the marina on weekends to enjoy the solace of being aboard in winter and do the little tasks that you never get around to when you're sailing." Richard Asztalos, St. Clair Shores, Mich.

Why Lay-up Afloat?

A major appeal of wintering afloat is eliminating the annual ritual and cost of hauling out, storing the boat for the season, then launching. Haulout and launch can be nerve-wracking events considering the risk to your vessel. Depending on the water your boat is floating in, you may be able to extend your time between bottom paintings, saving money and being kinder to the environment. When the time to re-do the bottom comes, you can have your boat hauled out for only a few days and then be back in the water again. [To organize your haulout refer to DIY 1996-#4 Winter issue, page 9 — Ed.]

In most regions, there is no substantial savings advantage in boatyard fees. Winter rates for outdoor storage include haulout, wash and launch, and range from US$17 to US$32 per linear foot. Fees for storage in-water vary widely, from US$42 per linear foot in Michigan up to CD$63 in Ontario.

If you choose to be a full-time liveaboard, living expenses are much less than maintaining a home ashore. In many areas, there are liveaboard communities in prime downtown waterfront locations whose living costs are significantly less than those of their neighbors ashore.

In you winter afloat, you'll need to notify your insurance company. Check your policy for "Exclusions" that concern ice and snow. Snow load can be an exclusion if you don't take adequate precautions.

Not Just Any Port

Finding a safe harbor that offers the necessary utilities and facilities needed is the first step towards successfully wintering afloat. Protection from surge and swell is particularly important when you are dealing with ice in the water.

Not all marinas or yacht clubs offer year-round services to boaters but those that do should provide reliable power for winter demands especially the constant running of electric heaters and deicers. Other requirements include snow removal services, a necessity on the docks, clean showers, washrooms and

laundry facilities, and portable pump-out services. (Midnight runs to the marina washrooms can be depressing, not to mention dangerous, when the docks are icy.) Dockside telephone and cable TV services are also nice if you choose to liveaboard full-time. Getting recommendations from current winter boaters is the best way to find a good facility.

Winter-Proofing

Once you have found secure dockage for wintering your boat afloat there are a few considerations when setting up the boat in its slip.

Strong nylon docklines and spring lines are needed to handle the fury of winter storms and doubling the lines is recommended. It's also important that lines don't hang down into the water. When the water freezes, the boat will be held rigid and lines could snap in strong winds.

JAN MUNDY

Log booms keep large chunks of ice away from the hull and contain bubbled water.

Power cords should have enough slack to handle strong motion without being pulled out of the receptacles but should not touch the water to avoid being frozen in.

When the boat is comfortably secured in the slip, some winter boaters choose to position a floating ice boom across the opening of the slip to prevent ice pans and flows from damaging the hull. Ice booms can be as simple as 2x4s secured across the slip opening or a chain of old tires strung together. The tires tend to dampen any swell as well. A deicer, which uses either a propeller (most common) or air to agitate the water and prevent it from freezing, is also needed. A 1/2-hp prop-driven unit will keep a 15m (50') diameter area from freezing and is hung below the boat or attached to the side of the dock.

If you decide to lay-up your boat in the water and are not living onboard, winterize your engine since you are not heating the boat

ELIZABETH DURNO

Leave some slack in the power cords and lash with cable ties to lines to prevent dropping in the water.

on a constant basis. Since the boat is in the water, you can leave the automatic bilge pump turned on. The bilge water won't freeze as it would ashore. Condensation shouldn't be a problem because the water temperature will be warmer than the air in most cases. Close all seacocks and pour a small amount of non-toxic antifreeze (see "What You Should Know About Antifreeze" on page 18) in all thru-hull fittings. Be sure to periodically check your boat, more often when stormy, or have the marina check it and report to you.

For many years, Richard Asztalos wintered his 9m (30') sailboat at Jefferson Beach Marine in St. Clair Shores near Detroit, Mich. He used a small electric heater and hung a 100-watt light bulb in the engine compartment to keep cockpit drains and shaft packing glands from freezing.

"I would keep the heat on low to minimize the condensation, and turn it up when I arrived on weekends," explained Asztalos.

Those living aboard are generally running heaters which dry out the boat. Asztalos, who now lives aboard *Charisma*, an Endeavor 42, in the same marina, relies on three electric heaters, fans to circulate the air and two dehumidifiers placed below the cabin floor to reduce moisture. As a safety precaution, he closes all seacocks, except the sink drain and the shower pump.

Remember last year's mother-of-all ice storms? It knocked out power in parts of Eastern Canada and the U.S. for a week or more. Loosing your power source means no bubbler and no heat. A portable generator is a wise investment for boaters choosing to winter afloat.

A Proper Winter Cover

If you are living aboard or plan to be on the boat a lot, the next step in preparing for a comfortable winter afloat is to build a shelter over it. This gives you a snow-free space to set down supplies and remove wet coats and boots before going down into the clean, dry cabin. The shelter also creates an insulating air pocket above the cabin top which keeps in heat and reduces the heating bill. If the shelter is made of clear plastic it creates a greenhouse effect and is a warm place to

ELIZABETH DURNO

Mini shelter over companionway made of heavy-duty plastic secured with staples or drywall screws to a wooden frame.

LAY-UP AFLOAT

work on boat projects without messing up the cabin.

A word of warning if you are using a fuel heater such as diesel: make sure you run the chimney out through the shelter so you are not exhausting into the shelter. But since you are at a dock, most winter boaters prefer an electric heater. [A review of cabin heaters and step-by-step installation guidelines appears in DIY 1997-#3 issue, page 18 — Ed.]

Not everyone chooses to build a shelter. Some boats have a pilothouse that serves the same purpose. Owners of cabin cruisers may choose not to increase the

continued on page 17

ELIZABETH DURNO

A deicer prevents surrounding water from freezing and damaging the boat.

TO EMPTY OR NOT?

Every fall you fill the fuel tanks before mothballing your boat for the winter. Then one year you can't be bothered and the boat sits for four months with half-full or less fuel tanks. Now what happens come spring?

According to some articles, nothing, all is well. But when you consider the chemical composition of gasoline and diesel fuels, there's a toxic mixture brewing in less-than-full tanks waiting for the engines to start up again. For an explanation, we spoke with Jeff Tieger vice-president of Star brite, a Florida-based company that supplies myriad boat cleaners, chemicals and additives.

Gasoline and diesel are blends of hydrocarbons. These fuels are meant to be used within 30 days after purchasing. After that time, exposure to moisture and oxygen begin to degrade the fuel. Every fuel tank is vented to the atmosphere which provides a passageway for moisture and oxygen to enter the tank. This causes a chemical reaction in the fuel, forming resins, gums and acids, none of which is good for your engine. Gasoline darkens and develops a shellac-like smell. Diesel fuel contaminated with water can smell rancid, almost sulfur-like, or may even smell like mildew if algae has started to grow. All are good indicators of fuel degradation.

Condensation from the daily changes in air temperature condenses on the inside of the tank and moisture droplets start building a water layer in the bottom of the tank. Engines don't like water. Tieger suggested that in an empty 757L (200gal) tank, it's not atypical to end up with 7.5L to 22.7L (2 to 6gal) of water at the end of a storage season. Another problem is oxidation of metal tanks in areas not submerged in fuel. This causes particles to flake off and float in the fuel.

There's also the danger of an explosion from empty tanks. Fuel doesn't burn, only fumes do and when combined with oxygen, is highly explosive. Should a charge of static electricity from a plastic tarp or other source discharge into the fuel tank...boom!

A full fuel tank minimizes condensation, prevents oxidation of the tank and keeps tank seals immersed in fuel. This fall, top up your fuel tanks, leaving room for expansion. To prevent fuel from breaking down, add a fuel stabilizer and run the engine for five minutes to distribute the stabilizer.

— Jan Mundy

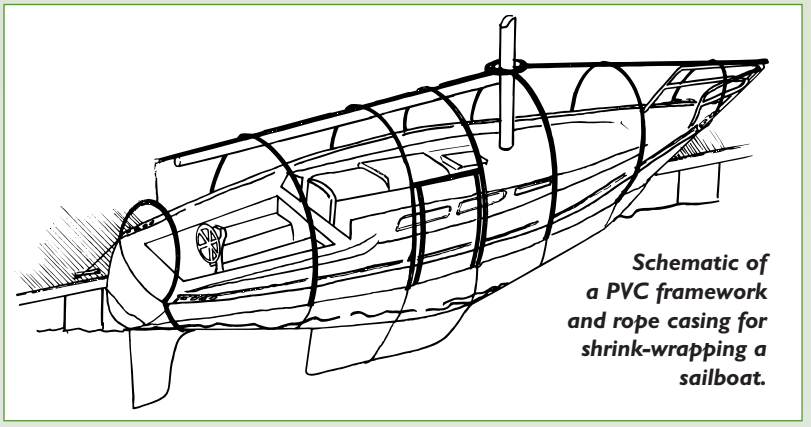
BUILDING A SHRINK-WRAP COVER

By Richard Asztalos

Every fall is a learning experience when shrink-wrapping my boat. On my previous boat, I built the frame of conduit pipe connected by clamps, some of which cost US$5 or more a piece, and rubber stoppers so the conduit wouldn't scratch the deck. The frame was assembled using a pipe bender and this giant Erector Set became the frame for the shrink-wrap. Total cost for the frame was US$200 plus US$100 for plastic shrink-wrap.

ELIZABETH DURNO

Do-it-yourself shrink-wrapping is an affordable alternative to plastic-wood "huts."



ANNE-MARIE HENDRY

Schematic of a PVC framework and rope casing for shrink-wrapping a sailboat.

For *Charisma*, I built the frame from about US$60 worth of 6.3cm (2-1/2") black PVC pipe (the type they use for underground sprinklers), duct tape (use 3M General Purpose Adhesive Cleaner to remove tape residue in the spring), two .9m (3') lengths of threaded rod, a few bolts, clothesline and about US$120 worth of shrink-wrap. Construction is fairly simple and easily adapted to fit most powerboats and sailboats.

I start by removing the lifelines, bend sections of PVC over the boom and duct tape to each stanchion. Use extra PVC to fashion a curved shape for the bow and stern pulpits. A ridgepole made of conduit pipe (US$2 for 3m/10' length) extends from bow to stern above the PVC and the boom, and secured with duct tape. Wrap a piece of PVC around the mast, above the conduit. This is the highest point of the frame where you need to secure the shrink-wrap well. For the door opening, I like to double up with extra PVC. Drill holes through the PVC and fasten the two sections together with bolts, washers and nuts. This is where I also use the threaded rod to start the door opening, which keeps the shrink-wrap in place when you start to heat and stretch. You could also use 2x4s bolted to secure the PVC and provide something else to attach a door to.

To keep the shrink-wrap from blowing away, I use clothesline or shrink tape (US$20), anything that doesn't stretch. Run lines under the boat from stanchion to stanchion and then around the freeboard parallel to the waterline, tying to each of the vertical lines.

Now comes the shrink-wrapping. I start by laying out the material on the dock. On Charisma, the beam is 3.9m (13') and I allow extra to overlap the freeboard by a foot or more. I cut the shrink-wrap in three sections: the first rectangle is for the bow and the next two are joined by a seam that we secure at the dock with a hand-held propane torch. Wearing heat-tolerant gloves, the plastic is overlapped then heated and patted smooth with the glove.

Now lay the plastic over the frame at the bow and using a utility knife cut as needed to accommodate stays, then wrap under the clothesline along the freeboard. Remaining plastic sections are then placed over the frame and secured to the horizontal line. Patch the forward bow section to the stern section, then slit the opening for the door, leaving extra that's wrapped around the PVC door frames then heated with the torch.

When everything looks shipshape, I take a propane roofer's torch and start shrinking the plastic. Don't do this in the rain or you'll have holes. You can always touch up the shrink-wrap and you'll probably need to after the first big wind.

The most creative part is designing the door. The water level drops in the late fall and sometimes my boat sits on bottom, which makes the dock higher than the deck. So the type of door I need is one that opens up not out. This year, I'm constructing a clear plastic, bi-fold horizontal door.

I now have an aerodynamic, wind-resistant, snow-repelling winter greenhouse to enjoy for four months.

About the author: Richard Asztalos has for the past four years lived aboard Charisma, *an Endeavor 42, at Jefferson Beach Marine in St. Clair Shores near Detroit, Mich. An avid racer, he won first overall in the Cruising Class in the '98 Port Huron to Mackinaw Race.*

ELIZABETH DURNO

Doorways come in a variety of designs and all must be strong enough to hold snow when it accumulates.

upper windage by adding a shelter. Others don't want a shelter that, despite the cold, would prevent any opportunity to go boating when they get a rare winter weather window. Some choose to just build a shelter over the cockpit or companionway to prevent snow getting in down below.

A popular and affordable shelter construction is made of heavy-duty plastic sheeting stapled to a wooden frame made of 2x4s. The plastic is rolled several layers thick along the frame before stapling so the plastic doesn't tear out from the staples as easily in the wind. Some people stick heavy-duty duct tape along the plastic before stapling which serves the same purpose. For a boat up to 12m (40') long the cost to build is about US$150. The wood can be reused if you plan well, but you'll need to purchase new plastic every year.

"When building a shelter of this construction it's important to avoid large expanses of open plastic unsupported by the frame," says Michael Guy, who has

continued on page 19

WHAT YOU SHOULD KNOW ABOUT ANTIFREEZE

Engines and water systems in boats stored in climates where temperatures drop below freezing must be winterized with antifreeze. That's the easy part. What you may not know is that there are different types of antifreeze and these are rated according to degree of protection. For the facts, I contacted Jeff Tieger, vice-president of Star brite in Ft. Lauderdale, Fla.

The two kinds of antifreeze are ethylene glycol (EG), the traditional automotive antifreeze that goes in a car's rad; and propylene glycol (PG), a non-toxic plumbing antifreeze. Chemically they are both similar. EG, however, is highly toxic and has a sweet taste. In the course of winterizing the engine, you're sure to spill a few drops which can contaminate the water supply and if consumed by children or animals can be fatal. You can use either product to winterize an engine, although PG is the safer solution, but when winterizing your water system, you must use non-toxic (PG) antifreeze.

Winterizing involves removing as much water as possible out of the plumbing or engine cooling system, then adding an antifreeze rated for the typical temperatures the boat is stored in. The most common antifreeze has a temperature rating, in Fahrenheit, of -50. This doesn't necessarily provide protection down to -50F. According to Tieger, ratings tests were originally conducted using copper pipe in homes. Boats use PVC pipe that will freeze at -15F with an antifreeze rated for -50F. If you stow your boat in sub-zero conditions, you'll need to go to a higher rating of -100F that provides protection to -80F.

Antifreezes for engines are further divided into two classes: operating antifreeze and storage antifreeze. Operating antifreeze contains a blend of additives for rust protection and corrosion resistance. Tieger doesn't recommend storing your engine with operating antifreeze as these additives have a potential to clog water passages if the engine is not operated on a continual basis. Bottles labeled "Contains silicates" or "Low-silicate formula" are clues that the product is an operating antifreeze. When recommissioning your boat in the spring, flush out the storage antifreeze and add an operating antifreeze.

When shopping for antifreeze, look for one labeled "For storage only" or "Not for coolant use," with a -50F to -100F rating. As a safety precaution, and to help preserve the environment, don't use automotive antifreeze. You'll probably pay a premium for marine-grade PG antifreeze, at least until EG is banned and automotive suppliers are forced to switch, which may happen sooner than later. As with any additive, refer to your owner's manuals. For technical assistance call Star brite's technical helpline at 800/327-8583, 9am to 4pm EST.

— Jan Mundy

TIPS WINTER SURVIVAL TIPS

A collection of tips from seasoned cold-weather boaters.

■ **Dockguards** Make sure you have adequate fenders as winds blow stronger in the winter. Don't use cheap fenders which become brittle and split. When purchasing fenders, bigger is better! Use cloth covers if the boat is painted to prevent color transferring to fenders. On larger boats use bias-ply tires if permitted by the marina.

■ **Rigging** On sailboats, remove the boom to lessen windage and prevent extra wear on the gooseneck. To reduce chafe, remove blocks on mast and all halyards, but first run messenger lines.
— From Elizabeth Durno who winters aboard Soltice Moon, a 14.4m (48') ferro-cement sailboat, at Bluffer's Park Marina, Scarborough, Ont.

■ **Damp Off** Place Dry Bunk or other similar product under mattresses and staple some in hanging clothes lockers close to the hull to eliminate moisture.

■ **Safe Footing** Install lifelines along the dock and keep a supply of kitty litter onboard for when docks freeze over.

■ **Think You Can Swim?** Leave your dinghy in the water and toss a few lines with stop knots in the water just in case you fall in. We have lost three people in five years in our marina.
— From Richard Asztalos

■ **Power-Loss** Seacocks, plumbing systems and engines need no attention if the boat is heated. But if the heating source fails, then plumbing that is not close to the hull may freeze. As a safety precaution, winterize the engine and run antifreeze through all thru-hull fittings.
— From Michael Guy who leaves Blue Dragon, *a Colvin 34, in the water at Port Credit Marina, Mississauga, Ont.*

lived for many years with his partner Lise St. Germain aboard his steel-hulled schooner, Blue Dragon. "This creates a lot of irritating noise and vibration in the wind and doesn't support the snow load as well as small panels."

Some marinas or yacht clubs don't like this form of shelter due to the shanty town appearance they sometimes have. An alternative shelter, preferred by many boaters, is shrink-wrap (see "Building a Shrink-wrap Cover" on page 16). The cost is about double a plastic-wood cover but is clean, strong and private. A better, long-term cover is acrylic (Sunbrella) or canvas which lasts eight to 10 years but makes the boat very dark down below. When building any shelter be sure there are no hollow spots and allow clearance for stovepipes to eliminate a back draft. On sailboats, slope the cover away from the mast and securely tape it around the mast. To reduce the number of holes through the plastic cover for rigging, Asztalos recommends moving the lower shrouds to the uppers and securing them well with rigging tape.

About the authors: Paul and Sheryl Shard are the authors of Sail Away! A Guide to Outfitting and Provisioning for Cruising. *The new second edition is now in bookstores or can be ordered by calling toll-free at 888/319-2365.*

ELECTRONICS

INSTALLING LOGS AND DEPTH SOUNDERS

Follow these easy steps to worry-free installations.

Story and illustrations by Charles Moore

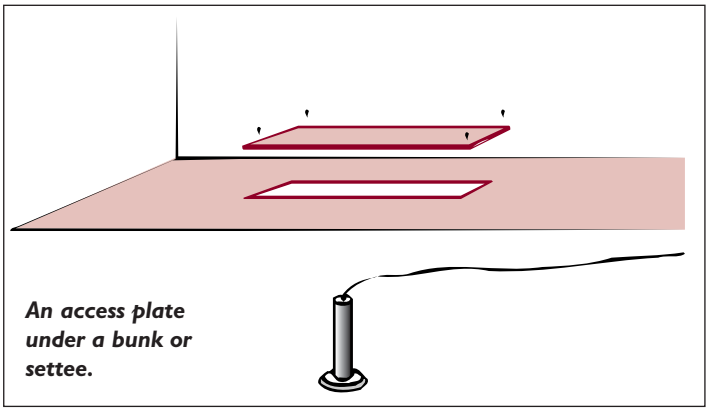
LESLEY G. CAMPBELL

Cutting a hole for a thru-hull can be an unnerving proposition.

Many boatowners get cold feet when it comes to electronic instrument installations that involve cutting holes in the bottom of their pride and joy. But not to worry. It's really not very difficult to achieve a professional caliber and leak-free installation.

The first task is to mount the hull unit, either a knotmeter impeller or sounder transducer. One aspect to consider when mounting the unit, is where crane or travelift slings will bear on the hull during haulouts. With some speed or logs, the impeller unit can be removed from inside the boat and replaced with a dummy plug to avoid haulout and launch damage or to clear fouling.

The simplest installation is on a runabout, where it mounts on the transom just below the waterline and at least 30cm (12") from the outdrive. In larger cruisers and sailboats, the hull unit is best positioned in an area of low turbulence well below the waterline, approximately amidships for cruisers and forward of the keel in sailboats. This will not always be possible however, and a good alternative spot, especially on relatively hard-bilged, flat-bottomed boats (power or sail), is about 2/3 aft and off the centerline.



An access plate under a bunk or settee.

Figure 1

Once the ideal spot is determined, it may still prove difficult to access, especially on boats with pan-type hull liners. Should you cut a hole in the liner or choose a less suitable but more accessible location? If you opt to cut, an access panel of wood or other material can be fabricated and screwed in place against a rubber gasket if watertight integrity is to be retained (**Figure 1**).

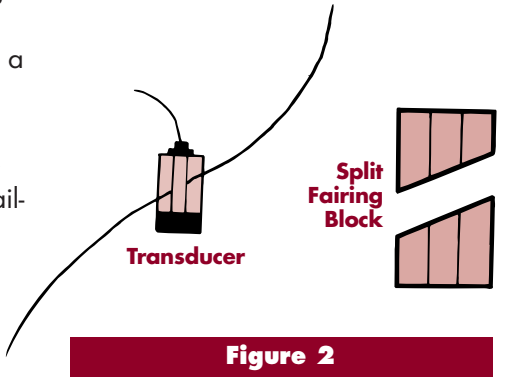


Figure 2

An angle block for mounting on an angled surface

Hole in One

Now you must cut the dreaded hole or perhaps not (see "Mounting Transducers Inside" on page 22). The usual method is to use a sharp, metal-cutting holesaw in an electric drill, but a technique described below in the section on cutting instrument head apertures may also be employed here. Be sure you are clear of bulkheads, tanks and other obstructions on the blind side. Measure twice and cut once. Drill a small pilot hole (easily repairable) to be sure, before committing yourself with the holesaw. Better yet, if the inside is accessible, drill from the inside out.

Log impellers don't mind if they're at an angle but sound transducers must be mounted on a perfectly flat part of the hull bottom or

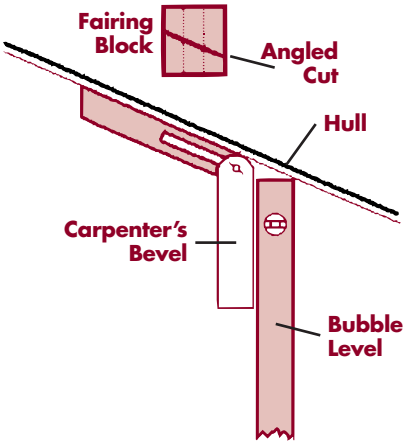


Figure 3

How to measure for the appropriate angle.

shimmed to a vertical, plumb attitude with angled fairing blocks inside and outside the hull (**Figure 2**). Use a carpenter's bevel and a bubble level (**Figure 3**) to transfer the hull angle to the block, then drill the transducer stem hole through the block (preferably with a drill press) before making the angled cut. With care you can cut the block with a handsaw, but it's much easier to do on the tilt table of a band saw. The outer block should be streamlined to match or improve on the transducer's shape.

Securely mount the transducer or impeller unit, bedding it with a generous amount of polysulfide or polyurethane (non-removable) sealant. Route the cable or wire to the instrument head location, carefully avoiding kinks and points of chafe. Keep depth sounder cables well away from other wires to prevent false readouts. Use nylon cable ties where necessary. Never attempt to shorten a sounder transducer cable. Coil any excess length and secure it with cable ties in a protected location.

Usually you will want to mount the instrument head on a forward bulkhead in the cockpit or the steering station dashboard. This will involve cutting another hole or two in the bulkhead or dash and sometimes in the liner behind it.

If your instrument head is circular and you have a holesaw available to fit, that's the way to go, but if the aperture required is more than about 7.6cm (3") in diameter, some alternative cutting technique must be employed. One way is to fabricate a simple jig that will allow you to cut an accurate circle with an electric drill.

Obtain a piece of 2.54cm (1") metal bar stock slightly longer than the radius of the proposed hole. Drill a shallow dimple centered close to one end of your bar stock, then use a compass to mark the desired radius on the bar. Now drill two 6mm (1/4") holes separated by .4mm (1/64") or less, side by side inside the radius arc and drill out the original dimple to 6mm (1/4") as well (**Figure 4**). The two closely spaced holes must be at exactly the same radius from the center (dimple) hole.

Stick duct tape to the back of your jig to prevent scratches on gelcoat or paint. Mark the hole location on the bulkhead or dash with the compass and drill a 6mm (1/4") hole dead center. Mount the jig snug but not tight with a 6mm (1/4") bolt through the single hole end. Drill a 6mm (1/4") hole in the panel through one of the closely spaced holes. Grind one side off the head of another 6mm (1/4") bolt to use as a pilot anchor, and insert it in this hole. Now drill through the radius hole. Remove the bolt/pilot, rotate the jig slightly, and reinsert the bolt in the hole you just drilled. Continue "walking" the jig around the hole radius until you return to the starting point. Remove the jig and use a small file to remove the material from between the drilled holes. You should have a near perfect circular hole.

A faster but less neat and precise method is to drill a pilot hole then cut around the marked circle with a sabersaw with a metal-cutting blade. Affix masking tape to the cut line on both sides to prevent chipping and to the saw's bottom plate to prevent scratches. This mode is of course necessary if your instrument head is rectangular or square. In this case, you'll need to radius the corners with a drill bit or holesaw to prevent stress cracks in the fiberglass.

Install the instrument head in the bulkhead or dash following the manufacturer's instructions. Be sure to seal the cutout with sealant. For bulkhead mounts, you may have to cut a hole in the cabin liner for access to the back of the instrument.

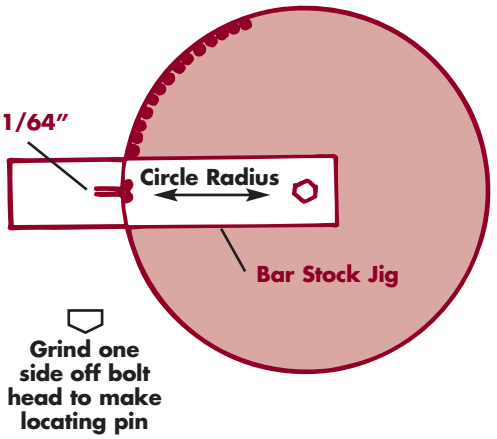


Figure 4

A jig for cutting round holes to mount an instrument head.

If there is sufficient space between the cabin liner and outer bulkhead to accommodate the instrument head body, you can make an access panel similar to the one described in **Figure 1** to cover the access aperture. Where instrument backs protrude through the liner or there is no liner, fabricate a box-like cover [see DIY

1998-#2 issue, "Good Boatkeeping" column — Ed] or use inexpensive plastic mixing bowls for individual covers (not pretty, but novel). Connect light and power supply leads to your breaker or fuse panel following manufacturer's instructions, test for proper operation and the job is finished.

About the author: Charles Moore is a Nova Scotia-based freelance writer and editor. His articles, features, and syndicated columns have appeared in more than 40 publications in Canada, U.S., Europe, and Australia.

MOUNTING TRANSDUCERS INSIDE

It's technically possible to mount your depth sounder transducer inside of uncored fiberglass hulls in a tube or chamber filled with non-toxic antifreeze (water only in southern climes), castor oil or even in a blob of silicone sealant. Such installations will avoid the dreaded hole cutting and reduce drag, especially on high-speed powerboats, but don't expect top performance from your sounder, especially in deep water.

Inside transducers won't work with cored hulls or even solid fiberglass ones if air bubbles or voids are present in the layup. You'll have to locally cut away the core and inner laminate. This may compromise the structural integrity of the hull, so don't do this without consulting a surveyor or boatyard. Antifouling on the outside of the hull may also negatively affect the instrument's accuracy. On the plus side, a transducer mounted in the bilge is easily accessible for repair or replacement.

ENGINE TROUBLESHOOTING

NOISE AND VIBRATION CONTROL

When selected and installed correctly, flexible engine mounts can greatly reduce vibration from an engine that is "hard" mounted. Here's what you need to know about selection, sizing and installing the proper engine mounts.

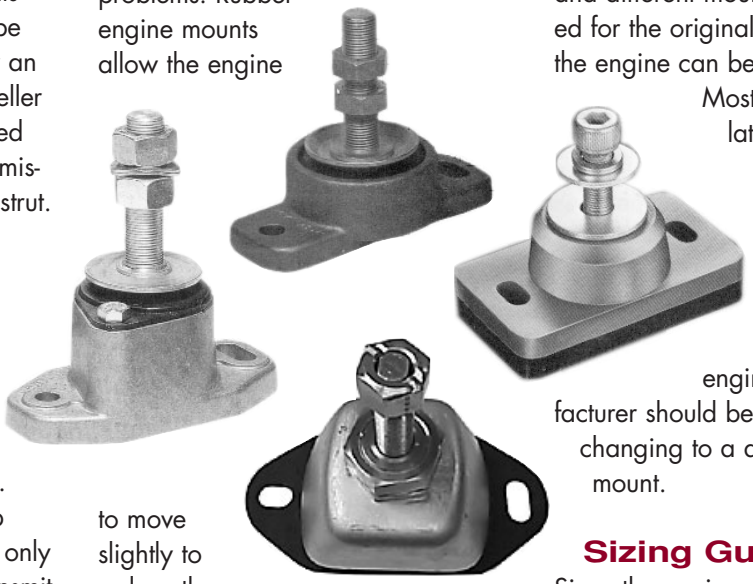
By Robert Hess

Engines are the usual cause of vibration because they are not only impossible to balance perfectly, they contain rotating parts, shake, jump and vibrate as their pistons move up and down with the force of combustion. Before you assume the vibration is caused by the engine — and the solution is different engine mounts — the complete drive train should be checked for vibration caused by an out-of-balance propeller or propeller shaft, a loose, worn or misaligned cutlass bearing, and a loose or misaligned cutlass bearing support strut. Other causes of vibration could include a misaligned engine or transmission, an out-of-balance engine or transmission shaft or flywheel, a loose engine or transmission component, loose engine mounts, or incorrect or damaged engine mounts.

Since it is impossible to stop engine vibration completely, the only way to prevent it from being transmitted to the hull structure is by mounting the engine so that it is insulated from the hull. This allows the engine to flex without transmitting the movement. This usually involves fitting rubber-in-sheer or hydraulic flexible engine mounts, and in some cases installing a flexible propeller shaft coupling to prevent misalignment of the propeller shaft. [A discussion of flexible couplings will appear in DIY Spring '99 issue — Ed.]

Mounting Considerations

Installing flexible engine mounts in a boat with an inboard drive and a rigid connection to the drive shaft which previously had the engine mounted directly to the engine bed rails or used solid adjustable mounts (i.e. sailboats) can create several problems. Rubber engine mounts allow the engine to move slightly to reduce the amount of vibration transmitted to the hull, but by doing so they allow the engine drive shaft to become misaligned and pivot in its bearings, which can cause increased shaft vibration and rapid bearing wear. In the case of a stern tube "dripless seal" packing gland, increased movement can allow the seal to move out of alignment causing it to leak. It may be necessary to modify the shaft by installing a flexible coupling or extra support bearings and to cut a section out of the engine mount area to allow space to fit the engine mounts and still retain propeller-shaft-to-engine alignment. For those reasons it's very important that the drive system be evaluated carefully before rubber engine mounts are installed in boats that were originally built without flexible engine mounts. You'll need to consult the engine and mount manufacturers.



Stern drive systems are not as affected by engine movement because they have a flexible coupling between the engine and outboard drive. Engines are usually fitted with engine mounts at the factory and different mounts can be substituted for the original mounts as long as the engine can be aligned properly.

Most stern drive installations mount the engine to the hull at the front of the engine, and to the transom at the rear of the engine. Both the engine and boat manufacturer should be consulted before changing to a different style of mount.

Sizing Guidelines

Since the engine mounts (solid or flexible) are the only points at which the engine is connected to the hull, it follows that they must not only handle engine vibration, but also transmit engine torque (or twist) and propel forward (or reverse) thrust to the hull. They also must handle the slight "up angle" thrust of the propeller shaft, and keep the engine properly aligned when the boat is being tossed about in rough seas. An engine broken loose from its mounts

could give modern meaning to the old nautical metaphor, "a loose cannon."

The flexible engine mount material must be very strong, with a fail-safe feature to prevent complete

NOISE-PROOFING YOUR BOAT

Noise on a boat comes from many sources. The primary source is airborne noise transmitted by the air throughout the cabin, cockpit, and deck. It's generated by the engine, primarily the exhaust system, drive train or hull structure. Mechanical noise from the engine or drive-train is usually a warning sign that a component is wearing out quickly, or has already worn to the point that it is damaged, and so the noise can actually be useful in alerting the operator to an impending failure. Carrying out the repair will have the side-benefit of eliminating the noise, so engine exhaust system repair, engine valve train adjustment, engine and transmission rebuild (including setting gear backlash to specification), propeller shaft packing gland bearing replacement, engine air intake repair, and other mechanical repairs should be done before attempting to reduce or eliminate the noise by other means. Transmission friction plate rattle that occurs even in transmissions that are in good mechanical condition can sometimes be eliminated by the installation of a transmission "damper" drive plate. Once the engine and drive train are repaired or adjusted to specification and lubricated properly, the next step in reducing airborne noise is to fit a more efficient exhaust muffler system. [A complete review of exhaust systems will appear in the DIY 1998-#4 issue — Ed.]

If the exhaust is already quiet, or a more effective system has been installed, and there is still a requirement to reduce airborne noise further, then the insulation of the engine compartment [see DIY Winter 1996-#4 issue — Ed.] and exhaust system should be considered.

There are two types of insulation that can be fitted to insulate the engine compartment: sound absorbing which reduces noise but not vibration, and sound deadening which incorporates an anti-reverberation plate in the insulation that reduces noise and vibration. Exhaust components can be insulated to reduce noise (and heat) by wrapping the exhaust pipe and muffler

separation. A mount failure while the boat is under full power could cause the engine to rotate instead of the propeller. The rubber material used in the mount must also be strong enough to hold its shape over a long period of time. A gradual change in dimension as the mount compresses could allow the engine to slowly move out of alignment with the propeller shaft.

Specifications for engine mounts should include the correct size and load rating, and the following charac-

with heat-resistant, sound-insulating tape, usually a metal foil-covered fibreglass wrap. Insulation should be fire resistant and designed to prevent the absorption of oil and inflammable fumes.

Waterborne noise, generated by underwater components, radiates through the hull into the interior of the boat. The most common source of waterborne noise is propeller cavitation, usually caused by incorrect propeller size or pitch, which not only generates waterborne noise but causes the engine speed (and exhaust noise) to change rapidly.

Not only can noise on a boat be airborne and waterborne, but it also can be structure-borne (carried by the boat material itself) and in some cases is actually noise generated by the harmonic vibration of the hull with water, engine, or propeller shaft related vibration. Structure-borne noise and vibration can be produced by the action of water or a boat component against the hull itself. Water rushing by the sides and bottom of the hull can create structure-borne noise, and water forced against the rear of the hull by the propeller can create a drumming noise if the hull is not properly reinforced in this area. A whine or rattle from loose rudder bearings, a worn rudder control rod pivot, loose propeller, or worn cutlass bearing can be transmitted to the hull too. Since the engine and propeller shaft assembly is mounted at only a few points (usually the engine mounts, the stern tube and the rear strut cutlass bearing), any vibration caused by a loose, bent, unbalanced or misaligned condition in any of the drive train components will be transmitted to the hull at those points.

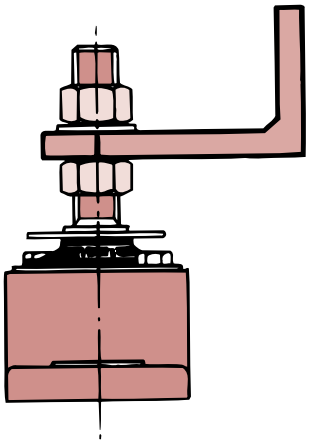
In some cases it may be possible to reduce harmonic vibration of the hull and components by altering the drive ratio or propeller specification to change the engine cruising rpm, and thus change the engine vibration frequency, or by altering the mass of the hull by altering the ballast or fuel and/or water tank capacity. In most cases, however, it will be much simpler (and cheaper) to reduce engine vibration transmitted to the hull by installing flexible engine mounts.

— Robert Hess

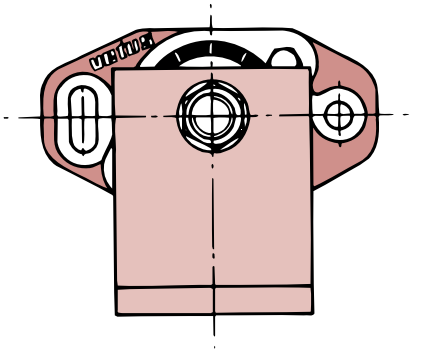
ENGINE TROUBLESHOOTING

teristics: zinc-plated steel or aluminium shell (some mounts may also use synthetic materials); electrically passivated; oil shield to protect rubber as the natural rubber used in some mounts is damaged by engine oil; adjustable height; saltwater corrosion protection; and an operating temperature range of -30°C to 30°C (-22°F to 86°F). Certain mounts also have slotted holes to assist in alignment and a fail-safe design, such as a metal guard or chain to hold mounts together or the engine in place in case of mount failure.

When ordering your engine mounts, suppliers will need to know the engine model and horsepower, shafting arrangement, spacing of the engine bearers both vertically and horizontally, clearance between the hull and the mounts, number of engine mounting points, transmission reduction ratio and maximum boat speed or engine rpm. Some manufacturers include engine mount formulae in their catalogs to allow you to select the correct size of mount when ordering.



VETUS



Correct mounting of flexible mount.

Flexible engine mounts are available from many different manufacturers, however, commonly used marine engine mounts are made by Barry Controls, Bushings, Globe Rubber Works, R&D Marine, Soundown and Vetus. Some engine manufacturers also offer mounts for specific engines. Prices start at US$24 up to US$150. Easy to install, a wide range of sizes fits most every engine.

Installation Requirements

On a retrofit installation, flexible mounts usually match the original

footprint without alteration. Some boats, however, may require you to modify or reinforce the bearers and the hull (foundation).

Bearers that lack lateral (sideways) stiffness, which is typically the least-stiff direction of the foundation, must be reinforced with gussets made of fiberglass or wood laminate. Flexible mounts need higher clearance between the mount and the foundation than the rigid type, which shouldn't be a concern on boats with the old-style mounts with tall studs. Otherwise, you'll need to raise the bearings using wood spacers and reinforce with layers of fiberglass cloth and resin. Some atypical installations may require removal of the old bearings and the building of new ones.

SOUNDOWN

On a retrofit installation, flexible mounts usually match the original footprint without alteration but bearers may need reinforcing. The engine must sit low on the mount's threaded stud to prevent breakage.

Flexible engine mounts should be installed so that each mount takes a proportional share of the engine weight and load, so that the engine is properly aligned with the propeller shaft. It's important that the engine sits low on the mount's threaded stud to prevent breakage. In installations where the engine is aligned higher on the studs, any lateral force acts as a lever arm, increasing the bending force and over time, fatigues the studs.

To ensure the engine stays properly aligned after installation, the new mounts should be fitted to the engine for at least 48 hours before final alignment of the engine with the propeller shaft. This will allow the rubber to compress to its working dimensions. The alignment should be checked again once the boat has undergone sea trials. When aligning the engine with the propeller shaft flange, support the shaft to eliminate "shaft droop" caused by the weight of the shaft, and adjust the engine mounts until the engine and shaft flanges meet at the same angle and height. Check the flange alignment by using a feeler gauge to verify that the gap between the flanges is even.

About the author: Robert Hess has a background in automotive and marine mechanics and in 1994 he restored Water Music, *a 7.5m (25') Hughes that he cruises on the coastal waters of Canada's West Coast.*

ENGINE TROUBLESHOOTING

WEAR-FREE COLD ENGINE STARTS

A prelubrication oil system extends engine life and eliminates premature failure of engine components due to lack of lubrication on start-up. Installation is quick and easy.

By Jan Mundy

You may not realize it, but simply starting your engine causes significant wear. The grinding and knocking sounds a cold engine briefly makes upon startup is engine wear occurring. In fact, as high as 95% of engine wear occurs in the first 10 seconds after startup before oil has pressurized and coated bearings and other critical parts.

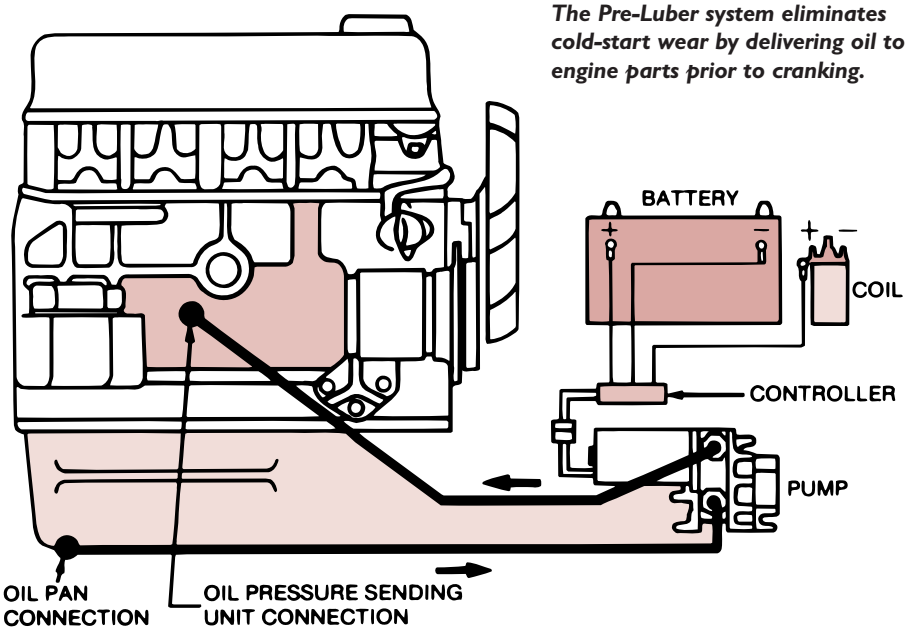
When a hot engine is turned off, it begins to cool and lubricating fluid drips into the oil pan. The longer the engine sits, the thicker the cooling lubricant becomes and the more difficult it is to pump the oil. For a few seconds after a cold startup, no oil pressure is present. Running at fast idle, the engine waits for oil to coat the bearings, cams, rods and pistons. This causes cold start-up engine wear. Should the engine stall, the wear process is repeated. Abrasive metal particles that are rubbed off at start-up also accelerate engine wear. Letting an engine warm up at a slow idle does not eliminate engine wear. Such un-oiled "dry" starts occur in very cold or very hot weather, after an oil change or following prolonged periods of non-use. Your engine may last a lot longer if all moving parts are prelubricated before start-up.

Hailed as "the greatest thing since sliced bread" by Marine Business Journal, the Pre-Luber from Engine Lubrication Systems minimizes dry-start wear on engine components each time the engine starts. Originally engineered in 1988 for cars, the system has gone through various generations and the newest marine version has eliminated pressure problems experienced by earlier models.

Operation is quite simple. An electric pump-driven system wired to the engine's existing ignition lubricates and pressurizes the engine with oil prior to cranking. Turning the ignition key to the "on" position sends a signal to the Pre-Luber to start. It pulls oil up from the oil pan into the engine and pumps oil through the engine following the same oil channels as the engine oil pump. For up to 60 seconds it bathes friction-prone engine surfaces with oil. Engine oil is pressurized up to 55 psi before turning the key to engage the starter and starting the engine. Pre-Luber then shuts off and the oil pump takes over. As the system isn't wired to the starter motor, in an emergency situation or when you're impatient, you can turn the key to the "start" position and drive away without waiting for the prelubrication cycle.

Weighing less than 4.5kg (10lb), the Pre-Luber's compact and lightweight pump is a patented ring and rotor mechanical unit capable of pumping up to 140W oil. It's compatible with all natural and synthetic engine oils and additives. A built-in check valve prevents oil back flowing into the pump, causing a loss of pressure. A brass mesh filter screen filters the oil; another filter can be added to the outlet line if desired. Power draw is four to 26 amps depending on engine temperature.

Quick five-minute oil changes are possible with an optional disconnect coupling without having to loosen the drain plug. Just put the hose end into a container, turn the ignition key to "on" and pump out



The Pre-Luber system eliminates cold-start wear by delivering oil to engine parts prior to cranking.

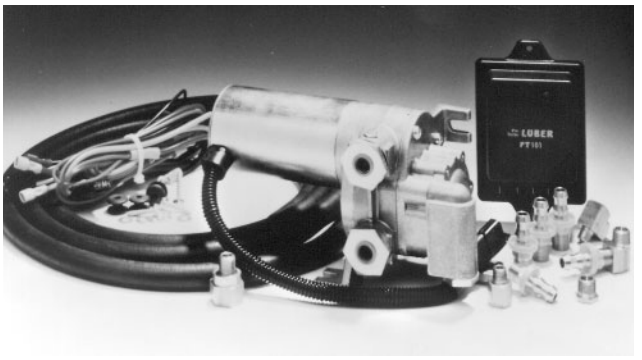
dirty oil without having to loosen the drain plug. Upon startup, the Pre-Luber automatically fills oil filters.

Pre-Luber comes in three 12-volt versions to fit most gas and diesel engines: Standard (US$498), Heavy Duty (US$545) for 454 cu. in. gas and 7.2L diesel engines, and Turbo; the 24-volt system retails for US$649. With a turbo-charged diesel engine, the turbo bearing is the last critical part to receive oil. The Pre-Turboluber (US$599) incorporates a cool-down cycle to lubricate the engine and prevent heat "spikes" after shutdown. With the engine off, the pump continues to run oil through the engine for 30 seconds to five minutes, the recommended minimum time being three minutes. This provides engine and oil cooling, reduces condensation and engine warping, cools turbo bearings and apparently doubles the life of the turbo charger.

Installation

Installation is relatively easy with a few basic hand tools and takes about two hours. The standard ready-to-install kit includes a pump, electronic control module, 1.8m (6') wire harness, brass fittings, 2.7m (9') of hose, drain plug, grommets, mounting hardware and instructions. Heavy Duty and Turbo kits do not include hoses, as these systems usually require larger diameter hoses to carry sufficient oil capacity to prelubricate the engine.

Mount the pump on a bulkhead in the engine compartment well within reach of the hose and wiring connections. Connect one end of the hose to the engine oil drain plug, extend it to the pump inlet fitting, allowing some slack, then slip it over the fitting. Attach the second length of hose to the pump outlet and connect the other end to either the oil-sending unit on the engine or to the oil filter. The optional quick-disconnect coupling (US$20) goes on this hose for quick oil changing.



Ready-to-install kit includes all hardware and the job takes about two hours using basic hand tools.

Route hoses so they run freely and secure to bulkheads with screwed-on cable ties.

Now mount the control module in the engine compartment and connect the four color-coded wires. Hookup is easy with the wiring harness: attach the red and yellow joined on the male plug end of the harness to the female plug end on the Pre-Luber, run the separate red wire to the battery and black wire to a ground, then connect one end of the orange wire to the panel and the other to a hot lead when ignition key is in "accessory" or "on" position.

With replacement engines costing thousands of dollars, a pre-lubrication oil system is a relative minor outlay that extends engine life and delivers wear-free starts.

For further information contact Engine Lubrication Systems, 64 State Rd., Paoli, PA 19301; Tel: 800/647-7383 or 610/647-2417, Fax: 610/644-0877, Email: enginelube@aol.com.

Deck-orating An Old Cruiser

Resurfacing worn nonskid with glued-on synthetic material is a good alternative to painting and offers exceptional traction. Here's how.

Story and photos by Craig E. Anderson

Our "new" boat, a 1972 6.6m (22') Westerly Warwick designed by Laurent Giles, was fundamentally sound when purchased in August 1995 but in need of some refurbishment. Among the things needing attention was the deck; the old gray nonskid was showing the effects of age and weather. Repainting was clearly the easiest solution, but we opted to resurface the nonskid portion of the deck with a material overlay and have not been disappointed with the results.

The old nonskid was showing the effects of 25 years of age and weather.

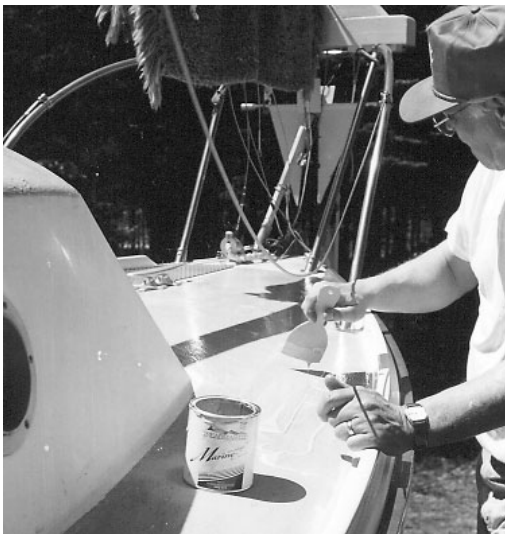
Made of a mixture of cork, rubber or polyurethane, overlays give a long-lasting, maintenance-free coating with superb nonskid qualities, especially when wet, and protect deck surfaces from dings or chafing. We selected Treadmaster M, a raised, diamond-patterned cork polymer nonskid material. The product is 33mm (1/8") thick, sold in sheets that measure 1.2m (47.5") x .90m (35.5"), and available in either white sand, gray or teak colors. Although relatively expensive, we were able to purchase the four sheets we needed at significant savings through a mail-order marine catalog. We also obtained the two-part epoxy marine adhesive designed for use with Treadmaster. Our total material costs came to about US$300.

The process of preparation and application was time consuming and somewhat tedious. The job took two of us about 15 hours not including drying time, although rain, cold weather and other responsibilities extended the actual project time. The epoxy adhesive must be applied at temperatures above 15.5°C (60°F) to obtain the desired adhesion. As with painting or fiberglass repair, preparation is very important and must be done carefully.

We began with a thorough cleaning of the deck surface with TSP (trisodium phosphate) and water followed by a boat cleaner until accumulated dirt and grime were removed. This was followed by a sanding of the old nonskid surface with 180-grit paper. The sanding proved somewhat problematic — the old nonskid surface had a rubber-like quality to it that quickly clogged up the sandpaper. After giving it our best effort, we thoroughly brushed clean the surface. We washed it again with TSP and water, and, after drying, wiped it down with a tack cloth.

Making the patterns to use for cutting the nonskid was the next step. We used newspaper, although a slightly heavier brown Kraft paper or butcher paper might have been better. Tracing the outline of the old nonskid was relatively easy since it was still slightly raised from the rest of the deck. Keeping the paper stationary while tracing the outline is crucial. A good method is to cut out one or two 7.6cm to 10.1cm (3" to 4") holes in the pattern paper. This enables you to affix the paper to the deck with masking tape without having to tape the edges. We did not discover this suggestion until the job

Making accurate patterns is exacting work and any misalignment will multiply once the fabric is glued in place.



A specially formulated two-part epoxy is applied to the deck and the nonskid material.

was completed, but we think it is a capital idea.

After delineating the patterns, we cut them out and laid them on the deck to be sure they were correct. It's important to mark the patterns "front" and "back," and "forward" and "aft" to prevent confusion later. Separate patterns must be made for each section of deck to be covered. You cannot assume that each side mirrors the other and that simply reversing a pattern from port to starboard sides will work. We found it does not.

Once our patterns were cut and dry-fit, we taped them to the wrong side of the nonskid material, and carefully cut the material with sharp scissors or utility knife. Although the manufacturer does not advise butting up two pieces of the nonskid material, we felt we had to in several places given the configurations of the deck and previous nonskid areas. We were meticulous, however, in making sure that where two pieces of Treadmaster met, the diamond pattern was matched up perfectly. As the pieces were cut, we laid them out on the deck to insure that we had a proper fit.

Lay the nonskid in place then apply moderate pressure to squeeze out air bubbles and excess glue.

The final step was to fasten the material to the deck using the two-part epoxy glue. After a vacuuming and

Deck-orating An Old Cruiser

Teak-colored nonskid looks attractive, protects the fiberglass deck and provides better-than-new traction.

final dusting of the deck with tack cloth, we were ready to begin. Since the pot life of the epoxy was only about 30 minutes, we laid only a section or two of the nonskid at a time. The epoxy was spread with an applicator (inexpensive plastic putty knives) on both the deck surface and the backside of the nonskid, being careful to coat both thoroughly. The nonskid was then placed on the deck, adjusted until correctly positioned (it moves easily before the epoxy sets), and then pressed down firmly to eliminate any air pockets. A rubber roller might be helpful in this, although we did not find one necessary. Excess epoxy that squeezes out the sides must be wiped away with a rag or will leave a stain on the fiberglass.

TIPS — Working With Deck Overlays

▼ *Deck overlays add weight, about .22kg (.5lb) per square foot.*

▼ *Have a variety of circular and oval shapes at hand for producing fair corners and angles around hardware.*

▼ *Use wood or fiberglass battens, held in position with weights, for marking long deck curves.*

▼ *Make templates as large as possible without becoming unmanageable.*

▼ *Leave at least a 3.8cm (1-1/2") gap between patterns and all deck hardware for water drainage.*

▼ *Using a felt marker, transfer the template outline to the deck, identify the alignment of each piece and number it and the deck to simplify final fitting. Transfer all markings to the wrong side of nonskid material after cutting.*

▼ *Remove any spilled glue from the deck or fabric with solvent before it hardens.*

▼ *Always wear protective clothing and use a respirator when sanding fiberglass.*

▼ *When working with epoxy glues, protect hands with disposable gloves or barrier cream, or use both.*

The final result has been very satisfying. Not only has the appearance of our boat been aesthetically enhanced by the new teak-colored nonskid, we have a surface that gives exceptional traction. Moving about on the deck of a pocket cruiser can be a challenge in heavy seas and rough weather, and it's reassuring now to have a superior nonskid. If there is a downside, it is that this material is a little hard on bare knees or feet, but that was something we knew before we began. It's a small tradeoff in our opinion, for the improved appearance and security.

About the author: Craig E. Anderson resides in Chicago, Ill., but keeps Shorebird II of Stonington *in Escanaba, Mich., his port of entry to the sailing waters and wonders of Green Bay and northern Lake Michigan.*

installing a PRESSURE-WATER SYSTEM

You need not buy a new, expensive boat to enjoy some comforts of home. Follow these easy instructions for installing a pressure-water system then just turn a tap and water flows. What could be better!

Story and photos by David & Zora Aiken

Tools & Materials

Drill & bits
Assorted screw drivers
Sharp utility knife
FLOJET model 2840 Water Pressure System
Hose: 19m (3/4") inlet, 12mm(1/2") outlet
All-stainless hose clamps

When we bought our boat in 1978, it was remarkably well equipped for its day. It boasted an electric water heater, a pressure water system, an engine-driven generator (in addition to the ordinary alternator) and two electric heads. Since our philosophy at the time was a keep-it-simple minimalism, out came all of the above. I don't recall the fate of the water heater or pump, but one head remained on the dock in Nassau (with permission from the dock owner), the other became a planter in a Florida boatyard and the generator found new practical use in its recycled life as the basis for a mooring in a Bahamas harbor.

Now, 20 years later and settling into a different kind of liveaboard lifestyle, the simple life has less appeal. The idea of the easy life is taking on new significance and so, after years of a hand pump in the galley and a foot pump in the head, our classic boat is now equipped with a very modern pressure-water system.

Initially, plumbing might seem to be one of those jobs requiring a knowledgeable outside person, but as more manufacturers have become attuned to the "I'd-rather-do-it-myself" thinking, the installation of such a system fits in the category of the average boat owner's capability.

All boat projects should be planned carefully, to avoid do-overs and to make sure everything you'll need is on board. With this project, the planning stage will establish the shortest routes for hoses to follow and the most centrally located place for the pump, assuming it may be serving more than one faucet.

The system we installed is a FLOJET (US$294.55) — an all-in-one pump (Quad diaphragm unit) and accumulator tank with a built-in pressure switch and a separate inlet strainer. Compact and lightweight, it fits in a locker and weighs just 4kg (8.8lb). Once installed, the pump pulls water from the boat's water tank and sends it to the accumulator tank. With the accumulator tank, the pump doesn't run constantly whenever a faucet is turned on. The tank retains enough pressure to allow the water to flow for a short time without the pump working. When pressure in the accumulator tank drops to a certain level, the pump turns on to refill the water and restore the pressure in the tank. FLOJET's system also includes a strainer installed between the water tank and the pump. This prevents any sediment that may be in the water tank from reaching the pump and fouling the valves.

FLOJET model 2840 Water Pressure System mounted on an engine room bulkhead. Note strainer in foreground.

Location, Location

Of course, the closer the pump can be to the faucet(s) and the shorter the hoses, the simpler your plumbing maze will be. Our boat had a good start: the center cockpit is immediately aft of both the galley and the head. The pump could fit neatly in one of two huge seat lockers or be mounted in the engine

room beneath. The engine room allowed easiest access and a bulkhead was vacant. The FLOJET unit can be either deck-mounted or bulkhead-mounted to a solid surface. If bulkhead mounted, the pump head should be down or lower than the motor. Once installed, the strainer would be visible and easy to clean.

Installation

Gathering tools for this job is especially easy: all that's needed are a drill and bits, screwdriver and a sharp knife to cut hoses.

First, assemble all the parts. Besides the unit itself, have handy all needed hose lengths, a good supply of all-stainless hose clamps and whatever adapters you may need to connect faucet to hoses. Be sure to use reinforced hose made for high-pressure applications. And, of course, you'll need the faucets(s). The standard household kitchen faucet might be too big for a boat sink as it arches up too high. Bar sink or laundry tub faucets are better, having a lower arch or none at all (faucet extends almost straight out over sink).

Before mounting the accumulator in position, attach hoses to the pump: the inlet hose connects to the water tank and the outlet hose goes to a faucet(s). Screw the pump unit into its chosen place with the supplied four rubber mounting feet, then run the hoses. Eventually, you'll include all the required tee-fittings that will lead cold water to each faucet (galley, head sink and shower) plus one hose into the water heater and another out of the heater and directed to each hot-water faucet (**Figure 1**). But start with one faucet; ours was the galley sink. Securely fasten the strainer to a bulkhead, cut the water supply line from the tank and connect the ends onto the strainer. Clamp all hose connections securely.

TROUBLESHOOTING: REDUCE PLUMBING SYSTEM NOISE

By Chris Beh

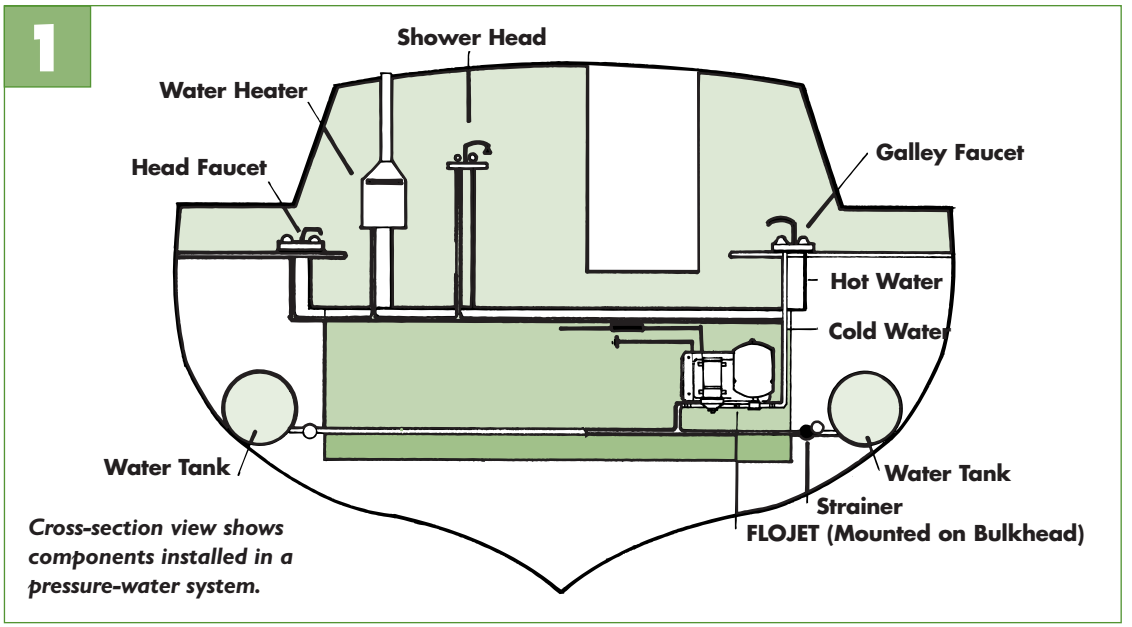
Positive displacement pump "noise" can be attributed to many factors. The way the pump operates lends itself to some noise, inherent in these devices, but you can reduce the amount of noise transmitted to the boat by carefully following a few installation details.

Be sure to mount the pump on a solid surface with solid supports underneath. If you can knock on the mounting surface and it sounds like a drum, vibrations are going to travel through it. Use the manufacturer's supplied rubber feet to mount the pump and don't overtighten. To reduce vibration, use at least 45.7cm (18") of high-pressure flexible tubing between the pump and "hard" plumbing both on the inlet and outlet fittings. Elbow fittings cause turbulent flow and back pressure on the pump, increasing noise levels, particularly if placed within the first 61cm (24") of the pump outlet. Better to replace elbows with high-pressure flexible tubing.

Another source of plumbing noise is vibration from piping and fittings where they pass through bulkheads and behind drawers and shower walls.

To check for noise, grab the piping on either side of the pump. Does the noise and vibration level decrease while you hold the piping? Turn on the tap(s) one at a time and check which one(s) creates excessive noise or vibration. Check the strainers. Clogged strainers, as well as air leaks, can make a pump labor and cause noise.

About the author: Chris Beh is an applications engineer for SHURflo in Santa Ana, Calif.



Cross-section view shows components installed in a pressure-water system.

Wiring

As with any wiring project, remember to disconnect the power before you start. This is a very basic job: take the negative (black) and positive (red) wires coming off the pump and connect them to the appropriate distribution panel. Splice an in-line fuse into the positive wire. Check pump specs for the recommended fuse size. FLOJET models are available for 12-, 24- and 32-volt DC systems, and 115-volt AC that plugs directly into an AC outlet.

The tank should be pressurized before starting the pump. Use a bicycle tire pump to pump up the pressure. Follow manufacturer's instructions and check the pressure after filling and before starting the pump with a pressure gauge. Like a bike tire, pressure can be reduced by pressing the center pin of the valve.

Start Up

See that the water tank is at least 1/4 full. Open the faucet(s) to purge air from the system. Turn the power on so the pump will start. When air is out of the system, about a minute or so, close the tap(s). The pump will pressurize the tank, and then turn off and on automatically as required to maintain the pressure in the system.

You could add another element to the system: a water filter, for good drinking water. If you're dockside on a relatively permanent basis, you can connect directly to city water supply, but if you choose to do so, install a regulator to protect the pump from the high water pressures (see "Now That You Have Pressure Water..." on page 36).

Next on our do-to list is to install a water heater, shower and sump. [For step-by-step instructions to install a water heater see DIY 1997-#1 issue, page 20 — Ed.]

About the authors: David and Zora Aiken are the authors of Good Boatkeeping *and* Good Cruising *published by International Marine. The Aikens currently live aboard a 1963 10.5m (35') Chris-Craft sloop,* Atelier, *berthed in Grasonville, Maryland.*

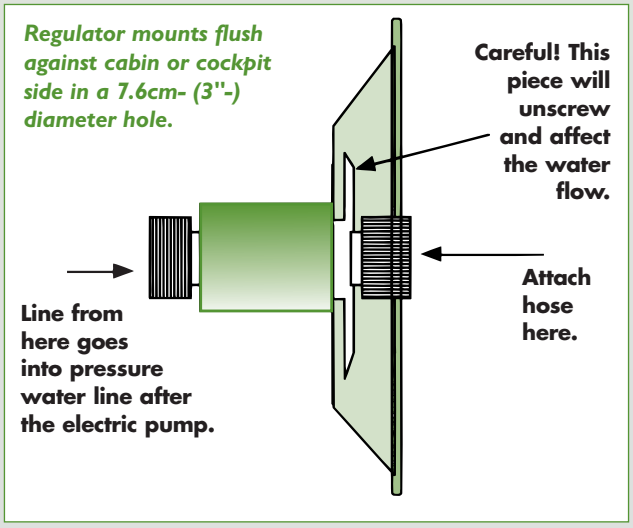
NOW THAT YOU HAVE PRESSURE WATER...

For a few dollars and an afternoon's labor, you can easily bypass the filling of tanks and connect a pressure water system to dockside water.

Story and illustrations by Ryc Rienks

The installation of a water pressure regulator, such as the PAR Water Pressure Regulator made by Jabsco or SHURflo's 183 RV Regulator, allows unlimited water flow with no compromise of the onboard pressure system. It connects to the pressurized cold-water line (after the electric pump or accumulator such as FLOJET's 2840), reducing high-water pressures up to 100 psi down to 35 psi. Two styles are available: an in-line model with brass garden hose fittings or the one I installed, a white flush-mount model (either PAR 44410-1000 or SHURflo 183-029-08).

Installation is simple and inexpensive. You'll need a regulator device (about US$30), a length of hose long enough to tee into the plumbing downstream of the pump, a barbed-end tee-fitting, a straight hose connector and four hose clamps sized to fit the hose. Tools needed are a drill, jigsaw or 7.6cm (3") holesaw, utility knife to cut the hose, pilot bit to drill the mounting screw holes, assorted screwdrivers, and polysulfide or silicone sealant.



The installation involves cutting a 7.6cm- (3"-) diameter hole through the side of the cabin or perhaps in the cockpit. This is where the regulator mounts and dockside water joins with the pressure water system in

the boat. Select a location for the regulator that will keep the hose out from under foot and allow any drips to run over the side without too much fuss. Before you cut the hole, make sure you have clear access from the inside, ensuring the hose will run fair and be safe from moving objects or other systems that may create a conflict (engine exhaust heat, for example).

Check the fit of the regulator in the hole to be sure it will fit flush. Next, drill pilot holes for the four mounting screws but don't mount the regulator yet. At this juncture you may wish to go below and tap into the water system. Turn off the pump switch and tape it in the off position (or install an on/off pump switch).

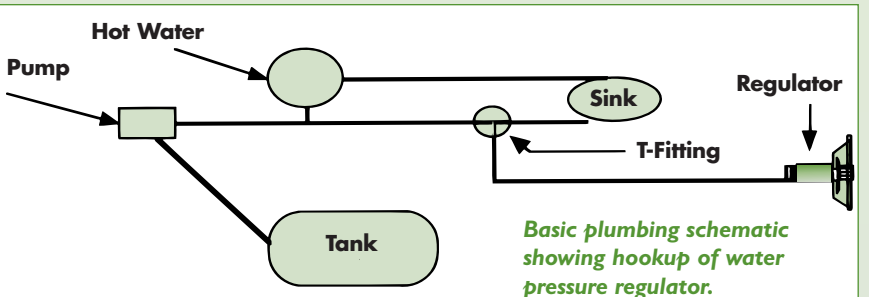
Now, feed the new length of hose through the cutout and verify it reaches to the water hose, leaving some slack, and hooks up correctly. If you have a water heater, you must be sure to connect to a cold-water line. This is important. There is a device in the hot-water system that will not pass water backwards, thus an incorrect installation will give you cold water out the hot tap, and nothing out the cold.

Now cut the cold line, attach the hose ends and the extra length of hose to the tee-fitting, and hose clamp all three fittings.

Return topside to the hole in your boat and add the hose connector to the back of the regulator. Slip the end of the new hose onto the barb and hose clamp this connection.

Apply sealant liberally around the regulator and screw it in place. Connect your hose between the dock fitting and the regulator and open the faucet.

One cautionary note: cultivate the habit of turning off the water faucet on the dock when you leave the boat. Should a leak occur in the onboard plumbing, your boat would be at risk of sinking from freshwater being piped in. This actually happened on a boat in our marina and it was down nearly 61cm (2') before neighbors realized what was happening.



Basic plumbing schematic showing hookup of water pressure regulator.

Another interesting aspect of these regulators is the outside fitting where you attach the hose. The process of attaching and removing the hose can cause the assembly to loosen and rotate. At least it did on ours. The result was a reduction in water flow to the point of having nothing at all coming out. I replaced the supposedly defective unit and after the replacement was installed on the boat, I attached a hose to the old one. Surprise! Unscrewing the central part of the regulator a few turns, idle curiosity not genius at work, I discovered I had restored the flow through the unit. Now I have a spare regulator.

About the author: A former musician, custom knife-maker, teacher and writer, Ryc Rienks lives with his wife aboard a Cascade 36, currently berthed in San Francisco.

The Litmus Test

Osmotic blisters come in many disguises. Some are purely cosmetic, others compromise the structural integrity of the hull. Whether your boat is with or without blisters or a barrier coat, use this test to survey your boat, you might be surprised.

By H.W. Roman Folk

Testing Tools

Waterproof marker
Safety goggles
Disposable gloves
Litmus paper
Sharp scraper
Small grinder
Hot air gun
Drill with 12mm- (1/2") diameter countersink bit
Plastic head mallet
Magnifying glass
Dental probe or thin, flexible blade knife
Small paint brush
Fast-curing filler

With all the controversy and disagreement in the marine industry regarding osmotic blistering of boat hulls, most owners don't know who to believe regarding the seriousness of the problem. Is it just cosmetic or are blisters possibly an external sign of structural degradation of the laminate? Is it a problem that is easily cured by grinding and patching or is it necessary to remove laminate layers and apply new material?

Fiberglass boats built of polyester resin (most production boats) may be affected by a problem, that over a period of years, could completely degrade the laminate and eventually cause a vessel to become unseaworthy. This problem is a chemical process called resin hydrolyzation which is defined as the breakdown of cured polyester resin into its component raw materials owing to an interaction between permeating water molecules and chemicals that are normally present in polyester. Boats that are hauled for the winter and have anywhere from four to six months to dry out, tend to suffer deep-rooted hydrolyzation to a much lesser extent than their saltwater counterparts that spend a full year in relatively high temperature water. (Be especially overcautious if you're considering buying a "bargain" boat from southern climes.)

Research has found that blisters can be caused by several agents acting singly or in various combinations. Considering the extreme range of conditions in which boats are used and the various laminate schedules, it's only logical that there isn't a single cause for osmotic blisters. So how do you determine if the blisters found are a result of damaging chemical processes?

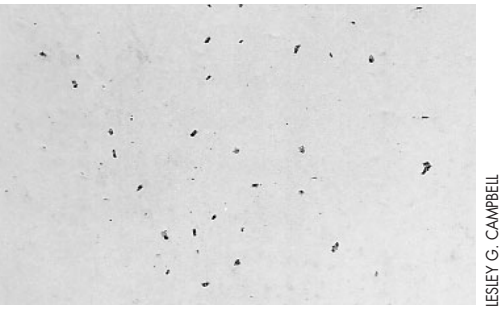
Sounding the Hull

The blister tests described below interpret what is occurring beneath the gelcoat. These tests measure the degree of acidity in the laminate, rather than a hull's moisture level. Readings from moisture meters may not be a true indication of the hydrolyzated state of a hull and are only truly accurate when interpreted by an experienced surveyor.

These tests require that the boat be out of the water. Clean the bot-

JAN MUNDY

Blisters found at the gelcoat-laminate interface are repaired by blasting or peeling of the gelcoat, drying, filling the voids and applying a thick epoxy or vinylester barrier coat.



LESIEY G. CAMPBELL

Small, cosmetic blisters with a neutral pH value of 7 are easily patched.

tom of the boat and draw circles around all blisters with a waterproof marker. Do this the minute the boat is hauled — smaller, cosmetic blisters often disappear within a few hours. Larger, deep-rooted blisters that extend into the laminate may be visible for many months after the boat comes out of the water.

While standing at the bow and then the stern, sight along the hull where it's supported by a cradle or jack stands. Look for any deflection or hollows where the hull is in contact with the supports. On sailboats, look for any concavity on the bottom where the keel intersects the hull. Does it look as if the keel is pushing up into the hull? If you think there are hollows in the hull lines, get someone else to look at the boat to see if they see the same problem. Then with your plastic mallet, tap the hull, using a steady rhythm (tap, tap, tap...) in the suspect areas. A solid laminate has a nice "ringing tone." A waterlogged core and damaged laminate beneath the surface offers a much duller sound. Mark the areas of "dull" sounds with the waterproof marker. A "soft" bottom is not always caused by a damaged laminate. Another source is laminate fatiguing and microcrazing of the resin through years of abuse as found in many older powerboats.

The Acid Test

Blisters may have several reasons for developing and the following should help you determine what type or types are on your boat. The size and location of the blisters are useful in determining the cause. However, a boat may have adjacent blisters caused by different processes. Additionally, the presence or lack of a barrier coat will determine the nature of the blistering.

Small blisters, less than 6mm (1/4"), present in a band about 15cm- to 25.4cm- (6" to 10") wide at the waterline, are often caused by algae or grass that grows on the waterline. Parts of the organism dig into the bottom paint and gelcoat where they decompose and cause blisters to form. Another possibility is chemical pollutants floating on the surface and reacting with the bottom paint, often discoloring the paint. Pop a few of these blisters and test the liquid content with your litmus paper. If neutral, a pH value of 7, or nearly so, means they are cosmetic and easily patched.

Interface blisters are those that form between the gelcoat and the first laminate layer. Uncured resin, excess hardener or air-filled voids allow water to concentrate and become an acidic solution, potentially dissolving the surrounding resin (hydrolysis). Fluid in these nearly always has a pungent, rotten odor and may be under considerable pressure — wear goggles when breaking the blisters. The fluid will be slightly acidic, somewhere between 4 pH and 6 pH. Interface blister cavities usually have a tiny hole in the bottom. When opened, a larger cavity will be found. If the blister is of the interface type, this cavity will have smooth, solid sides. Always wear safety goggles when working on blisters, as some when punctured can emit a high-pressure stream of liquid that may be extremely corrosive.

Close-up Survey

To perform the next tests, the original laminate must be examined. You will need to scrape or sand away sufficient antifouling paint to determine if the boat has been previously barrier coated. Select two or three spots on each side, just above the keel and under the cockpit should be sufficient. A small grinder saves a bit of labor at this point.

If your boat has been barrier coated, spot patched or is an older boat that has never shown blisters, don't think that all is hunky-dory. If your boat has no blisters, at each spot where you have exposed the original laminate, drill a hole with the countersink bit — don't drill all the way through. Examine each hole with the magnifying glass. Can you see dark spots? Is liquid seeping out of the layers? Are layers separated? Is the resin soft or spongy? The pH readings on any such damaged area will invariably be quite acidic. If no liquid seeps from the drilled area within 30 minutes, the area around the hole

may be gently heated or left overnight and examined the next day. The change in temperature will normally cause some liquid to appear on the surface.

Where there is a barrier coat with visible blisters, open the blisters and test the fluid with litmus paper. Neutral (pH 7) or alkaline (pH 8 or higher) readings are normally a sign that the barrier coat didn't cure properly. Acidic readings are a sure sign that the laminate is affected by resin hydrolyzation and is being degraded.

It's not unusual to find adjacent blisters with different pH readings. If the blisters are scattered over the surface of the hull, open several of them. Use a Dremel, a variable-speed, hobby-type die grinder with a 5mm (3/16") diameter round-tipped rotary file to open blister holes. Examine the surface in every exposed blister cavity. Quite often a tiny hole can be seen as with the interface blisters. Use the countersink bit to drill into the laminate at this point. Examine the sides of the hole with the magnifying glass while gently probing with the dental probe. Are laminate layers easily pulled apart or are they already separated? If the hole is dry, wet your paint brush with clean water. Gently heat the area around the hole. If any liquid is seen seeping from the newly exposed laminates, test with the litmus paper. Use the brush to push a strip into the hole, if necessary. An acidic reaction at this point is not a good sign. The strong acid and separated layers are positive signs that the laminate is being affected by resin hydrolyzation.

Caution: Be extremely cautious when heating fiberglass. A paint-stripper-style gun releases enough heat to cause heat damage to the laminate even to the extent of causing trapped solvent to flash off. Also, around 45°C (150°F) many coatings start to soften, so an epoxy or vinylester barrier coat may be damaged.

You've scraped away bottom paint and drilled holes in the hull, now what? First, take close-up photos of the spots with the strongest acidic readings and also of the blisters found in any recently applied barrier coats. Photos shot at greater distance can be used to document the locations of your tests. Barrier coat problems should be discussed with the applicators if you didn't perform the work, and with the manufacturer if you did it yourself. Fill all the holes and areas where you used the grinder with a quick-dry epoxy or vinylester glue or filler (i.e. 3M Marine Premium Filler, Marine-Tex), prime and paint.

If you find that resin hydrolyzation is taking place within the laminate of your hull, there is, arguably, not much you can do about curing the problem. It's a costly repair if contracted out and a massive job for the do-it-yourselfer, although, not unworkable. One of the oldest fiberglass boats surveyed by Ontario-based surveyor Jonathan Watson was a powerboat built in 1952. The bottom had gone "soft" due to a combination of fatiguing and a certain amount of resin hydrolyzation. This boat was successfully rebuilt by removing the damaged laminate layers and relaminating. [See DIY Summer '96 issue, page 6, for how to relaminate a hull — Ed.]

Blister repair methods and materials have greatly improved and can repair all but the most severely hydrolyzed hulls. Proper preparation of the hull — removing all damaged laminate, thoroughly drying the hull and correct application of a barrier coating — is the key to a successful, long-lasting blister repair.

[For information on drying hulls, removing gelcoat and applying barrier-coating materials, see DIY Fall '95 and Fall '96 issues — Ed.]

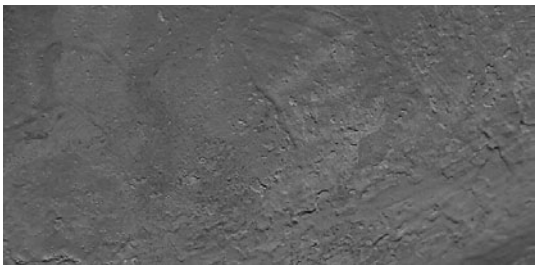
About the author: Roman Folk has spent more than 20 years as captain, navigator, crew and builder of power- and sailboats up to 45.6m (155') and has logged eight transatlantic voyages.

FAST REMOVAL OF BOTTOM PAINTS

Blasting antifouling paints away with non-toxic baking soda is an effective, non-abrasive alternative to sanding, grinding or applying chemical strippers.

By Don Campbell

After completing extensive repairs on the delaminated deck of our '74 vintage Alberg 30, *White Opal*, [see "Replacing a Soggy Deck," DIY 1998-#2 issue — Ed], our next step was to paint the bottom. After years of adding layers of sloughing antifouling paints, the



LESLEY G. CAMPBELL

Before: Years of applying sloughing-off, soft bottom paints have left a rough, bumpy surface.

After: Baking-soda blasting followed by a freshwater rinse leaves the hull ready for a finish sanding.

was anything but smooth, which surely affected the boat's performance. Friends had warned me that manual removal of bottom paints, by either sanding, grinding or scraping, was an arduous chore, painstakingly slow and not particularly healthy because of the amount of copper (cuprous oxide) contained in the material being removed. I considered sand blasting which cuts through the paint fast but can damage the surface resulting in hours of filling and fairing. In my search for an alternative, I discovered the Armex Accustrip System, a very passive blasting method that uses baking-soda crystals. It's a highly effective solution to removing paint.

The process of applying baking soda is similar to sandblasting. A high-volume, high-pressure air compressor is used to propel baking soda (sodium bicarbonate) from a metering system to a nozzle that allows the operator to direct the flow to the surface to be cleaned. It's the same baking soda used in the kitchen but the crystals are much larger, about 170 microns in diameter I'm told, and while this is still small, it's very adequate for the job at hand. (A micron is 1/1,000 of a millimeter or about 1/25,000 of an inch.) The velocity of the crystals passing through the nozzle can be varied depending on the surface material. For gelcoat removal, velocities of 720 km-h (450 mph) are often used. The energy to remove the paint comes from the crystal shattering rather than any abrasive action from the blasting process. Because of this, there is no scratching or roughing of the gelcoat, so the job is very kind to the surface. In fact, the particles are gentle enough to remove paint from an empty pop tin without denting the aluminum! Voids or osmotic blistering will break open and any liquid will be expelled.

The contractor I hired inquired about the available space at the boat site and surroundings. Because the boat was stored on a trailer at our farm,

with no close neighbors, no shrouding, drop cloths or extra precautions were necessary.

The application of sodium bicarbonate will change the pH in the soil, giving a faster neutralizing reaction than the application of calcium carbonate (lime).

Actual blasting of the 23.5sq.m (253sq.') area was completed in 2-1/2 hours, which allowed me to begin sanding the same afternoon. About 70kg (150lb) of baking soda was used. There was so little residue in any one place under the trailer that none could be scraped off the gravel driveway. Some of the grass along the edge of the driveway did die but this was probably from copper toxicity rather than the sodium bicarbonate. The flow of bicarbonate at the end of the nozzle was so light that one could not see any color change of the background due to white crystals coming out the nozzle. The only noticeable reaction was the receding paint line as the material was directed at the hull. The waterline paint had also been layered and as much of this as possible was removed by blasting; not a perfect job, but made sanding a much-reduced effort.

The author sanding with a random orbital sander and 80-grit paper to remove minute traces of bottom paint and smooth over blisters.

LESLEY G. CAMPBELL

Applying Interlux Watertite fairing compound.

This process is useful for any cleaning application that requires gentle handling or restoration of virtually any surface. Drawbacks of the process are few. If wooden blocks support depth gauge transducers, they will be eaten away by the process, the softer grain in the wood first. And certain epoxy coatings (i.e. Interlux 2000) are difficult to remove. When weighed against the benefits, namely speed and quality of the final finished surface, the payoff is worth the cost.

Preparation is minimal; whether you're sanding, grinding or blasting, the dust that coats surroundings must be confined, especially in marinas.

Final sanding was necessary to remove all traces of old paint and small blisters, taking about 10 hours each side with 80- and 120-grit paper plus another four hours sanding the waterline. Sanding time will vary with the surface conditions, osmosis damage and desired finish. Use extra care when working among heavy metals like copper. Wear plastic gloves, a suitable respirator with

proper filters, and coveralls sealed at the neck and cuffs. Wash work clothes separately from other laundry.

Fairing was done using Interlux Watertite (a fast-cure, two-part epoxy fairing compound) then the waterline was taped with 3M Long Mask and the hull coated with VC Tar then VC 17 antifouling paint. I found that Crown-Meakins 5mm foam rollers lasted twice as long as Simms brand with the VC products. Interlux recommends non-foam rollers for the job, but I found that foam rollers gave a very even surface for the VC Tar. Application time was relatively quick once the weather cooperated. You don't want rain on these products while curing, so I waited for good weather, which meant the painting was completed over three weeks. The waterline was then taped and finished with three coats of Sikkens yacht paint. Total time spent was 50 hours over five weeks.

About the author: After many years of dinghy sailing, Don and Phoebe Campbell purchased an older, in-need-of-TLC Alberg 30. His account of replacing their boat's totally saturated cored deck appeared in DIY 1998-#2 (Summer) issue.

DIY REPAIR BILL

The following is the cost to refinish the bottom of a full-keeled sailboat with a length of 6.9m (22'8"), draft of 1.27m (50") and 2.13m (7') beam at the waterline.

Blasting	$800
VC products	$500
Sikkens paint	$40
Rollers, sandpaper, tape, brushes, fairing compound	$150
Total	$1490

Notes: Cleaning several boats at one site at one time will lessen the cost per boat with most contractors. Add drop cloths to the above cost if cleanup is necessary. Check with the contractor to see if they have past experience with the surface to be cleaned. Do not blast off copper paints near a garden and be considerate of other's property within marinas and boatyards.

DOCKSIDE New Products

IDEAL SEALANT FOR BEDDING HARDWARE

Shop Tested

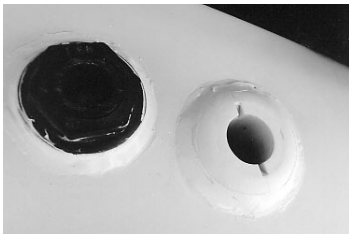
Deck fittings mounted by the boat manufacturer without any sealant caused water penetration into the wood core.

More is best when applying sealant to ensure you don't have any voids.

Moisture in the deck core is a serious problem that over time, can result in complete delamination (see DIY 1998-#2,"Replacing a Soggy Deck," page 17). Any fitting that passes through the deck or has drilled holes for fasteners, must be sealed to prevent water migrating into the laminate. Unfortunately, many production boats come out of the factories with minimal caulking and in some cases (our DIY test boat, for one), none at all. If you haven't already done so, now's the time to remove all thru-mounted hardware and recaulk either with a polysulfide (semi-permanent) or polyurethane adhesive sealant (most bond permanently); use the latter when removal is not necessary.

3M Marine Adhesive Sealant Fast Cure 4200 has all the benefits of a polyurethane sealant with the advantage that you can remove fittings and it cures fast: working time is about 10-minutes at 23.8°C (75°F). Plan on applying the sealant, mounting the fitting and finishing the job, one fitting at a time. In summer temperatures, it's tack-free in 20 minutes and reaches full cure in 24 hours. In cooler temperatures, Fast Cure 4200 stays tacky for up to two hours. Using a fast cure sealant means you can strip the deck of fittings and do all the prep in the morning, rebed by early afternoon and go boating at night and hopefully, get the job done without tracking uncured sealant all over the deck. Paintable and sandable, it forms a watertight and weather-resistant seal on hardware above and below the waterline.

Remove excess sealant with a putty knife then wipe with acetone.



To reseal fittings that are not accessible, such as baitwell thru-hulls or transom drain holes, remove old sealant, clean the surface with solvent, run a bead of sealant around the perimeter, then smooth with a tongue depressor or stick cut to a slight radius edge. A gloved finger dampened with water and run over the seam gives a smooth, uniform edge.

To rebed hardware, remove the fitting and clean both the mounting surface and the underside of the part to be mounted with solvent. Remove old sealant with a sharp chisel or sandpaper. Run a bead of sealant (use lots) around the cutout and fastener holes. Fittings with deep flanges will need plenty of sealant.

Tip: cut the cartridge nozzle at a 30° angle and apply the sealant by pushing, not pulling, ahead of the nozzle over the surface. Mount the fitting, fasten down, then scrape off excess sealant with a putty knife and clean with mineral spirits or other solvent that won't damage gelcoat or paint.

Fast Cure 4200 can be used on gelcoat, fiberglass, wood, plastics and metals and requires no primer. It comes in 88.7ml (3oz) tubes in white only, or 295.7ml (1/10gal) cartridges (US$12.95/CDN$15.95) in white and black. It's available at marine stores or contact: 3M Canada, Box 5757, London, ON N6A 4T1; Tel: (519) 452-6141, Fax: (519) 452-6550; 3M Marine Trades, 3M Center Bldg. 223-6S-06, St. Paul, MN 55114; North American toll-free number: (800) 3M-HELPS.

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Shop Tested

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most materials, other not-so-obvious uses could be sealing rivets and cracks in aluminum, a thread lock for nuts, repairing canvas tarps or sealing frayed rope ends. A mild-solvent formulation, Gloozit dries fast — tack-free in about 30 seconds — which means you can hand clamp the items you're gluing or wrap them with masking tape. It stays soft and pliable for much longer and reaches a full-cure in 24 hours. There is no special pretreatment of surfaces before gluing and clean up is easy with a sharp knife to trim the cured glue. Working with this glue is a lot less messy than other contact glues but it does produce the typical stringing. After more than a year's use, the little product remaining in our sample 90ml tube hasn't hardened, which gives this glue a longer shelf life than most. Made in the U.S., it's apparently only available in Canada. Contact: Burgess Chemical & Distributing, 38 Skagway Ave., Scarborough, ON M1M 3V1; Tel: (416) 264-4328, Fax: (416) 264-2784.

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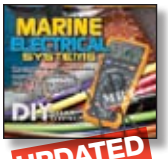

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A guide to expanding, upgrading, surveying and troublshooting your boat's AC and DC electrical system. All articles follow ABYC Standards.

Painting & Refinishing

The complete guide to painting and refinishing hulls, topsides and decks with marine coatings.

Launch & Haulout

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How to prepare your boat for spring launch and winter storage. Includes lay-up checklists, maintenance and lubrication guides, engine servicing, haulout guidelines, easy-to-build storage covers and more.

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Here's how to choose, install and operate equipment for your boat including: air conditioning and heating systems, audio systems, bow thrusters, davits, lightning protection, propane systems, refrigeration, windlasses and more.

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Weather to Go Boating

A Coast Guard proposal earlier this summer to cease broadcasting high-frequency (HF) weather forecasts, such as the "weatherfax" used by offshore skippers, has put the importance of accurate marine weather back on the radar screen of issues critical to boaters.

The Coast Guard collected comments over the summer on the need for high-frequency weather transmissions. Currently, their equipment is antiquated and it will take about $20 million to replace and upgrade it. These weather map broadcasts, which have been sent via radio signal for more than 80 years, provide valuable satellite images, sea surface temperature, and general marine forecasts. Data prepared by the National Weather Service is available via fax, e-mail, or using HTTP or FTP protocols. BoatU.S. has filed comments supporting continuation of these broadcasts due to their importance to boating safety.

The BoatU.S. Foundation always recommends that anyone going out for a day on the water check the weather forecast. Most often, boaters will get their weather forecast from the local TV or radio station and from NOAA weather broadcasts available on several dedicated weather channels on marine VHF radios.

But what else is out there? The Foundation decided it's high time to take a look and see what other marine weather resources are available, and how these new technologies are making weather information, well, more informative. Over the next few months, the Foundation staff will be testing a variety of products to see what provides the best information and at what cost. The results will be reported in an upcoming "Foundation Findings" article in early 2008.

In doing the preliminary research for this project, we were surprised to see just how many ways weather information is now available — over the Internet, through your cell phone, and, increasingly, integrated into marine electronics that utilize satellite radio reports.

Of particular interest are the very inexpensive cell phone options available from a number of software providers as well as many major cell service providers. For standard text messaging rates, you get very basic weather information such as current temperature, wind speed and direction, and anticipated weather events such as rain, based on the location you choose. (To try this, send a text to 466453. Type in the letter "w" then a space, followed by the city and state or simply the zip code.)

Other cell phone/mobile options for those devices that include Internet access are services which provide weather information on a subscription basis, generally priced in the $5-per-month range. There is even new software available specifically for the new "iPhones" from Apple.

If you have a Palm or Pocket PC device, you can have weather programs that get updated automatically, and even give alerts if a weather event is impending. One particular program which won the 2007 "Top Pick" for free-ware from *Smartphone* and *Pocket PC* magazines is the "Weather To Go" program from Tonaya Technologies Corp., which updates automatically and provides five-day extended forecasts for your location, or other locations concurrently if you travel.

For boats that go a little farther offshore and can't receive a cell phone signal, both major satellite radio service carriers also provide weather information, which is accessible through a variety of methods such as a computer connection or through newer models of marine multi-function displays and other stand-alone products. Several manufacturers include access to these reports. There are different levels of subscriptions, ranging in price from $10 to $100 per month. Some packages are designed specifically for anglers or sailors, for example, and have differing levels of information.

As the Foundation tests the products, you are invited to follow our tests. We will provide information and ask for input and suggestions on how and what we test using the Foundation Findings homepage BoatU.S.com/foundation/findings and the message boards on My.BoatUS.com. We also plan to show video clips of the testing to get you as close as possible to experiencing the real thing. ■

—By Chris Edmonston

BoatU.S. Foundation Boating Safety Grants Available

Applications are now available for the BoatU.S. Foundation's Boating Safety Grant Program which has a total of $50,000 available to small nonprofit organizations and groups around the country to fund projects that promote safe boating practices. The deadline to apply is Nov. 1, 2007.

Grantees can receive up to $4,000 each to fund innovative projects addressing boating safety issues specific to their local waterways. Past projects have included boating safety literature and signage as well as hands-on efforts such as life jacket exchanges and educational demonstrations.

Since 1988, the Foundation has awarded over three-quarters of a million dollars in boating safety grants to fund projects that promote safe boating on local waterways.

Grant guidelines, information, and applications are available at BoatUS.com/Foundation. The grants will be awarded in late January 2008. ■

BoatU.S. Foundation for Boating Safety & Clean Water

The BoatU.S. Foundation is a national 501(c)(3) nonprofit organization primarily supported by donations from individuals and grants. Please visit BoatUS.com/foundation for more information.

Good Boatkeeping

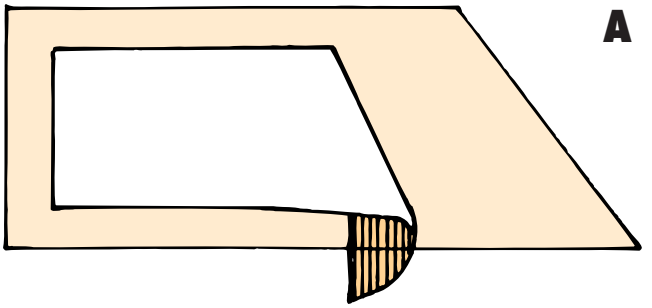
By David & Zora Aiken

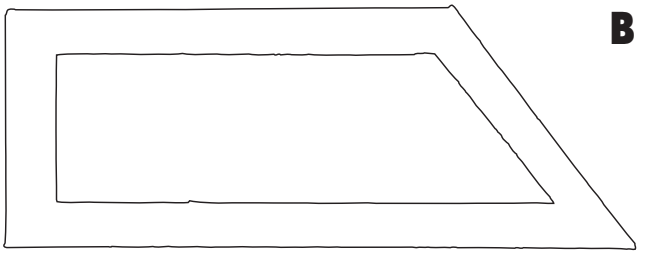
PERFECT PORTS

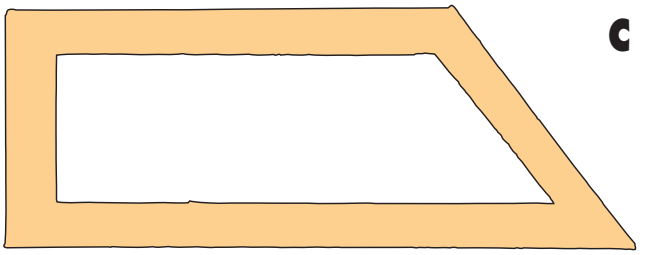
Whether you want some extra light in a stateroom or you need to replace the fixed ports in a wheelhouse, here's a way to make a neat job of installing non-opening, non-leaking Plexiglas or Lexan ports (herein referred to as plastic). Cut the opening, or remove the old ports. Make a pattern to use to cut out the new plastic ports, adding about 19mm (3/4") beyond the opening on all sides for fastening. From outside (where the port mounts) tape the new port in position. Working from the inside, make a mask for the center part of the port, covering the see-through portion (**A**). Use paper to rough cut the approximate shape, then tape the sides to the port neatly along the edge of the opening (**B**).

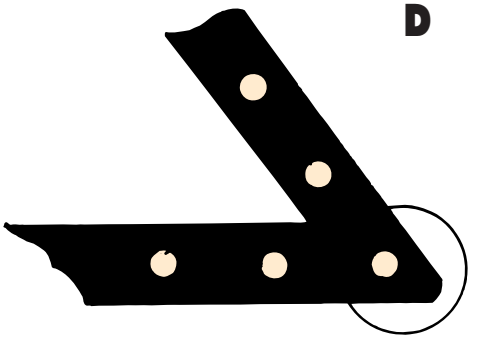
Remove the port from the opening. Spray paint the 19mm (3/4") border on the backside of the port (**C**). This is the "frame" where caulking and fasteners will hold the port in place. Use black paint, or whatever color might suit your installation. Buy an acrylic-based automotive paint; read the label to be sure it can be used with plastic (then test it to be sure). The goal is to have a neat, opaque painted surface visible from outside, rather than the usual messy look of caulking that may not have filled evenly or completely. Naturally, the paint must be sprayed before any screw holes are drilled, so all paint stays on the backside of the plastic, having no chance to drip through screw holes.

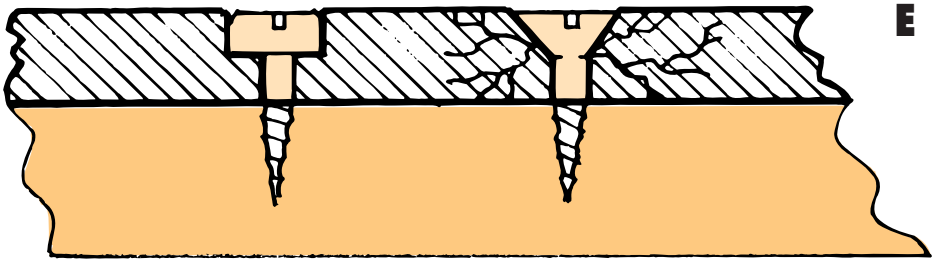
When the paint is dry, drill and countersink screw holes (in the non-painted side) at regular intervals all around the border (**D**). Install the port using clear silicon sealant and pan head screws that pull the plastic inward while keeping it flat so it won't crack (**E**). Don't use too many screws and don't overtighten; the sealant itself is a strong adhesive. Once the port is in place, the black border around the plastic will stay neat — since the paint is on the backside it can't get scratched or nicked and being opaque will hide any irregularities or dirt-catching voids in the caulking.











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