1999-#2

DIY boat owner

the MARINE MAINTENANCE MAGAZINE

Features

REFIT

A HEAD OF A DIFFERENT BLEND

Composting toilets were once only available for use in cottages and cabins. Now the same "head" technology has been sized for use in RVs and boats. Is it truly a viable zero-discharge alternative?

By David & Zora Aiken

MAINTENANCE

TEAK 101

What's the secret to great looking, long-lasting teak? Here's everything you need to know to refinish and maintain teak decks and brightwork like a pro.

PROJECT BOAT

FACELIFT FOR A CLASSIC CHRIS

New fiberglass deck, cabin windows, bow seat and hardtop extension give this '68 Cavalier a more contemporary look.

By Dwight Powell

STERN REFIT

Wanting a scoop stern, this intrepid owner added nearly 3' to his 27-footer.

By Rory Harley

Departments

Columns

Electronics

GEN-SETS — Selection, Installation and Options: Once you've accepted that a gen-set is right for your power needs, do your homework before you shop around.

By Kevin Jeffrey

Sailboat Rigging

Going Aloft: Two transatlantic sailors offer safe ways to prepare your equipment and crew for the trip up the mast.

By Paul & Sheryl Shard

Engine Troubleshooting

Drive Train Tune-up

Repacking A Stuffing Box: If your inboard's stuffing box is leaking, it's time to replace the packing. Here's how.

Drive Train Upgrade: Installing a flexible coupling on the propeller shaft can solve noise, vibration and shaft alignment problems.

Good Boatkeeping

Privacy Hatch:

This simple hatch refit provides the best of cabin comfort — privacy and light.

By David & Zora Aiken

TALKBACK Q&A

Eliminating Odors

Q: My boat's waste holding tank gives off a very nasty smell out of the vent. I've tried various deodorizing products and have had the tank pumped out several times. Can you recommend a product to remedy this problem?
Rick Jones, Troy, Mich.

A: Sealand has a product that installs easily in the vent hose to eliminate odors escaping from the holding tank. The Holding Tank Vent Filter contains activated carbon filtering material and is available in two sizes that fit 16mm (5/8") and 38mm (1-1/2") hose. Cost is US$79 and US$115 and includes hose adaptors and mounting bracket. For effective odor control, the company recommends yearly replacement.
— *Jan Mundy*

Propping to Match RPMS

Q: I have a 1988 Doral Cavalier with 4.3L 205 hp MerCruiser that seems under powered. With five people aboard, full water tank and three-quarters full fuel tank, it runs 3,500 to 3,900 rpm and I can't get the boat to plane. I adjust trim tabs and trim but there is no difference. Would a different prop fix this?
Colin Johnson, "Dock Holiday," Kitchener, Ont.

A: According to Lee Boyd of Mercury Marine, you should first check the accuracy of the tachometer by connecting a portable tach to the engine. The recommended operating range for your engine is 4,400 to 4,800 rpm. If the tach is okay, your propeller is in good shape (no nicks and dings) and your boat has always performed this way — if you haven't recently added extra weight or the engine doesn't need servicing — then a lower pitch prop may be in order. As every inch of pitch is worth 150 to 200 rpm, decreasing pitch should increase engine rpm. Boyd suggests buying a prop with 3" to 4" less pitch than your current propeller. The engine should gain 600 to 800 rpm, which is right where it should be. The lower pitch prop should help the boat plane quicker and have better throttle response.

Alternator Blowout

Q: I just installed a Balmar higher-output alternator and West Marine combiner on my Catalina 27. I checked the alternator using the pre-run tests suggested by the manufacturer, started the motor, went for a sail and everything worked perfectly. But a week later, the alternator no longer put out any juice. I checked that there was no magnetic field around the pulley bolt with the ignition on (there was a field when first installed). What would cause an alternator to fail and, I assume, blow out diodes?
Seth Horwitt, "Bay Gull," Alameda, Calif.

A: The main cause of alternator diode failure is breaking the output connection to the battery while the alternator is operating. A common way sailors do this is by turning the battery switch to another position while the engine is running. If you didn't do this inadvertently, it might be that a connection came loose. To my knowledge, there is no way a combiner could affect alternator diodes, since it simply connects battery banks together. Regardless of what the combiner was doing, the alternator output wire should remain connected to the house bank. Check with your combiner supplier. Your set-up should work, but a better method of dealing with keeping an engine-starting battery topped up is to use a Heart Echo-Charge. This device provides a small amount of current to the starting battery as needed, without using a battery combiner.
— *Kevin Jeffrey*

Cable Maintenance

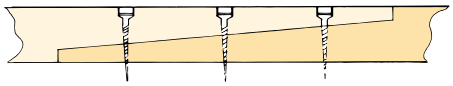
Q: The rack and pinion steering (single) on my '78 4.8m (16') Caravelle bowrider has become extremely stiff. I have dismantled the steering head and that is fine. It seems that the push-pull internal cable is sticking against the outer cable somewhere along its length. Disconnecting at the outboard seems to be extremely difficult.
Denis Grantham, Waterdown, Ont.

A: Stiff steering is a symptom. What you must do is determine the cause of the failure. Did water get in? Do the O-rings need to be replaced? Lack of maintenance and lubrication of outboard steering cables are the key reasons for stiff steering. Steve Auger, service training instructor for Mercury Marine, recommends lubricating cables every 100 hours of use in freshwater, 50 hours in saltwater. The transom bracket, which is part of the tiller arm assembly, requires maintenance and lubrication on the same time frame as cables. Manufacturers of earlier steering systems did not take a lot of precautions to ensure water didn't get between inner and outer cables resulting in corrosion of steel components. Actual

longevity for a steering cable is 500 to 750 hours, so I suspect yours is due for a replacement. DIY 1996-#1 issue has complete step-by-step instructions for replacing and servicing steering cables. If your cable isn't equipped with grease fittings, consider installing a Steersman Steering Guard. This mounts on the cable end and lubricates and seals the system.
— *Jan Mundy*

Cure for Sleeping Deck Butts

Q: The teak cap rails on my fiberglass trawler are about 15cm (6") wide and 3mm (1-1/4") thick, up to 2.7m (9') in length, and are joined with a very neat scarf joint. I applied nine coats of Epifanes varnish on these boards last summer and now the joints on the sunny side of the boat are showing varnish breakdown — the varnish has separated from the teak just at the joint. I suspect the teak (which is screwed to the hull) is expanding and contracting at different rates, cracking the finish over the joint and allowing water under the varnish. Would it help to widen the joint with a router to about 6mm (1/4"), and then apply a sealant? Other teak parts, hand rails, doors and trim, have stood up well.
Hank McClung, Schooner Cove, B.C.



Scarf joint for wood trim pieces.

A: The solution you propose is not unlike the joints on a teak deck. The wood is left with either a space all the way to the bottom, or a rabbet such as you suggest. A polyurethane or polysulfide marine adhesive sealant would create the elastic seal you are looking for. Perhaps you should rout the rabbet out, varnish the rail (including down into the rabbet) and then apply the sealant. That way the varnish is continuous over the edge.
— *Wayne Redditt*

Pot Heats But Smokes

Q: Within about 30 minutes after lighting the Dickinson Pacific diesel stove on our 9.6m (32') Farrel, ash accumulates and starts flooding the cabin and the outside of the boat via the chimney. Any suggestions?
K. Kozocari, Lady Anne, Port Alberni, B.C.

A: We assume that the ash you refer to is carbon and it's probably accumulating heavily inside the burner pot. According to Dave McIntosh of Dickinson Marine, the excess carbon can only be caused by the flame burning below the ring and inside the burner pot, blocking the burner air intake holes. The blockage of these holes causes the stove to "gasp" for air and this emits carbon or smoke under the stove and out the chimney. McIntosh

TALKBACK Q&A

says this is caused by: not enough fuel, the stove is operated too low, too much draft, the chimney is very long, or the combustion-assist fan is being used when not required or at too high a speed. Too much draft tightens the flame and pulls it down into the burner pot. For clean burning the flame must burn in the cemented combustion chamber above the burner ring. No flame should be evident below the ring when the stove is burning correctly. The solution is to thoroughly clean all the burner holes and keep the flame above the burner ring. These holes are situated on the side of the burner below the burner ring. There are four rows of holes, all 2.54cm (1") apart. The first row, which is about 2.54cm (1") up from the burner base is the most important. These are your primary air intake holes and they are angled down at 45°. To clean them thoroughly insert a nail, drill or bent wire from the inside and push up at a 45° angle.
— Jan Mundy

An Anode Too Many

Q: I have purchased a used 12m (40') aluminum cruiser that was kept in fresh water and has a bottom that has never been painted. I plan to use this boat in Louisiana brackish water and to haul every six months to clean as shipyard prices are very economical. The hull is adequately protected with magnesium anodes. Will applying antifouling (not copper base) paint help protect the boat from electrolysis? Considering the cost, I would prefer not to paint if not necessary. Would hanging extra anodes over the topsides while in a marina with stray currents help prevent electrolysis?
R.L. Broussard, "Prince of Tides," Houma, La.

A: Antifouling paint does not protect a boat from anything except aquatic fouling. Aluminum is very difficult to get coatings to adhere to because it oxidizes very quickly and aluminum oxide is very hard (it's used to make sandpaper). According to Jim Seidel of Interlux, primers such as Viny-Lux Primewash 353/354 are used to etch the metal and then Interprotect 2000E/2001ER is applied to establish a barrier to prevent oxidation and also to prevent electrolysis. It's possible to put too many zincs on a boat and actually cause a condition that looks very much like electrolysis and causes the same type of damage. The best remedy is to have someone who is experienced in solving electrolysis problems look at the boat and give recommendations specific to your boat on how many zincs should be used. Also, rivets and welds are usually not the same alloy that the boat is made of and you may see galvanic corrosion in these areas.
— Jan Mundy

Patching Holes in Fiberglass

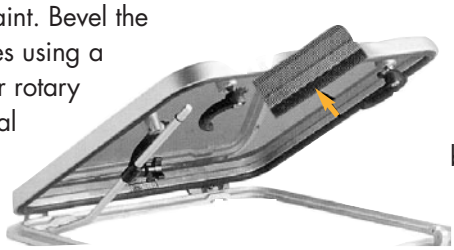
Q: As I clean up my 30-year-old Stamas, I now have quite a few screw and bolt holes, 6mm (1/4") in diameter and smaller, remaining after removing old lights, anchor mounts, horns, etc. These need to be filled, faired and painted. The plan is to fill the holes, sand the area, and repaint doing one area at a time. Then, much later, the whole boat will be repainted. I know that I can use epoxy, but is there another easier product?
Lee Beall, Trussville, Alabama
via email

A: For filling any holes, gouges, scrapes or dings, I highly recommend using 3M Marine Premium Filler, a simple-to-use vinyl-ester putty filler. It comes in a quart can and uses benzoyl peroxide (creme hardener), much like auto body filler. Applied with a putty knife, it dries in 30 minutes, then you can sand and apply color-matched gelcoat or auto-body touch-up paint. Bevel the edges of the holes using a counter-sink bit or rotary tool with a conical cutter (i.e. Dremel with bit number 192), before filling them. The bevel helps prevent the filler from separating and showing through the finish.
— Wayne Redditt

Finding Replacement Hatch Gaskets

Q: The large hatches in the main salon and V-berth of our Morgan 46 leak and are in dire need of new gaskets. Problem is that we cannot determine the manufacturer of our hatches. Do you know who made the hatches or where we can get replacement gaskets?
Melinda Carver, "Pegasus,"
via email

A: It's likely hatch manufacturer Atkins & Hoyle (Tel: 800-263-4184 or 416-596-1818) made your hatches as they did for many production sailboats built in the '70s and '80s. Replacement gaskets are available from Boat/U.S., West Marine and other marine stores. Look for closed-celled (so it doesn't absorb water) neoprene gaskets that are soft, much like the moldings on car doors. Many off-the-shelf gaskets are too hard and don't compress enough, causing the hatch to leak. Soft rubber gaskets provide a watertight seal, taking the shape of the sealing surface and compensating for hatches that are not level. These gaskets are more expensive (2.4m/8' for US$35) and available normally from hatch manufacturers in sizes from 9mm (3/8") to 19mm (3/4"). New gaskets are round and after two or three months take the shape of the sealing surface.



When purchasing, you'll need to know the thickness of the gap on the frame where the gasket installs (with glue). A too large gasket can stress-bend a frame, overload the hinges or the hatch won't close.
— Jan Mundy

TECH TIPS

TOUCHPADS ARE ON, EVEN WHEN OFF: In DIY 1999-#1 you printed a "Tech Tip" that all electronics should be turned off before starting your engine. Did you know that most touchpad electronic devices are always on, even when off? The touchpad connects to the power supply and sometimes, the processor. VHF radios, even those with on-off switches, usually have the power amplifier module connected directly to the DC wiring line. The solution is to have a master disconnect switch between your battery and your electronics. Turn it off when starting, then on to operate.
Larry Douglas, "M.Y. SEEKER," Sequim, Wash.

OVERCOATING LEAKING DECKS: We read in the Spring 1999 issue of *PassageMaker* magazine of a trawler owner who covered leaking teak decks with polyurethane truck bed liner paint. This is the stuff that's put on pickup truck boxes to protect the metal. Apparently it works!

STAINING BARE TEAK: If you don't like the look of bare teak but don't want to use an oil or varnish, sand lightly and apply an exterior oil-based stain. As the wood weathers, a touch-up with stain is all that's needed to keep the color fresh.

WASH UP, THEN CLEAN UP: Hand cleaner removes grease, tar, paint, adhesives, ink and other grime from not only hands but most hard surfaces as well. Use a petroleum-free cleaner such as Gojo, a solution containing d-Limonene, alcohol, natural oils and pumice. Squeeze it on, add water, rub and rinse well. Don't let it dry without rinsing — it will strip paint.

YELLOW MELLOW: Over time, certain gelcoats will turn yellow after an application of Teflon polish that doesn't contain wax or UV blockers. Teflon yellows naturally so read the label before purchasing.
Adam Boulay, Beverly, Mass.

CHAFE GUARD FOR HOSES: When routing hose through a bulkhead, floorboard or locker, drill over-sized holes then wrap a section of slightly oversize tubing over the hose and lock in place with wire ties or cable clamps.

CUT, RATHER THAN COIL: Many boaters coil radio frequency coaxial cables rather than cutting them to length and installing a connector. Coiling wires creates an inductor which opposes the signal trying to get from the antenna coupler to the receiver. When a manufacturer warns against cutting the coax, make large coils instead and space them away from each other but not near metal rails which, naturally, detune the wire causing serious problems when transmitting.
Larry Douglas, "M.Y. SEEKER," Sequim, Wash.

ISOLATING MAST METALS: Always use silicone sealant, zinc chromate paste or LanoCote when installing stainless steel fasteners to prevent the electrolytic action that occurs between stainless and aluminum spars.

READ GAUGES AT A GLANCE: When the engine is up to operating temperature and pressures are normal, mark the edge of the gauge bezels adjacent to the pointer position with a dot of paint, nail polish or tape.
Mel Smith, "Archimedes," Whitby, Ont.

BATTERY CHECK: When was the last time you checked the water level in your batteries? Check the electrolyte level at least twice a month during the boating season. If water levels decrease so the top of the plates are exposed you've lost irreversible battery capacity.

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 E-mail to info@diy-boat.com.

ShopTalk

REPAIRING WOODEN TRIM PIECES

Repairing chafed rubrails, dinged trim or filling of fastener holes after removing hardware is easy. Here's how.

By Wayne Redditt

There has been a trend over the past several years to eliminate wooden trim on the exterior of many fiberglass boats. This is in response partially to customer wishes — the desire to reduce maintenance tasks. Older boats that have various wooden trim bits usually end up requiring, besides the frequent varnishing or oiling, some occasional repair work. Some of the repairs likely to be encountered are chafed rubrails, dinged hatch trim or filling of fastener holes after removing hardware.

Identification of the wood is an important first step if the trim is finished with a transparent stain, varnish or oil. Painted parts do not necessarily have to be repaired with the same species of wood. Trim parts are typically made of teak or mahogany. Teak is golden brown to dark brown and darkens with age. It has a characteristic spicy odor, a waxy feel when sanded and coarse texture. Mahogany varies in color from light yellow brown to dark reddish brown. Grain is variable and growth rings are usually distinct. It darkens with age and may be indistinguishable from teak when weathered. Sanding the wood to reveal fresh material under the weathered surface will usually be sufficient to identify the type of wood.

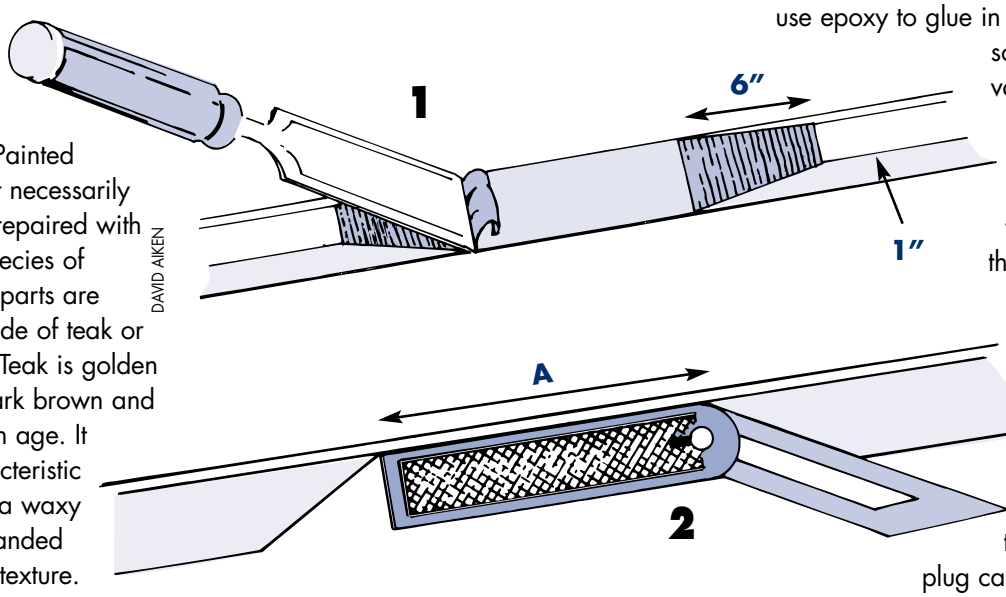
STEPS TO EXPERT RAIL REPAIR

STEP 1 Remove damage and bevel ends with a length-to-thickness ratio of 6:1.

STEP 2 Carefully measure dimension "A" and use bevel gauge to transfer angles to repair piece.

STEP 3 Glue repair piece into place with thickened epoxy or adhesive sealant (i.e. 3M 4200). Don't attach fasteners through scarf ends, as they will split. Rather, use masking or duct tape to apply clamping pressure if needed. Plug fastener holes.

STEP 4 Shape with a block plane or spoke shave followed by a sanding block until profiles match.



DAVID AIKEN

Filling Screw Holes

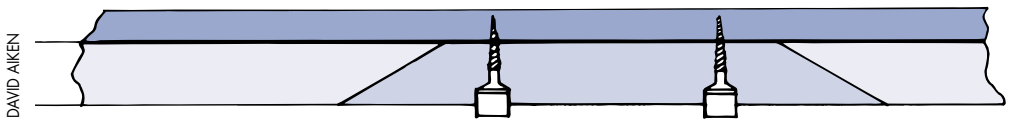
Let's first consider something really simple like filling screw holes after hardware removal. The easiest method is to pack the hole with colored filler that matches the wood. A more permanent and effective repair is to drill counterbore holes and insert a matching wood plug (called bungs by some repairers). This job requires a plug cutter. Available from Lee Valley Tools, The Woodworkers' Store and other specialty tool suppliers, this tool allows you to use scrap wood to produce filler plugs. The most useful size is 3/8" and although it works best in a drill press, it may be used in a hand drill, held firmly so it doesn't jump when starting.

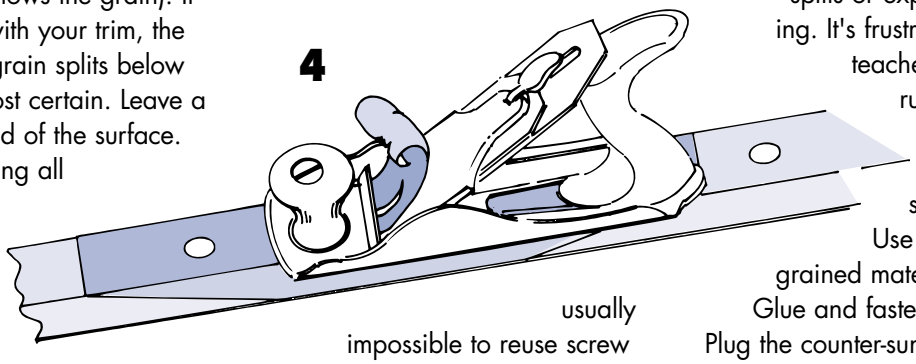
Enlarge the hole to accept the plug using a 3/8" counterbore, Forstner, spade or twist drill bit. Drill a very shallow hole, usually 1/4" to 3/8" deep, for the plug. Since this is an exposed piece of exterior trim, use epoxy to glue in the plug. [Ed — some prefer using varnish or oil to facilitate removal.] Mix a small quantity of slightly thickened epoxy, prime the hole by applying glue with a small toothpick, soak the plug in the epoxy, then press the plug carefully into the hole, aligning the grain of the plug and the wood. Don't pound the plug with a hammer. Compressed wood has a tendency to swell if the moisture content changes. This causes plugs to pop out proud of the fin-

ShopTalk

ished surface later. Rather, push it in firmly but gently.

Let dry overnight and remove the excess with a chisel or a flush cutting saw. This operation causes its fair share of anguish. Use an extremely sharp chisel. Start about half way on the exposed plug, working with the grain. Give the chisel a sharp rap. In most cases the resulting cut is angled (it follows the grain). If you started flush with your trim, the potential that the grain splits below the surface is almost certain. Leave a small amount proud of the surface. Sand flush, removing all traces of the epoxy ring that formed around the plug. Apply a stain or coating to complete the repair.





Splicing Rails

Replacing a damaged section of rubrail or gunwale with a new trim piece is likely the most difficult to do. Short sections of wood (the repair pieces) usually do not readily bend and workmanship is important to conceal this repair.

Begin by deciding how much of the old rail must be removed. If it's rot damage, remove all signs of decayed wood. This can be surprisingly extensive. If the wood has split or splintered from impact damage, determine what is salvageable and remove the rest. Carefully remove the fasteners and survey the underlying material. Plug the holes with wood plugs or an epoxy filler mixture; it's usually impossible to reuse screw holes in fiberglass.

The collection of curved surfaces on boats can lead to difficulties when splicing in short sections. The shorter the piece, the more difficult it will be to bend to the original shape. You could make the repair piece long enough to allow you to bend it in place without undue stress at the joint or the fasteners. If a shorter piece seems a better approach, you can cut the piece to shape with a band, jig or scroll saw.

End splices should be fairly long, with a length-to-thickness ratio of about 6:1, in order to provide sufficient long-grain gluing surfaces. Shorter splices or butt joints will not remain glued for long. Feather both ends to the outside of the rail.

Pre-drill all countersinks and pilot holes for the fasteners. Dry fit before final assembly with epoxy glue. Any defects in the wood will surely tell now. Often the repair piece splits or explodes when bending. It's frustrating, but it sure teaches you about grain run-out and orientation, as well as the effects of shakes and checks. Use the least straight-grained material you can find.

Glue and fasten the new piece. Plug the counter-sunk fastener holes using wood plugs. Orient the grain so that it is parallel to the grain of the wood in the repair. Push the plugs in firmly, after thoroughly wetting the hole and the plug with epoxy.

Use a block plane, spoke shave or chisels to contour the edges to match the original part. Sand and fair the repair until the profiles are identical. Stain and finish, making sure to first mask off all adjacent areas to avoid extending the repair zone.

The repair should be unnoticeable to the casual observer. Painted repairs of this type should escape detection altogether.

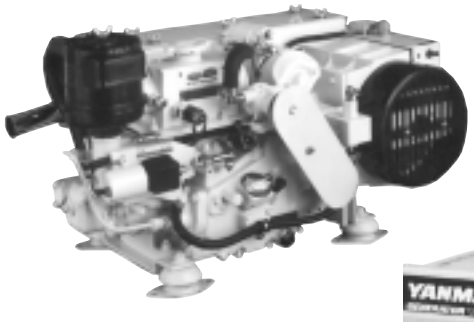
About the author: Wayne Redditt teaches boatbuilding, repair and restoration at Georgian College's Marine Technology-Recreation course in Orillia, Ont.

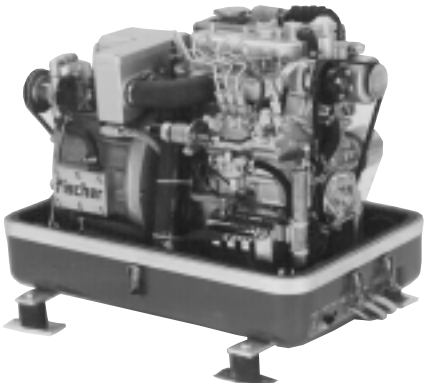
ELECTRONICS

GEN-SETS: SELECTION, INSTALLATION AND OPTIONS

Once you've accepted that a gen-set is right for your power needs, do your homework before you shop around.

By Kevin Jeffrey





Top, clockwise: Next Generation 3.5kW, Yanmar, Kohler, Fischer Panda 7.8kW.

I f you have a large AC electrical load and spend time away from dockside shorepower, you'll probably need to look beyond the capabilities of DC-to-AC inverters and start investigating gen-sets. Even if a properly sized inverter is capable of handling your load, the charging system needed to replace battery drain may be impractical.

A good example of an AC load too large for most inverter installations is air conditioning. The instantaneous AC current draw from air conditioning ranges from fairly modest to high, depending on the BTU rating of the unit. But it's not the current draw that creates the problem for inverters, which can comfortably handle large loads such as microwave ovens, toasters and coffee makers. The problem lies in the length of time and the time of day air conditioning is normally operating. Air conditioning runs for long periods of time and is used primarily at night, when charging sources have a tough time replenishing the battery drain. Large AC loads that run for extended periods of time generally require an engine-driven AC power source, the most common option being a diesel- or gasoline-fueled gen-set.

Gen-sets use two primary pieces of equipment, a rotary AC generator and a matched diesel- or gas-fueled engine. For the sake of efficiency, a gen-set's engine is properly sized to do the job required, usually with little or no wasted capacity, but you can increase the overall system efficiency dramatically by using an inverter along with the gen-set: use the gen-set to power large or constant AC loads, then use an inverter to power smaller or intermittent AC loads.

Selection

Equipment weight and size are important considerations for boaters, especially those with light displacement craft, and cost is a universal concern. Gen-sets can be big, heavy and expensive to purchase and to install, but don't let that deter you from considering one. There are compact units on the market that are reasonably priced and relatively lightweight, ideal for those with modest size boats.

An ideal gen-set would be lightweight, smooth, quiet, fuel-efficient, powerful, low cost, reliable, and would fit in a spare locker. Since it's difficult satisfying all of these requirements in a single unit, you'll need to establish an order of importance for your situation. If high power and low cost are your priorities, you may end up looking at models that are heavy, bulky and only moderately quiet. If silent operation, lightweight and compact size are the top requirements on your list, you'll undoubtedly have to pay a premium price in terms of dollars per kilowatt (kW). It's best to determine what characteristics are most important for your situation before you shop around.

The first thing to determine is fuel

ELECTRONICS

type. It's logical to choose the fuel that powers your auxiliary engine. Diesel is the marine engine of choice as it tends to last longer and be more fuel efficient, yet it's typically more costly to purchase and repair. If you are considering a gas-fueled model make certain it's approved to operate in a gasoline atmosphere — proper venting and exhaust are crucial for a gasoline engine used below deck as well as a carbon monoxide detector, as required by ABYC.

Gen-set engines vary in how many cylinders they have. Many of the small, high-speed models use Farymann or Yanmar single-cylinder engines, which are surprisingly balanced and relatively quiet. Kubota, Mitsubishi and Yanmar two- and three-cylinder engines are also popular for modest sized gen-sets. In general, three- and six-cylinder engines tend to be the most quiet and have the least vibration.

Electrical generators on gen-sets have magnetic poles that create AC power when they are rotated by the engine shaft: 1,200 rpm for 60Hz, 1,000 rpm for 50Hz gen-sets usually have six-pole generators; 1,800/1,500 rpm gen-sets usually have four-pole generators; and 3,600/3,000 rpm gen-sets usually have two-pole generators.

Industry standard gen-sets such as those from Kilo-Pak, Kohler, Northern Lights and Onan are made to run at 1,800 rpm for 60Hz output, 1,500 rpm for 50Hz output. Large gen-sets (over 20kW) using six pole sets in the generator run at 1,200/1,000 rpm, while the compact gen-sets from Entec West, Fischer Panda, HFL and Mase are designed for high-speed operation at 3,600/3,000 rpm. Relative newcomers to the field are the compact models from Next Generation Power, which operate at a mid-range speed of 2,800 rpm. The 1,800 rpm proponents claim lower noise and longer engine life, while the manufacturers of high-speed models claim they've designed their units accordingly and can produce more electrical power for a given weight and volume by using high-speed diesels.

Gen-set prices vary widely, mainly because the high-speed, low noise units are so much more expensive. Prices range from US$8,000 to US$13,000 for 4kW to 5kW units installed with soundshield, US$11,000 to US$16,000 for 8kW units installed with soundshield.

Soundproofing

All gen-sets make noise, but some manufacturers have gone to great pains to make their units run as quietly as possible. Next Generation claims its mid-speed models are as quiet as the 1,800-rpm units, without

TABLE 1 DECIBEL EQUIVALENTS

Diesel engine room	**120**	Aircraft take-off @ 200'
	110	Rock band, Table saw
Diesel generator @ 3'	**100**	Car horn @ 16'
	90	Heavy traffic
Most diesel generators with soundshield @ 6.5'	**80**	Electric shaver
	70	Average radio
Fischer Panda generator @ 6.5'	**60**	Normal conversation

the need for sound enclosures as with the high-speed units. Compare decibel ratings of the various units on the market (**Table 1**). If noise is a big concern, choose a model with a good soundshield, or have a soundshield made (hard case or soft-sided) to help insulate gen-set noise from the rest of the boat.

While it's true that gen-set noise varies widely, I feel all engines on board need to be soundproofed if you're going to enjoy your time on the water. Most of the high-speed models use water cooling in both the engine and the electrical generator itself, allowing the gen-set to be completely enclosed in a well-insulated, soundproof box.

Power Rating & Efficiency

Power ratings for gen-sets begin in the 2.5 to 3kW range, and continue up to 20kW or more. The most common gen-sets for pleasure craft are in the 4 to 12kW range. Gen-sets achieve their rated power at a given engine speed necessary to produce the required AC frequency; engine speed remains fairly constant, regardless of electrical load. Even though the actual load on the engine is related to how much electricity is being used, running a gen-set to satisfy a small AC load is inherently inefficient. Some gen-set manufacturers (notably Balmar) have embraced what is known as VST (variable speed technology). Gen-sets with VST adjust their speed according to electrical demand, while maintaining the correct AC frequency and waveform. These models cost more, so you'll have to decide if you can afford the extra efficiency.

Cooling & Exhaust Method

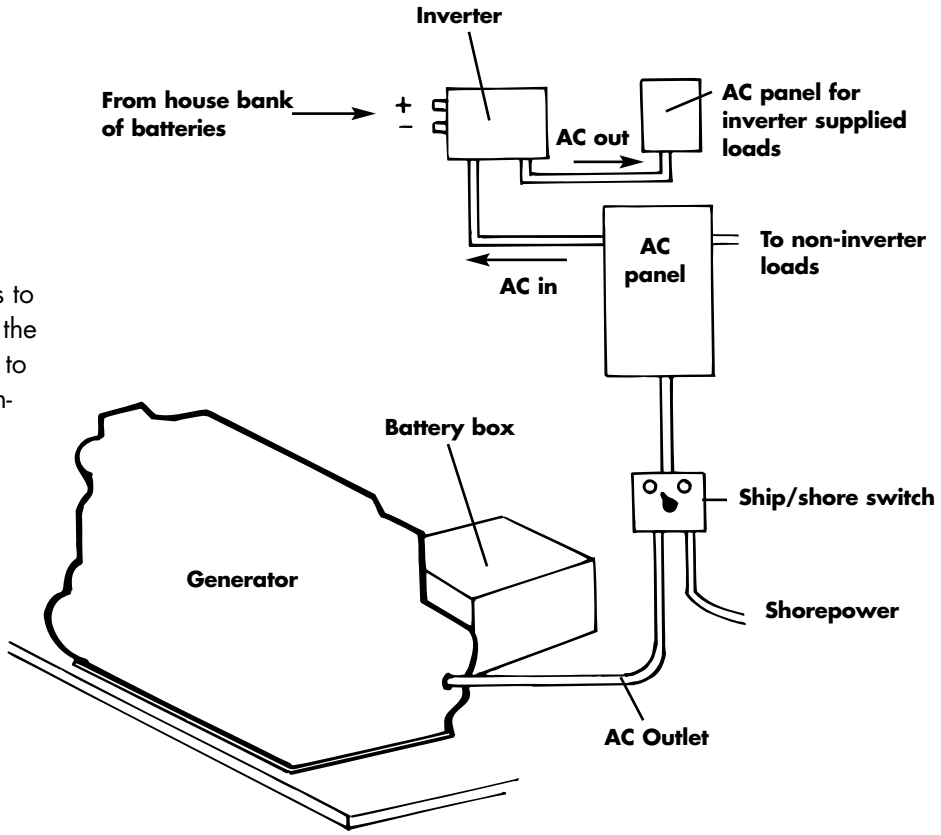
Most marine gen-sets are water cooled with two separate cooling circuits. One circuit pumps seawater from outside the boat, up through a heat exchanger, and back overboard. The second circuit pumps freshwater from the heat exchanger, through the engine block and exhaust manifold, and back to the heat exchanger. Many of the high-speed gen-sets incorporate an additional cooling loop in the generator itself, which increases efficiency and allows the unit to be completely enclosed in a soundshield without worry of overheating.

Some gen-sets installed in monohull sailboats are "keel cooled." In this type of system a cooling pump moves freshwater through a cooling grid on the bottom of the boat. You'll still need a seawater circuit (intake, pump, siphon break etc.) if you want to have a wet exhaust.

Engines on pleasure vessels usually have a wet exhaust to dampen the exhaust noise. Dry exhaust systems are more appropriate for workboats, although there are devices that separate the water and exhaust air before they exit the boat, eliminating that tedious splashing sound of wet exhaust outlets just above waterline [Ed — refer to "Wet Exhaust Systems," DIY 1999-#1 issue.]

TABLE 2
TYPICAL INSTALLATION WITH AN INVERTER

Output from generator goes to a ship-to-shore switch up to the AC panel which then leads to an inverter and to a subpanel for non-inverter loads. This isolates heavy loads from the inverter. A subpanel connects to the inverter for devices with low power demands.



DAVID AIKEN

Installation

Any marine engine should be mounted on a well-reinforced platform using rubber isolation mounts. Some gen-set suppliers offer "hydrolastic" mounts that provide the ultimate in vibration resistance. Check with your dealer for his/her recommendations on platform material selection, thickness and reinforcing.

For wet exhaust systems, plumb raw seawater through a strainer and into the engine's heat exchanger, then into the exhaust piping; exactly where depends on how the gen-set sits in the boat. If the point where the cooling water is injected into the exhaust is less than a foot above the waterline, you'll need a vented loop (siphon break) to prevent seawater from siphoning back through the raw water pump after the engine is shut down. Never use a scoop-type water intake on the outside of your hull, since this can inadvertently force water past the raw-water pump, into the muffler, then on into the exhaust manifold and into the engine cylinders. You'll need to have a good diesel fuel filter/water separator installed in your fuel line, and a separate battery for starting your gen-set. See **Table 2** for a typical electrical set-up; for complete installation procedures, refer to the instruction manual supplied with your gen-set.

Make sure to plumb a loop between the muffler and exhaust outlet. This loop should be at least 30cm (12") above the loaded waterline. An alternative to this type of arrangement is to use Soundown's Waterdrop Silencer or a Gen-Sep from Northern Lights, which separates exhaust and water before they exit the boat, eliminating splashing or pulsating water flow at the exhaust outlet. [Ed — see "Silent Exhaust" in DIY 1999-#1 issue, page 34, for a complete description and schematic.]

Options & Accessories

Gen-sets are designed to maintain starting battery charge. Additional safety and monitoring equipment includes start/stop panels, engine hourmeters, AC and DC electrical meters, ship/shore switches and carbon monoxide detector. Automatic controls can be installed to shut down the engine on high exhaust temperature, engine overspeed, low water level and low oil level.

Some gen-set manufacturers mate their engines with a high-output DC generator to provide high-capacity battery charging instead of AC output. This option works well if all of your AC needs can be supplied by an inverter, but don't consider this system for air conditioning — that load is simply too large and on too long to make this set-up practical.

About the author: Kevin Jeffrey works as an independent electrical power consultant and is the author of the "Independent Energy Guide" and publisher of "Sailor's Multihull Guide," now in its second edition.

A HEAD OF A DIFFERENT BLEND

Composting toilets were once only available for use in cottages and cabins. Now the same "head" technology has been sized for use in RVs and boats. Is it truly a viable zero-discharge alternative?

Story and photos by David & Zora Aiken

"There have to be alternatives." The comment prompted unanimous agreement at a dockside discussion on the frustrations brought by heads, holding tanks, no-discharge zones, prohibiting of Type 1 MSDs (Marine Sanitation Devices) and lack of pump-out stations. There must be alternatives.

Sun-Mar has one. For some time, the company has manufactured composting toilets for use in cottages and cabins located where ordinary plumbing is not an option. Now the same toilet technology has been sized for use in RVs and boats: the Ecolet (Ecological Toilet).

Is it truly a viable alternative? The only way to find out is to try it.

The Composting Process

Many people are familiar with a garden compost pile — that mound out back where the vegetable peelings, overripe fruit, eggshells etc. are tossed in a random stack and eventually (with the help of the neighborhood worms and microcreatures) the mound becomes dirt, a special kind of dirt.

In the composting toilet version of this same process, toilet paper and human waste breaks down (with the help of some moss and microbes) and becomes dirt. The right combination of peat moss, soil, air, heat and moisture transforms toilet contents into "an inoffensive earth-like substance" — usable stuff that could be used in the garden without concern about dreaded diseases.

What are the microbes and where do they come from? They are microorganisms or bacteria found in topsoil and peat moss, "good germs" that activate the breakdown process. (For instance, Sun-Mar offers a Microbe Mix to add to the peat moss mixture in the composting toilet.) The moss itself can be purchased from a local nursery.

Three-Chamber System

A composting toilet is far removed from old-fashioned backhouse technology. The basic principals of cover-up and break-down may be shared, but there the similarity ends.

Inside the Ecolet's box design are three separate chambers. Positioned just under the toilet seat is toilet number one; a "hatch" in the top is open to accept waste. Most of the composting is done in this top chamber, which is not only a receptacle but also a drum. Here, the composting process is started with a mix of soil, peat moss and water. The chamber holds heat (a necessary requirement for good composting), and the drum is turned occasionally to mix and aerate the contents (oxygen being another requirement). When the drum is turned, the top hatch closes automatically. Later, after composting has taken place, the drum is turned in the reverse direction; the hatch opens to allow the partially composted material to fall into the second chamber, also known as the finishing chamber. Obviously, this is where the composting is completed.

Sun-Mar Ecolet composting head -- no holding tank, no pump outs, no odor, no head chemicals, no thru-hulls -- just a cup of peat a day.

No liquid enters this drawer, and drying air circulates around it. The drawer is emptied whenever it's necessary to make room for more compost from the drum. Pull out the drawer and empty it in a garden or garbage bag. There is no smell to the finished compost.

The function of the last, lower

chamber is to collect the excess liquid, which then evaporates with the help of a 10-amp, 110-volt heating element. A low-draw, .33-amp,12-volt fan installed in the vent stack, runs continuously pulling air (evaporated liquid) out of the chamber, up the vent stack (which is attached to the rear toilet), and out of the boat via a vent on deck or wheelhouse top. A topside exit is also an option but you must avoid sharp bends and is installed with a gooseneck or loop above the waterline. Regardless of the exit point, the system must be watertight; adding saltwater kills the compost mix, freshwater just makes it wetter.

Original head compartment required moving bulkhead and reshaping floor to accommodate larger Ecolet. Instructions for building the curved locker shown on the left appeared in "Good Boatkeeping," DIY 1998-#4 issue.

The coast guard-certified Ecolet is made in two styles: the basic box and a model with a 45° bottom section to fit against the hull side. Of necessity, the Ecolet is considerably taller than a standard toilet; seat height is 73.6cm (29"). However, the design includes a fold-up (and down) footrest to help ease the seating comfort factor. Recommended capacity (number of people using toilet) is three to four persons for weekend or vacation use and maximum two for liveaboard.

Odor-Free Stack Venting

Whenever alternative toilets are discussed, the first and greatest concern is odor. In the case of the composting toilet, where does all of the odor go? With an ideal composting process, there will be no odor. If it's less than perfect, any odor will still go up the vent stack and out of the boat. Surprising but true — we notice no smell inside the boat. As part of the venting system, filters are placed in the fan box, so the departing air is forced through two types of filtering material before it exits the boat.

One of the filters is Zeolite, the other activated carbon. The Zeolite absorbs ammonia, and the other filter removes substances other than ammonia. Each is encased in its own bag, to be placed (and easily replaced) in the vent fan box. These filters help to ensure continued friendship with dock neighbors, so timely replacement is essential.

The Zeolite filter material can be "recharged" by soaking in saltwater for a day, rinsing, and drying in the sun. Keep an extra bag on board for replacement time so the vent stack will not be left without a filter.

The carbon filter cannot be recharged, so add it to your list of spares.

A Cup or Two A Day

Now that the chamber theory has been explained, here's the basic how-to of actually using this toilet. Fill the drum with a mix of 1-1/2 to 2 gal of peat moss and a quart of topsoil. Moisten with warm water and add a compost starter, if you wish. Every time the toilet is put to major use (i.e., a solid waste deposit) add another cupful of peat moss. (Increased usage requires a heavier, bark-type mulch.) Every third day rotate the drum four to six revolutions to mix and aerate the compost. As the chamber fills (and

Overflow hose for excess liquids connects to a holding tank.

the contents break down) do the backward drum rotation, which drops residue (the earth-like substance) into the finishing drawer. About every eight weeks, depending on the usage, empty the drawer.

HEADS

Installation

Since the Ecolet is such a departure from a standard toilet, it's important to measure the available space very carefully. To help you determine the best location and orientation, make a rough model using corrugated cardboard. You'll need 30.4cm (12") of clearance for the footrest to fold down and for the drawer to pull out.

Measuring 50cm (19-1/2") wide and 58cm (23") deep, with a footprint of 27cm by 47cm (10-3/4" by 18-1/2"), the Ecolet should fit without remodeling on most boats over 10.5m (35'). On our boat, we rearranged and enlarged the head compartment to give us more room for storage and a shower. Luckily, a small hanging locker (the kind that's never used) was located next to the head; removing one bulkhead opened up nearly a foot of additional space — just enough to allow removal of the "finishing" drawer. Portions of the sole had to be restyled and fiberglassed to provide a solid flat base for the toilet.

(Left) Angled vent stack directs air (evaporated liquid) out of the head via a clamshell vent on deck. (Right) A rubber coupling (after the fan box) facilitates disassembling the pipe and box for servicing.

While the cardboard model is in position, decide where the vent stack will exit. Consider the location with the least possibility of seawater entering the stack.

In many installations, the stack will extend straight up from the Ecolet. In our case, the toilet is not

touching the hull side, but is inboard a bit. We wanted the vent to exit off to the side, so the vent stack is angled. We also measured wrong and had to add an extra coupling at the bottom.

Once the toilet location is determined, install the hold-down brackets (supplied). Place the Ecolet in position and connect the overflow hose (in case of excess liquid) to a holding tank; a 2-gal jug would suffice as the unit has a 2.5gal capacity. Cut a 7.6cm (3") hole in the deck-

Tip-out locker stores peat moss handy for frequent dosages.

head for the vent stack, and assemble the stack, fan box and filters. (You'll need a Robertson (square) screwdriver to install the filters.) Connect the wiring for the 12-volt fan (with an in-line switch) and lead the 110-volt plug to an outlet that is protected with a ground fault circuit interrupter.

When taking measurements for positioning of the toilet, check the width of the hatch entering the cabin and also the width of the head door frame. In our boat, we had to remove the door and cut away a portion of the frame so the Ecolet would fit through the opening.

The outside vent must allow adequate air movement but prevent seawater from entering. We used a low-profile clamshell deck vent available from most marine stores.

Our vent stack installation includes a rubber coupling section not supplied by Sun-Mar. Because of

HEADS

the tight quarters in the head, as well as the need to remove the fan box occasionally to change filters, the rubber coupling was used to make disassembling the pipe and box easier.

To keep a small amount of peat moss handy, we built a tip-out bin into one of the head lockers. A covered 1 gal plastic bucket or trash basket would also be practical. Keep a plastic cup in the corner to use when adding peat.

All told, the enlarged head compartment doesn't intrude on the salon and the new tongue-and-groove bulkhead that closes off the head from the main cabin adds to the decor. Installation is easy and takes a day provided you've done your homework, measured properly and have all the necessary tools, extra fittings and hardware handy.

Both the straight-back and sloped-back models sell for US$999/CDN$1255 and includes all necessary hardware and fan box with filter material. An optional 12-volt heating unit is US/CDN$75 and shipping by UPS costs $30 to $50. You'll need to add a deck vent and we replaced the supplied corrugated hose with a plumbing collar that fits the vent stack to simplify removal of the fan box.

For more information contact: Sun-Mar, 5035 N. Service Rd., C9, Burlington, Ont. L7L 5V2; Tel: 905/332-1314, Fax: 905/332-1315, Email: compost@sun-mar.com.

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 10.5m (35') Chris-Craft sloop berthed in Grasonville, Maryland.

IS A COMPOSTING HEAD FOR YOU?

A letter from a DIY reader last spring prompted us to investigate the Sun-Mar Ecolet toilet. He was converting a fishing boat to a cruiser and couldn't find anyone who had boat-tested this unit.

The Ecolet is not every boater's cup of "peat." While its bulky shape is a departure from the traditional throne, size shouldn't be a concern for boats with a 1.2m (4') square or larger head compartment. Most probably, it's the "outhouse" image that some boaters may find unpleasant.

Nonetheless, if you boat in a zero-discharge area, the Ecolet may be a workable solution to the holding-tank-pump-out problem for large sailboats, cruisers, houseboats or trawlers. Provided the boat is capable of generating 110-volt power (shorepower, gen-set or inverter) it's a totally self-contained system: there's no holding tank to empty; a completely odor-free cabin (there's nothing more repulsive than a ripe holding tank), you don't need to carry head chemicals which, at best, only mask the odors; peat moss is lightweight and storing it shouldn't be a problem on most boats; and as wood fibers apparently bolster the mix, one can use as much toilet paper as desired.

The 12-volt fan pulls all the odors out the stack through the deck vent. When the Aikens first installed the Ecolet, the fan didn't have a filtering system. This did not make for affable neighbors. Installation of the Zeolite and carbon filters substantially reduced the odor which is no more objectionable than odors emitted from a holding-tank vent when the wind blows into the cockpit. As for changing filters, which should last a long time depending on usage, this can be a nasty job; to contain odor it's recommended blocking the lower vent and stack. The Aikens used this toilet for a month before writing this article and haven't had to empty the compost tray. Their peat moss locker holds about 1 gal and lasts about three weeks.

I doubt the Ecolet system can handle a liveaboard family of four, but should be able to sustain two people cruising with occasional guests. While away from the dock, boats with limited power would probably run the heating unit (evaporator) less and collect the liquids in the overflow holding tank. Actual capacity of the holding tank depends on usage: Sun-Mar recommends a 5-gal tank for occasional use; 10 gal for cruising. The company also advises having a power back-up, such as solar panels, or a wind or water generator. In the event of a power loss, there's no exhaust, which can cause an ammonia odor in the head compartment. Failure of the heating element is less of a concern; unevaporated liquids drain into the holding tank. Lastly, efficiency decreases as the temperature drops, so if you boat year-round in cooler climates, Sun-Mar recommends a minimum cabin temperature of 15°C (60°F) and insulation of the vent stack for extended winter use.

— Jan Mundy

SAILBOAT RIGGING

GOING ALOFT

Two transatlantic sailors offer safe ways to prepare your equipment and crew for the trip up the mast.

Story Paul Shard, photos by Sheryl Shard

Going up the mast is one of the most daunting jobs for many sailors. In fact, say the words "going aloft" and suddenly a crew, especially one with acrophobia, comes up with lame excuses such as, "You're lighter than I am so it makes sense that I pull you up." Certainly there are elements of danger in going three or more stories above a boat deck, but as with sailing, you can minimize your risks by taking precautions.

The author preparing to go aloft in a bosun's chair.

Going up the mast may look dangerous, but can be quite safe if you take the necessary safety precautions. It can truly be more dangerous not to go aloft if it means missing a problem that could cause the mast to drop while underway.

"What you can't see, can't hurt you," doesn't apply to your rigging and masthead. I always go aloft before a passage and at the beginning of each season to check out all the mast rigging and fittings. In this case, I'm trying to prevent going aloft to fix something at sea, which is much more dangerous. I'll inspect all

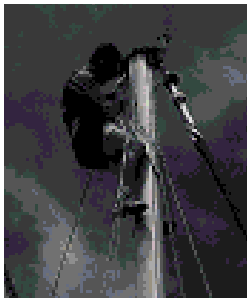
Safety line made of 12mm (1/2") line and eye spliced to a spring-loaded carabiner wraps around mast and fastens to D-ring on safety harness.

places where wires touch spreaders or exit the mast for signs of fatigue, look for chafe on halyards, check standing rigging swages or end fittings and spreader bases for wear. At the masthead, I check the fittings, Windex and lights. Any potential problems or suspicious parts should be addressed in the calm water of the marina or anchorage. Prevention is the best kind of insurance.

Using a Bosun's Chair

The most common method of going aloft is to rig a bosun's chair to a halyard that connects to a winch and have a crew member (or crew members) hoist the person aloft. The only special equipment needed is the bosun's chair itself. These can be as simple as a wooden plank or made of fabric and dressed up with side pockets and detachable pouches. A good bosun's chair should feel secure and be comfortable.

The key to going up safely is preparing your equipment and crew



Adding a couple of folding mast steps gives a higher perch and a secure foothold at the top.

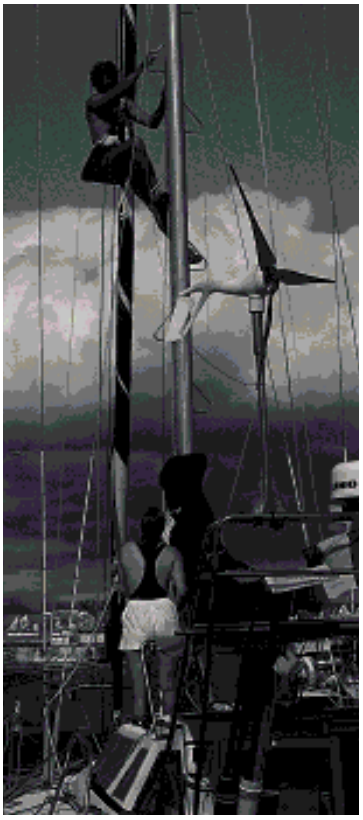
TIPS CLIMBING KNOW-HOW

▼ *Regardless of what device you use to go aloft, wear tie-up shoes and long pants to avoid skin cuts and abrasions. Deck hands should never stand on deck beneath a person working aloft. The "sky is falling" could be a hammer.*

▼ *For good measure, tie all hooks with #4 cord to secure the connection.*

▼ *If you are purchasing an electric windlass in the near future, consider how it could be used to get someone aloft. This could be the reason you've been waiting for to get that "shinny" new winch.*

▼ *Consider adding two mast steps about 1.5m (5') down from the masthead. These are a great help while working aloft. Folding ones won't snag anything and offer low windage when not in use.*



Person going up climbs mast steps while deck crew tightens safety line attached to bosun's chair. Without the chair, rigging access is limited.

before you start. First, choose a halyard that you have complete confidence in; you'll be putting more strain on it than it normally gets in regular usage. Check that the route aloft is clear. If you go up the back side of the mast you'll likely choose a main halyard since it will put you aft of the masthead when you reach the top. If you have lazy jacks, reposition the main halyard outside these so you don't get entangled. If you have an electric windlass with a rope gypsy, you can probably rig a block at the base of the mast to run the halyard forward to this winch. Check that the line won't snag and enters the winch at a fair angle to prevent overwraps. A second snatch block to the toe rail could be used to correct any misalignment but this adds friction. Test out a tie-off for the winch. A normal self-tailing winch should not be trusted to hold the line. Instead, while winching, periodically make fast the line to a horn cleat (don't use a cam or jam cleat or halyard stopper) or handrail on deck. This provides a safety point if the line should slip off the winch.

To attach the bosun's chair to the halyard use a bowline or buntline hitch [Ed — Instructions on how to tie this knot appears in DIY 1997-#2, page 31], locking pin shackle or spring-locking carabiner — never trust a snap-shackle to take the load.

When I go aloft I don a safety harness that is secured to a safety lanyard or can be fastened to a spare halyard. When I get above the first spreaders, I loop the lanyard around the mast. This is refastened when I pass the upper spreaders, but it means I can only fall a fraction of the mast height in the event the bosun's chair or halyard fails. It also means I won't swing wildly away from the mast if the boat starts rocking.

Now prepare the tools you'll need for the work aloft. Collect all now and save the embarrassment of describing the tool to a helper when you're 15m (50') in the air.

SAILBOAT RIGGING

I prepare a canvas bag for tools and attach it to the bosun's chair so it's within easy reach. For heavy tools, such as a rechargeable drill, attach 6mm (1/4") safety lanyards to prevent crashing on deck. If I plan to work aloft for a while (i.e. adding a new fitting), I tie messenger lines on the heaviest tools and hoist as needed. [Ed — Also attach messenger lines to the chair to hoist or lower extra tools or parts as needed by the person in the chair.]

With everything in place, review the procedures with the crew operating the winch. Make sure they understand what you need and how to do it safely. If using a mechanical winch, plan on an extremely fit individual or two to winch you aloft. On our boat, Sheryl winches me up, but I help by shinning up the mast where I can.

Don't forget to review how to lower the chair — have only two turns on the winch drum and play out the halyard smoothly without jerking, taking care to prevent winch overrides.

One last check that you have all the tools and they are safely secured for the trip aloft, one last look at the halyard attachment to the chair and up you go! Check that the chair is reasonably comfortable as you first take your weight on it. Winchers must closely monitor the halyard and person going aloft, slowly hoisting as instructed. When the person aloft reaches the proper height, securely tie-off the halyard. The deck crew should move light footed about the deck — motion is magnified at the masthead — and should keep well clear of the "falling" zone under the chair.

Capt. Al's Mast Ladder slides up the mainsail track or slot to the masthead. You'll gain better control if you place your feet pigeon-toed in the flexible steps.

TIPS PLAN AHEAD

Take photos of the masthead, light assemblies, spreader bases and all other fittings before raising the mast, or take a trip aloft with your camera. This helps you plan and prepare the tools and parts needed for the job before you go aloft.

Solo sailor Louis de Boer uses Mast Lift to go aloft.

Other Options

Good climbing options for short-handed crews or singlehanders are permanent mast steps, installed all or part of the way up, or a temporary ladder. For safety, both of these devices must be used with a bosun's chair or safety harness attached to a spare halyard. (This also allows the climber to swing out to check spreader fittings.) The deck crew keeps pace with the climber, snubbing up the halyard as needed. Add a safety lanyard to hold the climber close to the mast, freeing hands for work.

Mast ladders with flexible steps come in a variety of styles. Hoisted by the main halyard, these slide up the mainsail track or slot. All ladders require dropping the mainsail and depending on the height of the gate, may require removal of mast slides as well. [Ed — Since testing Capt. Al's Mast Ladder in DIY 1997-#1, we've discovered that the key to stop swinging and gain complete control is to climb with your feet turned in.]

Mountaineering gear is available that lets you climb aloft yourself. One device I have seen is the Topclimber. Similar to mountain-climbing ascenders, it has attachments for the feet that allow the climber to ascend a taut halyard.

Another mountaineering-related gadget is the Mast Lift, a mechanical winch that's hoisted to the masthead and secured. It has a continuous loop line that runs from the winch, down through a block on deck (it must be setup for the particular mast height). Sitting in a bosun's chair, the climber pulls the line and this drives the winch at the masthead. A pull of up to 14kg (30lb) force is all it takes but the climber must pull nearly six times the mast height of line. For a 13.5m (45') mast, that means 81m (270') of line. Costing around U.S.$1,200, it's certainly more expensive than a bosun's chair, but it may be worth it for singlehanders.

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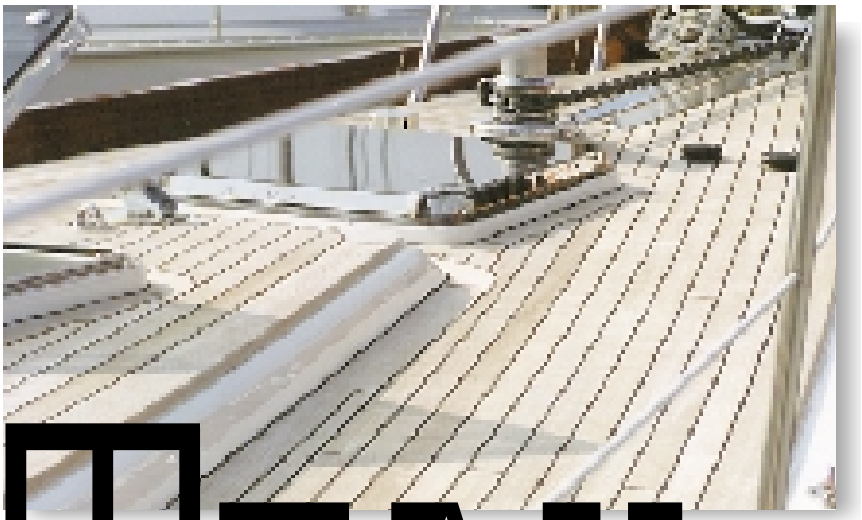
About the authors: Paul and Sheryl Shard are the authors of "Sail Away! A Guide to Outfitting and Provisioning for Cruising" from Pelagic Press, now in its second edition. They are currently cruising in the Mediterranean aboard their self-built Classic 37 "Two-Step." You can follow their adventures at www.searoom.com/shard.



TEAK 101

CLEANING TEAK:

THE FIRST STEP TO ACHIEVING A PROFESSIONAL FINISH

One-step teak cleaners are just as potent as their two-part competitors without the caustic dangers. If you are a user of two-part cleaners, now may be the time to switch.

Story and photos by Jan Mundy

Teak — the bane of every boat owner. I swear my next boat is not going to have any wood on the topsides but since my boat does, I need to maintain it. Maintaining teak can absorb a lot of time so you need products that are easy to apply without a lot of elbow grease and are long lasting.

If you've owned a boat for a while, you no doubt have a locker full of snake oils, products that claim to be the absolute solution, but in actual use, aren't worth a dime. Teak products are no different. There are numerous teak finishes available — oils, varnishes, synthetic blends and most boaters know which ones hold up best in their climate. But what about cleaners? When cleaning you're removing the previous coating, stains, dirt, oxidation, mildew and oils inherent in the wood then bleaching it to a uniform color. This is the first step before you can apply a protective coating (see "Teak Finishes at a Glance" on page 29).

Teak cleaners all have their mystical way of cleaning. Some are granular, some are liquid, and others are gels. Some are acid-based, many are highly caustic alkaline solutions, and a few are biodegradable. Some contain a mildewcide to destroy mildew spores. They are applied in either one- or two-steps with several requiring a waiting period, while a few are applied, scrubbed, then rinsed off. All are applied over wet teak, some are diluted with water. When applying cleaners, especially acid- or alkali-based ones, always wear gloves, protective clothing and eye wear.

The teak side decks on DIY's 6.6m (22') test boat were weathered badly. Much of the original Perma Teak, a water-based acrylic finish, had worn away, although some was still intact, the wood had mildewed and there were black spots. This was a good test to see what products would effectively clean the teak and also remove the coating.

One-Step Cleaning and Brightening

Bearing in mind that DIY's test criteria is to judge products on effectiveness and equally important, ease of application, we set about to test eight teak cleaners. We divided the side decks into four sections, separating each with masking tape. On one side deck we tested four one-step cleaners; on the other, three two-step and one with an optional second step. Scrub pads and applicators were washed thoroughly between applications of the

Before cleaning

After applying one-part cleaners to test panel after scrubbing with a stainless-steel scrubber: (left to right) Amazon One-Step Teak Cleaner, Iosso Teak Cleaner, Cape Ann One-Step Teak Cleaner, BoatLife Teak Brite Teak Cleaner.

Highly caustic two-part cleaners chemically react with the teak, turning it black, then orange and expose the wood layer underneath.

Before cleaning.

After cleaning test panel with two-part alkali-acid cleaners: (left to right) Te-Ka Teak Cleaner, Boat Armor Unique Teak Cleaner, Star brite Teak Cleaner, Aurora Teak Clean.

various cleaners. Exposed gelcoat surfaces were masked with 3M Ready-Mask, a pre-taped plastic film that's a great time-saver if you can find it at your local chandlery or a paint shop.

Amazon One-Step Teak Cleaner, Iosso Teak Cleaner, Cape Ann One-Step Teak Cleaner & Brightener and BoatLife Teak Brite Teak Cleaner are one-step, water-based cleaners. We applied each according to the label's instructions, scrubbing lightly with a 3M Scotch Brite pad.

Amazon is an acid-free liquid containing a mildew remover. Just squirt it out of the bottle, scrub and rinse, there's no waiting time. Iosso is a powder you mix with water, apply with a brush and let sit for 10 minutes or longer for extremely weathered teak, during which time you must reapply as needed to keep the surface wet. Cape Ann is a pine oil-based thick green gel — perfect for handrails, gunwale strips or teak louvered doors. Applied with a brush, it clings to vertical surfaces without splattering or running. Wait 15 minutes, then scrub and rinse. BoatLife is a granular mixture containing oxalic acid. Easy to use, first shake the bottle well to mix, sprinkle over wet teak and scrub. We applied about a table-

TEAK 101

Use a bristle brush or 3M Scotch Brite pad to agitate teak cleaners.

Scrubber of last resort: rub the wood across the grain when using a stainless-steel one to prevent tearing the soft grain wood fibers which then would require sanding.

spoon of the crystals over our 30cm by 15cm (1' by 6") area.

Results after one application were mixed. All had done an excellent job of cleaning and brightening the teak. Cape Ann was the only product that had removed most of the residual coating. What remained was gummy and after the wood dried was easily removed with a paint scraper. On the other three panels, the coating remained hard.

Cleaners were reapplied, this time scrubbing with a stainless-steel scrubber. I don't like using one — it does a good job of removing most old finishes, but can also raise the grain which then requires sanding with 80- to 120-grit paper. Sanding is fine for brightwork, as most is

TEAK FINISHES AT A GLANCE

Cleaning teak is followed with "sealer" coats, either oil, varnish, a modified preservative or water-based acrylic, to renew the wood's natural oils and protect the teak. Whatever you decide to use will involve plenty of TLC, but the results, if properly done, will be worth it.

As with cleaners, there is a wide selection of different finishes available. Modern coatings are usually compounds of five basic components: linseed, lemon, soya or tung oil; natural or synthetic resin; solvent (usually mineral spirits); driers to accelerate curing and enhance hardness of cured coating; and additives, such UV blockers and mildewcides. You'll pay more for protectants containing additives and driers, but these products generally last longer.

Premium teak oils, such as Star brite Tropical, are tung-oil based with UV inhibitors, mildewcides and driers. They dry to a semi-hard finish with the characteristics of varnish, but won't chip or peel. Adding driers to an oil causes them to go cloudy so these oils are often available in different colors such as golden or mahogany, although the clear finish usually doesn't change the color of the wood. Soya, linseed and lemon oils are frequently found in the less expensive, standard-grade oils. Oils require regular cleaning and recoating and because of their non-skid qualities, are the only choice for decks other than leaving them bare.

Water-based acrylic coatings, such as Cape Ann Teak Fix or Perma Teak, contain solvents and organic oils (i.e. pine oil). Out of the can they are milky, but dry to a clear matte finish that never chips or peels. The easiest of all coatings to use, they are brushed over wet teak, with successive coats applied in 30 minutes or less without sanding. Six coats are recommended for maximum protection. Reapplication usually involves total removal of the coating (see "Cleaning Teak" on page 26) but as the oil is organic, the teak won't mildew.

Armada, Cetol and Woodmate, are the most popular teak protectants. These are oil alkyd resin coatings, often referred to as modified preservative coatings. They contain synthetic iron oxide pigments that give the teak a slight orange tint which fades in time. They cure to a hard film and similar to varnish, will peel and chip. If the finish is allowed to deteriorate, removal is a challenge requiring a methylene chloride-based chemical stripper (the manufacturer of Cetol recommends using Citristrip). When applied properly, you can expect these coatings to last six to 18 months with only minor touch-ups.

Nothing beats the rich, shiny gloss of varnished teak. Before applying, the teak must be wiped down with acetone or other type of "dryer" to remove oil from the surface or the varnish won't bond properly. It's usually necessary to initially apply eight to 10 coats, followed by regular maintenance coats.

thicker than 12mm (1/2"), but not recommended for teak-over-fiberglass decks, as often times the wood is very thin. When scrubbing teak, be sure to always rub against the grain to eliminate a washboard effect.

This time, Amazon and Iosso removed all the residual finish, but Iosso took a lot of scrubbing. Scrubbing raised the grain slightly with Amazon; the most harsh was Cape Ann (see "Is Stronger Better?"

TEAK 101

You'll get the best oil finish when applied with a soft cloth or towel, not a brush, and forcing the oil into the wood so it doesn't sit on the surface.

on page 31). Amazon and Cape Ann darkened the wood considerably. BoatLife Teak Brite didn't remove all the old finish but dried to a bright, natural teak color, as did Iosso. Teak Brite also didn't raise the grain, even when scrubbed vigorously, which makes it an excellent sandless cleaner for weathered decks that normally have an oil finish, rather than a resin-base one. Iosso would be a good choice for boats with limited storage: a 472ml (16oz) container makes up to 151L (40gal) of solution.

Instant Chemical Reaction

On the opposite side deck, we applied four alkaline cleaners: Aurora Teak Clean, Star brite Teak Cleaner, Boat Armor Unique Teak Cleaner and Te-Ka Teak Cleaner. All but Star brite are highly caustic, alkali-acid two-part cleaners. These are highly hazardous chemicals and must be handled carefully to prevent damaging any non-wood surfaces, such as gelcoat, metal or painted. Mask and cover with plastic, avoid any spills and keep a hose within reach to rinse with freshwater immediately. It's also a good idea to keep a spray bottle handy to mist any spills. Wear rubber gloves and eyewear — these liquids splash when applied. Don't use any two-part teak cleaner on a boat in the water, or in a yard where these chemicals can run into a waterway.

Aurora, Boat Armor and Te-Ka all perform alike: you apply part one (an alkali with a pH as high as 14) over wet teak, which in all three products contains sodium hydroxide. This instantly turns the teak black, a chemical reaction between the acid and the sugar, oil and wax in the wood. Next, wait a few minutes, as specified on the label, then apply part two, an acid-based solution (pH below 7) that neutralizes the chemical reaction and turns the teak a golden yellow. This result is a bright finish, not necessarily natural looking but one that's uniform in color.

Despite what the packaging says, these are not scrubless cleaners. The 3M pad plugged up, so we switched to the stainless scrubber and had to scrub hard to clean the wood. In fact, these two-part cleaners required considerably more elbow grease to clean and remove the Perma Teak than any of the water-based ones.

Aurora required the least amount of scrubbing and was the most effective in brightening the teak but also the harshest, exposing the grain and leaving grooves in the wood. All but the Unique Teak Cleaner lifted the original coating. We followed the instructions carefully, so we don't believe our application was flawed. Te-Ka did remove the old finish but only after much scrubbing. Te-Ka came with a handy pour spout which made it easiest to apply without spilling. Unique was the worst for staining. Difficult to pour (use a funnel), it dripped down the side of the bottle and about 30 seconds later, had left a circular stain on the deck.

Star brite also is a strong alkaline cleaner containing sodium hydroxide but it cleans teak without a chemical reaction so it doesn't require a neutralizer. After applying, wait three minutes and rinse off. It required two applications and some heavy-duty scrubbing to remove the old acrylic coating. If you don't mind the look of the wood being slightly dark, you don't need to do anything else or for a lighter look, apply the non-chlorine-based Teak Brightener. Wait five minutes then hose off and you have wood that's a uniform golden yellow. This product contains oxalic acid and a mildewcide. Of the four alkaline cleaners tested, Star brite was the least harsh on the wood and probably wouldn't require sanding before coating.

Is Stronger Better?

Any time you apply a chemical to a porous surface and scrub, you're taking something away. The stronger the chemical the more aggressive the cleaning power.

Cleaning teak is no exception. Wood is made up of hard (dense) and soft (less dense) wood. Two-part teak cleaners perform much like liquid "sandpaper," removing a portion of soft grain, exposing the wood underneath. Over time, frequent applications damage the wood fibers, leaving grooves in the wood, which then requires sanding. Over time, frequent applications can damage the wood fibers and leave grooves in the wood, which then requires sanding.

If you just want to clean weathered or blackened teak, any of the products we tested will work. The one-part cleaners clean without any harsh chemicals. With a neutral pH (7 to 8.5), they won't harm other surfaces and are safe to use on decks; the stronger two-part alkaline cleaners with a pH as high as 14 may soften caulking — I highly suggest doing a spot test first. These cleaners also damage gelcoat and painted surfaces. After using a two-part cleaner, rinse thoroughly, flushing the decks, scuppers, drains and lockers. Any residue will continue to "eat" the wood and surrounding surfaces. Personally, I don't recommend their use.

Whatever you use to clean teak, buy a product that gets the job done quickly and safely with the least amount of preparation and effort. It's not really a lot to ask for.

17 FREQUENTLY ASKED QUESTIONS ABOUT TEAK MAINTENANCE

CLEANING

1. Do I need to clean new teak?

Yes, you must clean first; brightening is an option. Cleaning removes surface oils, ensuring a good bond to a teak protective coating.

2. Why has my teak turned black?

Oiled teak turns black or dark brown when it starts to degrade from UV exposure or moisture which eventually leads to mildewing of the teak. Any moisture trapped below a protective coating when applied also causes teak to turn black.

3. How do I know when the teak is clean?
Rinse the cleaned teak with water and let dry. Any remaining wet or "glossy" areas may indicate reapplication of the cleaner.

4. Can I use household cleaners?
Yes and no. Be careful when using strong alkaline cleaners (i.e. any cleaner that says, "Corrosive") and never ones containing chlorine bleach, especially on decks. Bleach may soften sealants, causing permanent damage.

5. Do I need to apply a brightener?
This normally isn't mandatory, mostly for aesthetics, although some one-step products (i.e. Star brite Teak Cleaner, BoatLife Teak Brite Teak Cleaner) recommend application of a brightener before applying oil or sealer to remove any cleaner residue and lighten the teak.

Strip-Away, a mayonnaise-like non-toxic, odorless gel, is engineered to safely remove many teak coatings on the topsides or inside the cabin.

APPLICATION & CLEAN-UP

6. Is it necessary to apply a finish to bare teak?
Yes and No. Cleaning removes the natural oils in the teak. If left bare (natural), these oils biodegrade quickly, oxidize and turn gray. It's more a cosmetic preference than a destructive condition. Bare teak soils more easily but regular washing with liquid dish detergent, saltwater and pot scrubber will keep it clean.

7. Can I coat over wet or dry teak?
Sealers and varnishes must be applied over dry wood, except the water-based acrylic finishes. After cleaning or a rain, wait two or three days before applying the first coat on bare teak. Any moisture could cause oiled teak to turn black. Application of a solvent-based solution prior to coating helps to evaporate any cleaning chemicals and moisture left in the wood.

8. What do I apply teak finishes with?
Use a foam brush, cotton pad or soft cloth to apply all products except varnishes or modified preservative coatings. For these, use the best natural bristle brush that you can afford.

9. How many coats of a sealer are required?
This depends on the porosity of the wood. Older boats with very porous teak may require four coats, new teak one coat. If you see the wood soaking up the oil (it looks dry), you need another coat. Be sure to remove all excess sealer that pools on the surface. It's recommended

To sand teak veneer, typically used for cabin soles, use a fine sanding pad with a light touch.

applying extra coats of all finishes to high-traffic areas and horizontal surfaces that are highly susceptible to UV degradation.

10. How do I remove oil from non-wood surfaces?

Remove coating with a dry rag before it cures. While there are some cleaners that claim to remove cured finishes easily, DIY hasn't tested any.

11. What are the white spots in my teak after oiling?

This is caused from the residual cleaning chemicals remaining on the surface. Before applying a sealer, make sure the teak is rinsed thoroughly.

After sanding teak you must wipe it down with acetone or denatured alcohol, and sometimes wash with an acid cleaner to remove the natural oils and waxes in the teak or the new coating won't adhere to the wood.

12. What causes oils to be sticky?

Stickiness is caused by excess oil lying on the wood. Easily prevented, liberally apply the oil, let it absorb for about 15 or 20 minutes then wipe off the excess to prevent pooling. Be sure previous coat is dry before recoating.

13. What is the proper disposal of brushes, rollers and rags?

All solvent-based finishes are flammable and capable of spontaneous combustion. Immediately after use, place all rags in a sealed water-filled container then dispose of according to local regulations.

Gloss without sanding: Formulated for teak and other oily woods, Epifanes Wood Finish Matte does not require sanding if recoated

UPKEEP

14. How long will a coating last?

This depends on where you boat, how well you cleaned the wood, the type of coating and number of coats, the local climate and variations between temperature highs and lows.

15. When is it time to recoat?

You want to recoat an oil finish before the wood starts to oxidize, turn black and mildew. If you catch it early enough, a light cleaning is all that's needed. Resin-based coatings need recoating when the finish starts to dull. Just clean with TSP and scrub pad, rinse thoroughly and apply a single touch-up coat.

16. How do I touch-up worn areas?

Lightly clean the wood with teak cleaner, rinse, let dry, then apply the coating, feathering it towards the edges. In a day or two it blends in and is barely noticeable. Follow additional preparation as instructed for your selected coating.

17. How do I remove old finishes?

As a rule, varnish and modified preservatives require harsh chemical strippers to strip the teak followed by scraping of the wood with a cabinet scraper. ⚓

ENGINE TROUBLESHOOTING

DRIVE TRAIN TUNE-UP

REPACKING A STUFFING BOX

If your inboard's stuffing box is leaking, it's time to replace the packing. Here's how.

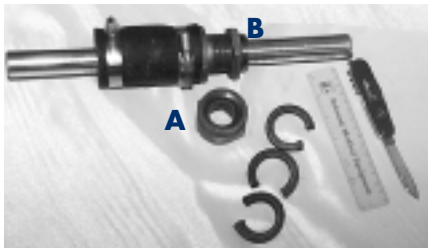
By Jan Mundy

Contrary to popular opinion, an inboard's stuffing box doesn't need to sweat eight drops or so a minute to ensure proper lubricating or cooling. This water just empties into the bilge (it's corrosive if saltwater), mixes with oil and then is pumped overboard to pollute the waterways.

When the stuffing box is leaking excessively or is hot to the touch after running the prop, it's time to replace the packing. There are new packing materials available that replace the traditional flax, the standard packing for more than a century. Flax does a fine job of sealing a stuffing box, but it's lubricated with wax and as the shaft generates frictional heat, the wax liquefies and drips out (with the water) dotting the bilge in a black, waxy residue. When the box leaks, the nut is tightened which compresses the flax even more, building up heat and blowing out more black goo. GFO fiber packing from W.L. Gore & Associates (800/455-2854) is a high-performance braided, grease-free packing for all stuffing boxes. GFO contains a high-temperature lubricant that stays in the packing (doesn't run out like wax). It's about five times more expensive than flax, but it doesn't shrink, rarely needs adjustment and keeps the bilge drier and cleaner.

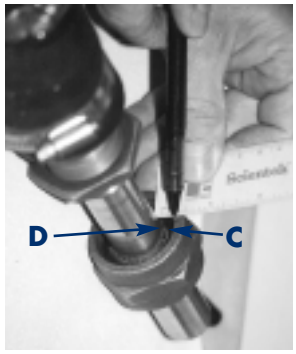
Repacking the stuffing box is not hard but it must be done correctly or the box will drip constantly, and in the worst case, you'll score the shaft. Follow these easy steps to a trouble-free installation.

1 A traditional stuffing box is made of two pieces: the packing nut (**A**) and a locking nut (**B**). (Stud-type stuffing boxes have the packing in the body and are held on with two nuts.) To loosen, put a wrench on the locking nut and another on the packing nut, then turn each in the opposite direction. In close quarters, a punch and hammer work better. On



twin screw boats, one shaft may have a left-hand thread. Unscrew packing nut until you have enough clearance to remove the old packing. While you're down there, check the condition of the hose that connects the box to the stern tube — which should be double-clamped at both ends — and replace if worn. (Depending on the installation, some boats won't have the hose). Hose replacement requires removal of the shaft at the transmission coupling.

2 Packing diameters range from 3mm (1/8") to 16mm (5/8"), so the first step is to determine the size of packing you need (most common sizes are



TIPS

ADD BOLT INSPECTION TO ENGINE START-UP CHECKLIST

Regularly check the shaft-transmission coupling bolts for tightness. Vibration eventually causes the nuts to loosen which can damage the drive train or worse, the shaft backs out the stern tube. You can prevent this by "locking" the bolt heads: install the coupling nuts with Locktite or replace standard nuts with lock nuts; and seize two of the bolt heads together with stainless-steel seizing wire. It's also good practice to install a zinc anode or an all-stainless-steel hose clamp on the shaft about 2.5cm (1") ahead of the stuffing box or just forward of the strut (if rigged).

1/4" and 5/16"). Just measure the distance between the inside diameter of the stuffing box (**C**) to the outside diameter of the shaft (**D**). This shaft requires 6mm (1/4") packing. Packing must be the correct size: oversize will cause packing to burn out, undersize will leak excessively. Now, remove the old packing. A dental pick works best, or use a corkscrew or self-tapping screw and driver, just be careful you don't scratch the shaft. Clean the box and shaft. Examine the shaft. It should be shiny but not badly worn or scored.

3 Cut the packing rings. Packing that is cut wrong normally causes a leaking stuffing box. The proper procedure is to wrap packing

ENGINE TROUBLESHOOTING

around an exposed portion of the shaft so it overlaps, hold firmly and cut at a 45° angle. You get a perfect circular ring and butt joint. If you just use the old packing as a pattern, lay the new alongside and make a square cut, you'll get an oblong shape and, once installed, a gap where the ends meet. When working in close quarters, it may be easier to wrap the packing around a piece of dowel or anything else of the same diameter as the shaft. Generally, three or four rings are needed, but this varies with the depth of the stuffing box. Don't rely on what you removed, as a ring may have worn or rotted out or the box previously was packed incorrectly.

4 Wrap the first ring around the shaft, match the ends and slide into the packing nut. Install the remaining rings, staggering the joints at 90° apart to prevent a weak spot. Make sure each ring is clean and firmly seated — don't hammer the packing material — before installing the next one. Once packed, attach the packing nut. If you can't start the nut on the threads, remove a ring. Screw on hand tight until you feel resistance. Run the engine for an hour or so. Check the box for leaks, then tight-

FINE TUNING THE SHAFT

Installing a flexible coupling on the propeller shaft can solve noise, vibration and shaft alignment problems.

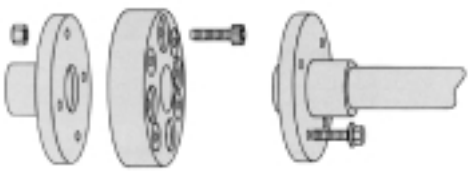
By Jan Mundy

Flexible rubber engine mounts are installed on engines to reduce the amount of vibration transmitted to the hull. Where an engine has flexible mounts and rigid gearbox and shaft couplings, the mounts move but the shaft doesn't. A gyrating engine results in a misaligned propeller shaft. This causes shaft vibration and wear of the gearbox bearing. On drive trains equipped with a dripless shaft seal, the increased movement can cause the seal to leak. The only remedy is to modify the shaft by installing a flexible coupling.

Flexible couplings made by Globe Rubber Works, R & D Marine (distributed by PYI) and Soundown, add flexibility to the shaft connection at the gearbox, reducing vibration and noise transmitted to the hull from engine mounts and propeller shaft — the telltale "ringing" or "singing" from the gearbox. Besides reducing drive train vibration, a flexible coupling also eliminates or reduces gear clatter when the engine is idling and excessive torque from changing gears, both which reduce transmission wear. Should the boat hit a rock or snag the propeller, a flexible coupling acts as a circuit breaker, absorbing the torque and then breaking before damaging the transmission or bending the shaft. Made of non-metallic materials, a coupling isolates the shaft from the engine, blocking electrolysis and protecting your engine and transmission from corrosion damage. Boat owners who have installed one also claim a reduction in propeller fouling.

Available in various styles to fit most inboard engines, prices start at US$100. (Stern drive systems are not as affected by engine movement because they have a flexible coupling between the engine and outboard drive.)

For smaller engines, a flexible-disk-sandwich coupling, such as the DriveSaver or R & D, fits between the existing shaft coupling and the transmission coupling on the gear-



The DriveSaver installs easily without hauling your boat out of the water.

en the locking nut with a wrench. You should be getting about one drip per minute when the shaft is turning. If the box leaks when the shaft isn't turning, you've cut the packing wrong or you have inferior packing. Tighten the nut slowly, in 3mm (1/8") increments. Don't overtighten, which can overheat and score the shaft. Also, check the temperature of the stuffing box. If hot, the packing is too tight and needs replacing.

5 Inspect stuffing box regularly to insure the leakage rate is maintained. When you need to tighten the packing, back off the locking nut, give the packing nut 3mm (1/8") turn, then retighten the locking nut.

In the event of a severe shock load, the R & D flexible coupling has two metal compression straps which keep the coupling intact, enabling the shaft to operate in both forward and reverse.

box. To install, remove the coupling bolts and separate the couplings. It may be necessary to force the couplings apart, but don't use a screwdriver or pick, or you'll score the matting surfaces. Install the coupling with the supplied bolts, align and tighten. Depending on the model, a DriveSaver adds 17mm (11/16") or longer to the shaft length. In some installations, this may require shortening the prop shaft by the thickness of the coupling.

Albeit a flexible coupling can compensate for some shaft misalignment, installing one is a poor excuse for a misaligned shaft. Compared to the standard .10mm (.004") tolerance with a rigid coupling, a flexible coupling allows a slight misalignment of up to .008" between the two couplings. (We'll cover shaft alignment in an upcoming issue.)

When purchasing a disc coupling, the supplier will need to know the flange diameter, number and diameter of bolts, and torque rating, which is determined by multiplying the engine hp x 5252 x reduction ratio, then divided by engine rpm.

Rated for 150 hp to 2000-plus hp engines, the RD coupling from Soundown consists of pre-compressed rubber blocks (optional neoprene for added damping). Available in single or twin units, couplings are supplied with adapters to fit Caterpillar, Hurth, PRM, Twin Disc, Velvet and most reverse gear transmissions. Installation in larger engines is somewhat more complicated and best installed during the building stage, although a refit is workable.

(Note: A discussion of flexible engine mounts appeared in DIY 1998-#4 issue. A review of dripless shaft seals appears in the next issue.)

PROJECT BOAT

FACELIFT FOR A CLASSIC CHRIS

New fiberglass deck, cabin windows, bow seat and hardtop extension give this '68 Cavalier a more contemporary look.

Story and photos by Dwight Powell

Before

In the eight years I've owned "Largo Lady" I've rebuilt the AC and DC systems, replaced interior lights and headliner, installed a propane-fueled stove, added a water-pressure system, holding tanks and cold-plate refrigeration. My project is a '68 wooden lapstrake Chris-Craft Cavalier, built in Stratford, Ont., hull number six of 20.

If you own a wooden boat you know that leaking windows can be a real pain. This boat was no exception and after a professional survey we discovered the dreaded soft spot, just below the port side window frame at the forward deck joint. I didn't have the time or the courage to take on this project then, so after a few seasons of injecting BoatLife's "Git"-Rot, a two-part liquid epoxy, I decided to tackle the job.

The work was done in two stages: First I stripped, repaired and epoxied the decks before tackling the windows. The decks, like so many of this era, were covered with vinyl. While this created a smooth surface, it also meant seams and the potential for leaking and rot. After stripping the vinyl, I scraped off the old adhesive with a sharp cabinet scraper, then replaced any soft or rotten wood. New wood was reinforced with backing plates, screws and epoxy resin thickened with a high-strength filler. A layer of 6oz fiberglass cloth and four coats of epoxy resin covered the deck. The final coat was sanded with 120-grit and painted with Sikkens Heavy Coat primer, followed by two coats of Sikkens Deckpaint Anti-slip. The result: a hard, durable and completely watertight surface with no seams.

After

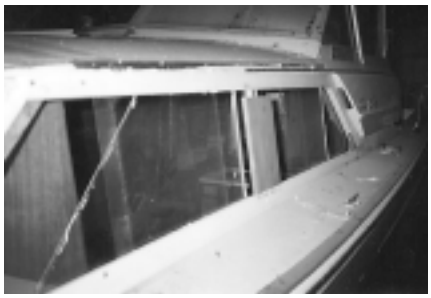
Window Options

Many older wooden boats, ours included, have cabin windows with wooden U-channels and the glass slides in plastic or metal tracks. The channels are wonderful resting-places for bugs and dirt and unless meticulously cleaned, these channels hold water. (Ingredients for wood rot: moisture, food (wood), oxygen and warmth.) One can never be sure that water is not seeping into some crevice to sit and initiate the rotting process.

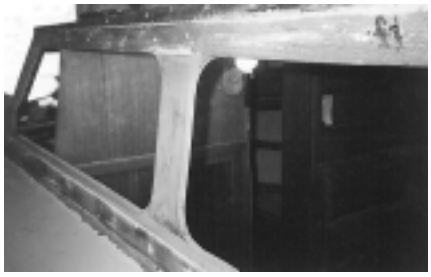
We opted to simply remove the glass, clean the channels, coat the wood with epoxy resin and replace the glass. This keeps the original look of the boat and is very inexpensive. But there's still the nasty job of cleaning those channels and the chance that the windows won't remain completely watertight.

After reading "Retrofitting Windows" in DIY 1996-#1 issue and talking with Willem Boon of Bomon, a marine window manufacturer in Laval, Que., I opted to replace the cabin side windows. These were built smaller to give 'Largo Lady" a more modern look and keep glass cleaning to a minimum. At the same time, I decided to completely change the look of the main cabin and deck — eliminate the front window and reduce the length of the side windows to accommodate a seat on deck, fiberglass the cabin exterior and extend the hardtop to cover the cockpit.

Once the windows and plastic channels were removed, inserts made of mahogany were cut for each corner. These had a 7.6cm (3")



Removing windows and fitting mahogany corners.



A wider-than-original mahogany center post glued in place. Mahogany has good rot resistance and is much easier to fabricate than teak.

Beginning seat construction.

Lauan underlay glued to the sides to blend in the new construction.

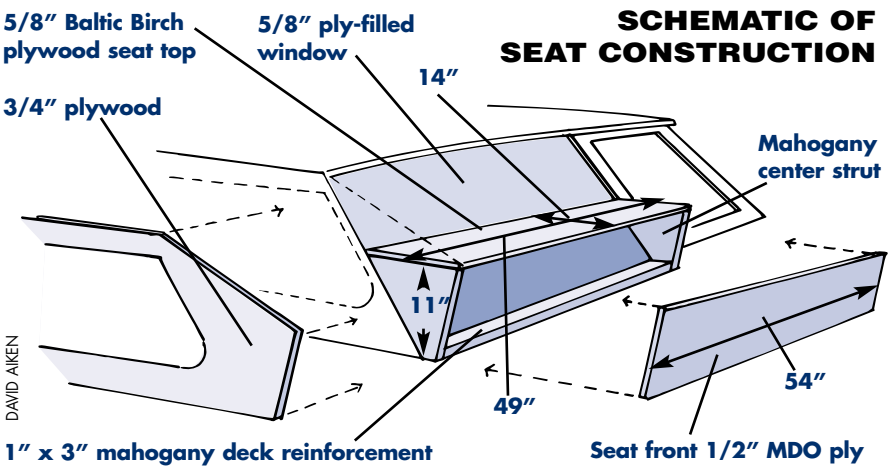
radius to fit the new aluminum window frames. Radius corners render a one-piece frame and are preferred to a four-piece section with mitered square corners that could leak.

To obtain the proper window measurements, I installed the inserts then took four measurements per window opening: height, width and both diagonals because the top and bottom are different lengths. This was fairly straightforward and Bomon willingly offered lots of guidance.

Constructing the Seat

Building the forward deck seat was the next step. Besides a place to sit, I hoped this would give the boat a

Forward seat takes shape. Only half of the window opening has been filled in with plywood.



PROJECT BOAT

profile more akin to a Chris-Craft Constellation or Catalina. Changing our boat's "look" was a little unnerving, but after a few rough drawings and approval from the first mate, I was up to the task. I'm no architect, so I simply made patterns from scrap Lauan plywood and kept putting the pieces together until I came up with a design that seemed to work and look right.

Before constructing the seat, the cabin front window openings were covered with 16mm (5/8") plywood. Both were made of Baltic birch and medium density overlay (MDO) ply-

Finished full-width foredeck seat, fiberglass deck and cabin top, and new windows.

wood. We chose the birch for its many ply, smooth surface and void-free interior; the paper-covered MDO for its smooth surface and ability to leave a smooth glass-like finish. The perimeter of the seat was framed with mahogany cleat stock for reinforcement and a place for fastening the plywood, but I didn't frame the seats; the angles and rigidity of the plywood provided plenty of strength. The deck was reinforced with 2.5cm (1") mahogany, screwed and epoxied to the deck. An interior deck beam directly underneath the seat provided additional support.

To create an unbroken line where the seat connects to the cabin sides, the new construction was covered with a skin of 6mm (1/4") Lauan underlay. It's inexpensive and has no voids that could trap moisture.

After filling screw holes with filler, the entire structure including the cabin top was covered with 6oz fiberglass cloth set in four coats of clear epoxy resin. All joints, especially where the cabin sides meet the deck, were filleted with thickened epoxy. If you do a good job of smoothing the fillet with a stir stick and removing the excess right away, sanding is much easier. [Ed — Step-by-step procedures to make professional-looking fillets appeared in DIY 1998-#4 issue.] Fillets replace the traditional quarter round, which on our boat, contributed to moisture entrapment and subsequent rot. The epoxy fillet is actually stronger, neater and adds to the structural integrity.

Final Deck Finishing

After filleting, sanding and filling, surfaces were finished with two coats of white Pettit Easypoxy Undercoater then four coats of semigloss white

(top) New windows are set in from the outside leaving no channels to lodge dirt and trap moisture; (bottom) Inside view of window clamps.

Cabin top and sides coated with epoxy resin.

Pettit Easypoxy, a one-part polyurethane. Easy to apply and very durable, the semigloss hides most of the imperfections and still gives a great looking surface.

Since the windows had been fitted before painting, we just put them in and installed the inner clamps. The inner clamps for the windows are prefit at the factory and attach with screws from the inside, leaving no holes through the superstructure. At last, no more leaks and we think, a nice looking job.

Building the Hardtop

I wanted two things with the hardtop: a larger flybridge and to get rid of the camperback canvas. Why have a tent when you can have a camper?

I made a template of the roof curvature line then made beams from double thickness 19mm (3/4") plywood, spaced every foot. I cut off straight the aft edge of the original flybridge deck overhang and used it to make a pattern for the new hardtop. Custom-made stainless-steel sister beams were then bolted to three of the plywood beams. To the aftermost stainless beam, I bolted stainless-steel uprights to each corner and to the cockpit floor. A local marine metal-

Close-up of hardtop and new canvas.

working shop made all metal supports from my wooden patterns. The design, I hoped, would be strong enough to support six people on top.

The entire hardtop was then covered with four layers of 6mm (1/4") Lauan and glassed, epoxied and painted using the same procedures as for the seat. The last plywood layer covered the entire flybridge and hardtop to eliminate the joint between old and new. The final touch was to install an aluminum drip rail around the edge and new canvas to close in the back and sides.

We don't have a classic looking Chris-Craft anymore, but we do have a more functional, modern-looking boat.

Did this job turn into a monster? No, not really. I knew it would be time consuming and even tedious at times, but I focused on the end product and the wonderful dry sleeps I would have. Hey, wooden boats don't have to leak!

About the author: Dwight Powell is an avid do-it-yourselfer and does all design, refit and maintenance on "Largo Lady."

DIY REPAIR BILL

In seven years of owning "Largo Lady," I've invested about $10,000 in upgrades. And, I'm not finished yet. In the planning stages are a soundproof enclosure for the generator, dinghy davits, anchor windlass, new railings and swim platform. It's been a lot of fun and enjoyed even more when we're cruising.

For this refit, the following material costs in were incurred:

4gal epoxy resin and hardener	$480
2qt Sikkens Deckpaint Anti-slip	54
2qt Sikkens Heavy Coat	85
4qt Pettit Easypoxy Undercoater and Pettit Easypoxy	108
3qt epoxy filler	120
20yd 6oz fiberglass cloth	130
15 sheets 6mm (1/4") Lauan plywood	360
5 sheets exterior-grade plywood	150
500 various stainless-steel screws	150
Mahogany lumber for trim	200
Windows	1,500
Stainless-steel uprights for hardtop	300
Aluminum extrusions	100
TOTAL MATERIAL COSTS	**$3,737**

PROJECT BOAT

STERN REFIT

Wanting a scoop stern, this intrepid owner added nearly .9m (3') to his 27-footer.

Story and photos by Rory Harley

Before: Aloha 8.2 with original stern.

There are many good reasons why the "French" or "Sugar scoop" stern is now pretty well entrenched on most new designs. Aside from making a great swim platform, it's a lot easier to get in and out of dinghies and makes a convenient landing area for things like pets and groceries. On the safety end, many boaters are unable to lift a 67kg (150lb) person with wet clothes out of the water, especially on boats with high freeboard; it's much easier to drag them a foot or so over a low stern.

After: New "French stern" extension blends in nicely with hull lines.

The best candidates for a stern extension are boats with fairly broad sterns with a stern immersion waterline exiting at or near the transom. Robert Perry designed the Aloha 8.2 in the early '80s with the objective of getting as much boat as possible in 8.1m (27'). Although plans show the waterline exiting about a foot or so forward of the transom, on my boat the waterline exit point with the boat standing still is at the bottom of the transom. When under power, the stern would dig in about 10cm (4"). When under sail and heeled, the boat's wide stern had water curling around the transom edges, creating drag in the process as demonstrated by water gurgling on the hull. Given that displacement boat speed is dictated by the designed waterline, I hoped an extension would prevent my boat from burying itself in its own bow wave and make the boat a little faster.

Cardboard template held with duct tape forms preliminary shape.

Preliminary Measurements

The first step was to determine what the boat would look like with a stern extension. I obtained the line drawings from Perry and sketched in an extension. To determine the length, a straightedge was placed on the boat's bottom and extended aft to locate a distance where the boat's designed waterline and the extended line would cross, then added 30.4cm (12") to allow the water to be drawn up the stern.

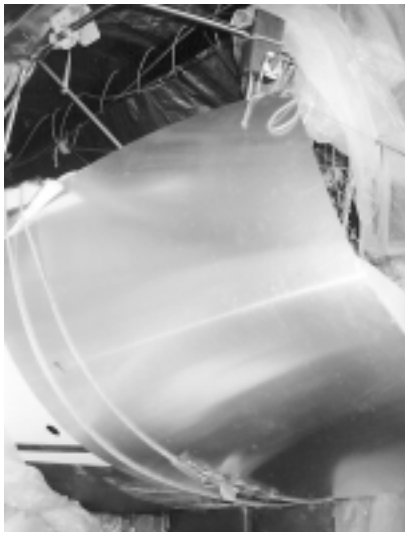
The deck of the extension must be angled to shed water. As the cockpit drained aft, I used the cockpit floor as the baseline and with a hydraulic jack leveled the boat in its cradle. When it came time to build the extension floor it could be easily matched with the baseline.

The next step was to shape the transom using cardboard and duct tape. Due to the boat's rather angu-

lar look, I elected to run the extension straight aft from the topsides about 30.4cm (12"), then bring it down at a 45° angle, approximately matching the bow angle rather than having a gradual curve. I finally settled on an extension length of 81cm (2'8") from the aft side of the transom to the end of the extension. This was the longest length that allowed me to reach the transom from the outer edge when standing on the scaffold.

Setting up the Mold

Perhaps the most difficult part of the job was getting started. As I was unable to obtain heated warehouse space, I elected to build a tarp shelter and do the fiberglass work in the spring during a four-week period between when the temperature didn't go below freezing and before my scheduled launch at the end of April.



(top) Line drawn across at top apex forms contour of one-off aluminum mold. Plasticine fillet fills the gap at the transom and makes a smooth, curved joint for glassing; (bottom) Wedges and cardboard shims inserted under lines close-fit the mold against the hull.

The mold was made of .040" thick aluminum sheet 3m (10') long by 1.2m (4') wide. It cost $100 and had to be carefully handled as it easily kinks. Wrapping it around the stern, it had to be fitted to provide a continuous curve flowing back from the stern without a "step" to show where the extension starts, and faired with the existing hull line.

I originally cut two sets of holes at the top for tying control lines. One set, more or less in the middle of the sheet, was for raising the mold into place. The

PROJECT BOAT

TIPS LESSONS LEARNED

■ *If you're not planning to do the glass work, line up your fiberglass expert well in advance and make sure you monitor the work (i.e. approve the gelcoat color match).*

■ *Paper templates for the large fiberglass cloth pieces — the boat's stern was a full 3m (10') on the perimeter —would have simplified laminating.*

■ *My extension floor was built too low. Most new boats have it about 30.4cm (12") above the water. A boat's stern dips down appreciably at hull speed; the easiest way to measure the location of the floor is from the scum line left on the stern at the end of the season.*

■ *Don't attempt this job outside. Make sure you have a sturdy scaffold to stand on and two ladders on either side of the extension.*

■ *Hand lay-up requires a lot of rolling to get the air bubbles out of the resin. Make sure you have lots of rollers and be prepared for some dirty work.*

others were drilled towards the outer corners and lines fastened to the toe rail to hold the mold tightly in place. This was trial and error, requiring several attempts to determine which angle best matched the vertical rise of the boat's buttock lines and produced the correct water flow angle up the extension. Another line was wrapped around the outside of the mold, led to the winches, then cranked in tightly to bring the mold skin-tight against the hull. In some areas, it was necessary to place shims to close-fit the mold against the hull. Cardboard shims were used to avoid hard spots.

Mold removed and outer skin laminate trimmed to desired shape. Note tangs on top edge and transom flanges for bolting and supporting the extension floor.

Holes for the rubbing strake and engine exhaust outlet were now cut out with tin snips. Finally another line was passed through a pair of holes at the top apex of the mold drawn together. A surprising amount of pull was required to bring the mold into place to ensure that the hull lines extended straight aft at the gunwale. It's important at this stage to check and recheck the lines run aft, without a step or curvature, with a long straightedge placed on the hull and extending aft over the mold.

Ready for the next stage, I called in a fiberglass specialist (I wasn't prepared to do this job) and got his concurrence that the mold was acceptable. He also developed a lamination schedule that approximated the original lay-up and did the hardest job of all fiberglass work: mixed up a gallon of color-matched gelcoat.

Forming the Outer Skin

Along the transom edge, where it meets the mold, I laid a Plasticine fillet. This performed the dual function of making a dam to prevent the gelcoat and resin from running out the gap and provided a smooth, convex angle necessary for fiberglassing. The entire stern of the boat and the inside of the mold was then covered with mold-release wax. Gelcoat was rolled on the mold, over the Plasticine and overlapped the transom sides and bottom by about 17.7cm (7"); this would form mounting flanges for the extension and extension floor.

Next day, with the help of the contractor, three layers of mat saturated with polyester resin were laid

BOTTOM LINE

The time involved for actually doing the job was 40 hours with the same amount of time for design, planning and material sourcing. I lacked the necessary skills for gelcoat spraying and fiberglass laminating, so I hired a contractor, although I was prepared to do the necessary grunt work like cutting the materials and grinding. Total cost was $1,000, including all materials and labor.

over the gelcoat and left to harden. Before pulling the mold off, two 9mm (3/8") holes were drilled at the upper end of the side flanges

Extension bolted temporarily in place. Take a close look: if you don't like the shape, scrap it and start over.

and the flanges through-bolted to the hull. This held the extension in position when the mold was released and allowed replacement of the mold in exactly the same location on the hull. The lines holding the mold were untied and the mold came off with a resounding crack.

Next, I cut the excess off the trim to the shape desired on the outside and the flange. I left two tangs on the top edge of each side with lines fastened to winches to help support the weight. With the new stern bolted temporarily into place, I checked the angle of the floor with a level, then stood back and surveyed the shape. This was the moment of decision — to scrap the shape, if it wasn't aesthetically pleasing, or to proceed with the project. Chances were there would be some areas where the shape didn't match exactly: I fell against the aluminum mold and on one side have a ripple under the waterline.

Reinforcing the Laminate

Opting to proceed, the next step was to drill the flange for bolts centered about every 15cm (6"). The mounting surface was bedded with adhesive polyurethane sealant (in this case Sikaflex) and the extension bolted to the transom. Once cured, the bolts above the proposed floor were removed.

The glass expert returned to con-

TIPS F.Y.I.

The basic formulae to determine the maximum speed of a displacement boat in knots is:

***** *1.34 times the square root of the designed waterline (DWL).*

***** *This value varies with hull shape.*

PROJECT BOAT

struct the inner skin, laminating alternate layers of mat and roving over the extension and the flange to the desired thickness. A layer of core material (Klegecell) with Core-Bond (polyester adhesive) followed, precut to shape with outside edges beveled a minimum of 10cm (4"). This allowed complete encapsulation of the core in glass. Laminating continued, alternating layers of mat and roving to a thickness of 6mm (1/4") to match the hull — the fillet depth at the transom was about twice this

Plywood floor laminated in place with cored inner skin, floor cavity filled with foam, ready for finishing with gelcoat.

thickness — finishing the lay up with mat and veil mat, a polyester batting used to prevent print through. Particular care in laminating the exposed sides above the floor resulted in a fair and smooth finish.

From inside the hull, bolt holes below the floor line were redrilled and the extension bolted firmly in place. A piece of 10cm (4") long stock was set in a vertical position at the rear of the extension to support the floor (the fiberglass flange on the transom supported the forward end). A template of the floor was made of scrap plywood and the shape transferred to marine ply. Two layers of plywood, glued together, made the floor. Edges were beveled, then the rough floor dry fit and the angle checked with a level. It was then glued and screwed to the rear cleat and transom flange and the joint taped with fiberglass and resin.

Finishing

The glass expert returned to pour two-part foam into the cavity. I didn't want to take a chance at pouring in too much foam and forcing the floor away from the extension. Finishing now entailed fairly straightforward work of glassing the exposed surfaces of the extension with mat and veil mat, filling in voids with polyester putty and gelcoating.

The job was complete except to extend the waterline and boot top further aft. The latter involved color-matching the boat's dark-blue gelcoat. I also needed to purchase a new boarding ladder to fit the extension. In time, I would design and build lockers for propane tanks (shown in the photo below).

Aside from making a great swim platform and mount for propane tanks, a modern scoop stern makes a convenient area for boarding dinghies, unloading pets or groceries and may improve performance.

On the Water

Certainly the stern doesn't dig in the way it used too, particularly when healed. This makes a big difference in the water noise level in the cockpit. The bottom of the extension sits on the waterline, so the boat should be faster. Regardless of top speed, I'm convinced the boat does less hobby horsing or pitching in a seaway. Now, I can stow my hard dinghy on the new stern and out of the water, which gains an extra 1/4 knot or so when under power.

About the author: A.R. (Rory) Harley is an engineer with the Canadian government and sails his Aloha 8.2 "E. Pauline Johnson" out of Ottawa.

A DESIGNER'S OPINION

Is a stern extension a viable refit for your boat? Mark Ellis, designer of Nonsuch and Niagara sailboats, says "Yes."

"Aside from the aesthetic considerations, as long as it's structurally sound and built light, any increase in waterline length should improve hull speed and performance.

"Provided the extension is above the waterline," continued Ellis, "an extended stern is generally positive in terms of speed, certainly off the wind where it will make the boat surf more readily."

In technical terms, the added displacement of a stern extension moves the boat's center of gravity aft, so the boat trims down slightly at the stern. Ellis advises that an extension must be kept as light as possible to eliminate excessive stern-down trim, unless the boat currently trims down by the bow, as was the case with the author's Aloha 8.2. One other cautionary note: the extension must not sit in the water or it will alter the balance, pushing the stern up and increasing weather helm.

— Jan Mundy

Good Boatkeeping

PRIVACY HATCH

This simple hatch refit provides the best of cabin comfort — privacy and light.

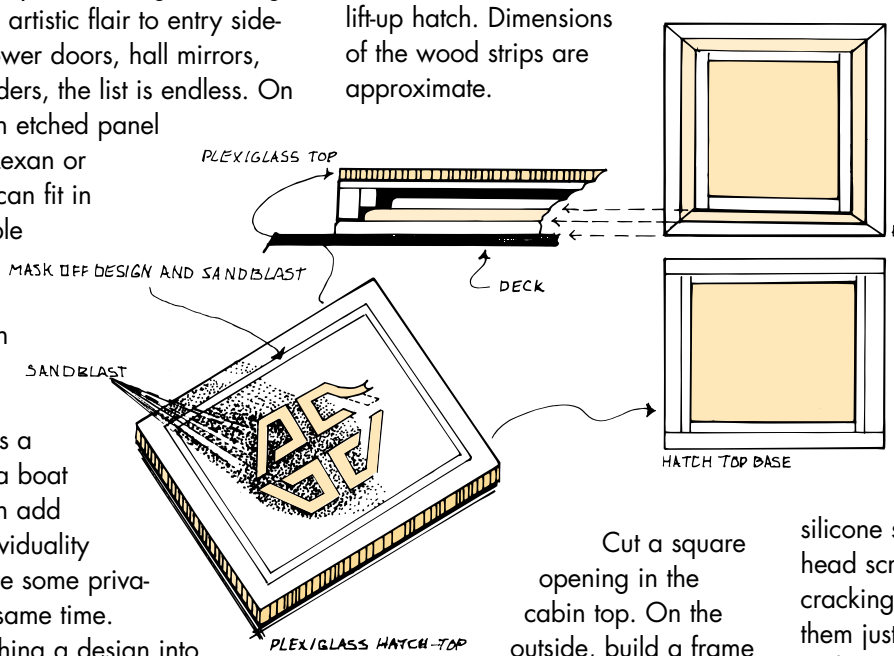
Story by Zora Aiken, illustrations by David Aiken

Interior designers have long known the versatility of etched glass, using it to add an artistic flair to entry sidelights, shower doors, hall mirrors, room dividers, the list is endless. On a boat, an etched panel made of Lexan or Plexiglas can fit in comparable spaces, though on a much smaller scale.

Here's a way that a boat owner can add some individuality and ensure some privacy at the same time. While etching a design into an overhead plastic hatch may call attention to the hatch, it also blurs the view through the plastic, offering privacy below.

Choose a geometric pattern or perhaps something that reflects the boat's name. Decide which areas you want to remain clear and cover those areas. We used ordinary masking tape for the example shown, which is our forward hatch. Instead of using masking tape to mask off the design before sandblasting, try self-adhesive shelf paper. When ready, take it to someone who does sandblasting. If you don't find a listing in the yellow pages, try a sign shop. It takes only a few minutes of gentle blasting with a light grit — just enough for an overall frosted look. Remove the tape or shelf paper and the plastic is ready for installation.

If you plan to build the hatch, here are the basics of a lift-up hatch. Dimensions of the wood strips are approximate.



Cut a square opening in the cabin top. On the outside, build a frame around the opening using wood strips about 6.3cm (2-1/2") wide and 19mm (3/4") thick. Miter the corners. (If the cabin top is curved, you may need to shape the bottom of the frame on the fore and aft sections.) Glue and screw this frame to the cabin top; countersink and plug the screws. Next, add a narrower frame on top of the first one with wood strips about 2.5cm (1") wide by 19mm (3/4") thick. These should be flush along the inner edge of the opening, creating a stair-step look on the outer edge. Miter these corners too. Glue and screw as before.

Another "step" is now added by an edge-up wood frame 12mm (1/2") thick that lines the inside of the hatch opening. The width of this wood depends on how far down the framework must extend into the boat; you may need to add trim on the lower edge later. Don't use mitered corners here (see sketch). The end result will have two steps that the top hatch fits over.

To build the lift-up top hatch, use appropriately sized wood strips so that the outer frame of the top hatch lines up with and touches the widest part of the lower hatch, and the inner frame touches the next step up.

The etched Lexan or Plexiglas panel can now be attached to the frame to cover the hatch. As with any similar installation, use silicone sealant and countersink pan-head screws (to minimize chances of cracking the plastic). Countersink them just enough to be level with the surface of the plastic.

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.