DIY boat owner

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# TALKBACK Q&A

## Installing Genoa Tracks

**Q:** I removed the self-tending staysail boom and want to install two tracks to accommodate the staysail. What is the angle the track has to make with the inner forestay?
*Michael A. Laaper,* Tamawind*, Merritt Island, Fla.*

**A:** When placing genoa tracks, the controlling factor is the shrouds, not the forestay, as you cannot sheet the sail farther inboard than the shrouds. Assuming your boat has a modern rig with the uppers fastened to inboard chainplates (not mounted on the topsides), position the tracks parallel to the centerline, straight back from the upper shrouds. — JM

## Low-down on Bottom Removal

**Q:** I have a 6m (20') Bayliner Capri. I need to remove several coats of antifouling paint without damaging the gelcoat. How should I do it?
*Claude Ladouceur,* Coqu*, Brome Lake, Granby, Que.*

**A:** Removing antifouling paint is a task most of us loathe. You do this by either grinding, scraping, applying a specially-formulated bottom paint stripper or blasting. The former three are the most arduous and hardest physically; the latter the most expensive. We don't recommend using chemical paint strippers, which may damage gelcoat or the polyester resin in the laminate.

Start with a clean hull, removing all surface growth such as algae, barnacles and sea grass. An acid-based cleaner (see our review on page 30) quickly dissolves any growth and grime. To grind off bottom paint use a 24- to 36-grit abrasive. This should remove about 70% of the bottom paint. Use a finer grit (60 to 100) to remove the remaining paint. Make sure you wear protective clothing, gloves and use a respirator. Grinding is messy, so some boaters opt to scrape the paint with a blade scraper. It works best if the blade is slightly dull, so file the supplied blade to a more obtuse angle. Repeat as required to maintain a good edge. Once most of the paint is removed, sand the hull with 60- to 100-grit paper. It's a painstakingly slow process — a lesson in endurance and patience.

Another option is to use Peel-Away, a non-methylene-chloride stripper that removes multiple bottom paint coatings. It's available in two formulations: Peel-Away Marine Safety Strip for most applications, and Peel-Away II for boats coated with an epoxy primer or barrier coat. Applying Peel-Away is similar to wallpapering. A non-sagging paste with the consistency of mayonnaise coats the bottom paint and then is covered with strips of plastic-coated paper. The paper seals the paste and prevents evaporation. Peel-Away's only drawback is the time it requires — it takes 24 to 48 hours before you can remove the paper and scrape the surface, depending on the thickness of paint and outside temperature. Optimum working temperature is 15.5°C (60°F); below 7°C (45°F), the product becomes dormant. Peel-Away is more expensive than sandpaper, the effort required is a lot less strenuous. The cost to strip a 7.5m (25') boat using the standard Peel-Away product averages $250. It covers 40 to 50 square feet per 3.785L (1gal).

Sandblasting with sand, baking soda or other mediums will remove the paint but must be done by a qualified operator. In unskilled hands, sandblasting can embed particles in the laminate and leave a bumpy finish that may have to be recoated with an epoxy. The Armex Accustrip System, which uses a baking soda-based abrasive, is a more passive process and does less damage to the gelcoat. — JM

## Aftermarket Parts, Freeing Windows

**Q:** I have an '83 Mirage 33 sailboat equipped with a Volvo Penta 2003 diesel engine. Could you tell me if aftermarket manufacturers offer equivalent fuel and oil filter replacements for Volvo parts. The Volvo part number for the fuel filter is 829913-5; the oil filter is 834337-8.

On a different subject, in your issue that covered retrofitting windows (*SPRING '96*), I tried to follow the suggestions for removing a window frame. After removing the screws from the aluminum frame I couldn't break it loose from the fiberglass. It appears that a sealant/adhesive was used. Is there an easy way to break the aluminum frame free? I made no attempt to pry the frame loose as it bends very easily and I didn't want to destroy the window.
*Hugh Baxter, West Vancouver, B.C.*

**A:** To answer your question on aftermarket parts, original equipment manufacturers (OEMs) generally don't encourage the use of aftermarket parts. With some parts you can save money, but occasionally, you actually pay less for original equipment. It's best to compari-

son-shop first. According to a local supplier, your filter is actually made by Bosch — it's the same part number as on the canister. As for the oil filter, AC Delco part number PF952 should fit, but be careful. We're told that this part fits a wide range of models and on some installations it may interfere with the belt which will put a hole in the side of the oil filter.

Window frames are often difficult to remove, depending on the type of sealant used. Use a sharp utility knife inserted between the frame and the fiberglass and carefully cut the sealant. Go slowly. It's a painstaking process but it's the only solution. Don't pry with a screwdriver or you risk puncturing the fiberglass or damaging the frame. — JM

## Restoring Metalflake

**Q:** I was particularly interested in your article on restoring gelcoat with acrylics (*SPRING '96 issue*). I have a 15-year-old Baja with a metalflake finish that is sun faded; normal waxing doesn't bring out a shine. A marina wet-sanded a test patch and it looks good, but the cost is US$1,300 and it won't guarantee the results. I would like to try Vertglas (an acrylic gelcoat restorer). How do I know how much wet-sanding to do before applying and what paper grits do I use? Is this a good product for metalflake? I have never attempted this before and want very much to make my boat shine again.
*Doug Kershner,* Journey, *Allentown, Pa.*

**A:** Metalflake is tricky stuff when compounding or sanding, so I'd definitely recommend a clear finish to bring up the gelcoat. Sanding is not necessary when applying Vertglas, which offers a three-step system: you first apply the Oxidation Remover to remove all chalking, followed by a thorough cleaning with the Boat Wash and then apply the Color Restorer/Sealer. Acrylics are not difficult to apply, but their fast drying times leave little room for error. Read the instructions carefully and don't overwork the product or you'll have a streaky, hazy finish. You'll want to apply at least six coats to ensure sufficient UV-protection. Plan on an afternoon to do the entire job. Acrylic finishes are not a permanent fix. You must recoat annually, applying one or more coats as desired — the more coats, the higher the gloss. Neglect an acrylic coating and it turns cloudy, peels and must be completely stripped. Damaged areas are easily touched up using the same application techniques. — JM

## Building With PT Wood

**Q:** I'm wondering if you have any information on using pressure-treated wood to upgrade a transom in a fiberglass boat. I'm fitting my boat with a

# TALKBACK Q&A

MerCruiser drive that requires a heavier transom so I figured I would put in two 19mm (3/4") layers of pressure-treated plywood. Is this a good idea?
*Randy A. Perry,* Dances With Waves, *Kentville, N.S.*

**A:** The use of pressure-treated plywood and lumber in boat construction has received a lot of press lately. Plywood transoms in fiberglass boats are normally set in a putty sealant to seal any voids, then encapsulated on both sides in glass and resin. The main concern for using pressure-treated or any exterior-grade plywood are the voids that are present in the wood. These voids must be filled around the stern-drive cut-out, and the opening must be well-sealed with epoxy on the end grain as well as all edges to prevent water migrating along the ply laminates. Pressure-treated plywood is not inherently stronger than other plywoods and probably won't last any longer if water infiltrates the laminates. — WR

## Oil Ratings

**Q:** I just purchased a '87 MerCruiser 470 (3.7L 165hp) with 200 hours and am in the process of spring recommissioning. My concern is this: MerCruiser's manual states that I should use 40W SF oil or 20W40 as a substitute, or as a second but less-preferable choice, 20W50. I am considering using Mobil 1 20W50 synthetic oil. What is your opinion on the use of synthetics in these engines?
*Gary Wortz,* Terri L, *New Castle, Del.*

**A:** According to Larry Watson, consumer affairs manager for Mercury Marine, your owner's manual was written 10 years ago and for many years MerCruiser recommended single-grade 30W or 40W SF-rated oil. Today, the recommended oil for use in all MerCruisers is Quicksilver 25W40 CD or CF certified multigrade oil (Quicksilver part number 92-832112A12). The use of other brands with the same certified viscosity and service ratings are probably satisfactory. Synthetic oils are excellent products and well-accepted in automotive use with no adverse effects, however, they have not been qualified by MerCruiser for use at this time.

## Engine Diagnostics

**Q:** We purchased a '77 Ontario 32 sailboat last summer that has a Yanmar 2QM20 diesel inboard. The engine runs perfectly but tends to vibrate a lot when running between idle (1,000 rpm) and the normal cruising speed of 6 knots. There is also a strange thumping noise when running at this speed. The cutlass bearing seems worn and will be replaced this spring, the engine has a flexible prop-shaft coupling and I doubt the engine has been aligned for some time. Are these symptoms normal for this type of engine?
*Dan Duchesne,* Coorie Doon, *Ottawa, Ont.*

**A:** From Dan Fong Of Total Power, Mississauga, Ont., comes this reply: All engines vibrate more at idle speed, which on your engine ideally is around 800 rpm, then should smooth out at 1,000 rpm. Check the engine alignment. Even a slight variation will increase vibration. At a cruising speed of 6 knots, the engine should not make any unusual thumping as you described. You need to determine where the thumping is coming from. A worn cutlass bearing can cause such noise and should be replaced. You should also check the engine mounts and flexible coupling. Also, take a measurement of your propeller tip clearance, which should be 15% of your propeller diameter. Recheck the engine alignment two weeks after launching. If the noise persists, you should have the engine serviced by a reputable marine mechanic.

## Windlass Info Wanted

Peter Lazenby of Duncan, B.C. is looking for operation and maintenance information for his '79-vintage Monica Marine windlass model 1500. Send written replies to 6145 Genoa Bay Rd., RR 1, Duncan, BC V9L 1M3 or fax to (250) 746-6775.

## Calling All American Marine Owners

Danny Covington sails a '74 7.5m (25') step-down fixed-keel sailboat built by American Marine Industries in Charleston, S.C. He and several other owners are interested in locating original owners' manuals. Send e-mail replies to him at drcov@aol.com.

# TECH TIPS

**STAINLESS OR NOT** If the plating on a so-called stainless-steel fitting should peel, the fitting is zinc and should be replaced with one of bronze or stainless steel.

**LUBE JOB** Keep your head's rubber valves, seals and piston o-rings flexible by pouring a half-ounce of mineral or baby oil dissolved in a half a toilet bowl of warm water. Close the manual lever to flush and pump the bowl just until the mixture disappears. Let stand for an hour or more.

**STAY FRESH** Fruits and vegetables stay fresh longer in Evert-Fresh reusable storage bags, which absorb and remove the ethylene gas released by the produce. Bags are sold in packages of 10, in medium and large sizes, and are available from health food stores, chandleries, West Marine (US$6 for large) and Boat/U.S.

**TENSION BLOCK** Should you strip the bolt in your alternator tensioning arm and the belt is too loose to produce any charging or properly drive the engine's cooling water pump, wedge a wooden or other non-conductive block (or blocks) between the alternator body and a nearby non-moving part of the engine block. Run slowly back to port for repairs.
*Phil Friedman, Port Royal Marine, Pompano Beach, FL*

**GALLEY DISINFECTANT** According to a study conducted by the Hospitality Institute of Technology and Management in St. Paul, Minn., the most effective way to wash and remove potentially harmful bacteria on cutting boards and galley countertops is to mix a solution of one part 5% white vinegar with four parts water applied from a squirt bottle.

**CABLE CORROSION** Rust appearing through the plastic covering of a lifeline cable indicates crevice corrosion and the safest course is to replace the cable.

**QUICK PATCH** To patch pinholes in an inflatable dinghy or fender, first partially deflate it to relieve the pressure, then apply a polyurethane sealant, such as 3M 520O. Use a toothpick to force the sealant into the hole and let it cure (up to seven days depending on the sealant used) before reinflating.

**HOW MUCH DOES IT HOLD?** To determine the capacity in U.S. gallons of a tank, a close estimate can be made by measuring the tank and dividing the volume of the tank in cubic inches by 231. Multiply the result by 3.785 to obtain litres.

**SAW GUARD** When storing handsaws, knives or other sharp objects, protect the blade with a piece of old, small diameter hose slit down the middle.

**SPIKE ALERT** To avoid voltage spikes that can damage sensitive electronic equipment, turn on electronics after you start the engine and switch them off before turning off the engine.

**SPLASH PROOF** To prevent splashing when emptying screw-on type metal canisters or plastic jugs containing liguids, hold the container with the spout facing up (on the top) so air gets in above the liquid level.

**MAGNET TEST** When trying to determine if fittings are plated steel, bronze, brass or stainless steel, check them with a magnet. Any attraction means the fitting is probably plated steel.

**SEAL IT WITH PLASTIC** Discharge and, sometimes, intake head hoses can be a major source of offensive odors. Tightly wrapping the hose with kitchen plastic wrap will seal smells in the hose until you are able to replace it.

**RIGHT OF ENTRY** To gain easy access to fasteners mounted under the cabin headliner without removing it, cut a hole in the liner under the fasteners and install plastic inspection ports.

**SHADES OF REMNANTS** When applying adhesives and sealants, clean up with a rag that is of a contrasting color. You'll be able to see the residue on the rag and can avoid wiping it back onto your finished work or your hands, clothing, hair, etc.

***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:*** **DIY Tech Tips, P.O. Box 22473, Alexandria, VA, 22304 or E-mail to info@diy-boat.com.**

# ShopTalk

## HOLDING THINGS TOGETHER

Joining two pieces of wood requires an adhesive of some nature. Follow these guidelines to pick the best one for the job.

***By Wayne Redditt***

Since the beginning of time, boat builders have been applying various formulations of gooey stuff in an attempt to keep the sea out of the boat.

Nowadays, this "stuff" is generally referred to as an adhesive-sealant. In the real world of boat repair, the distinction is moot. In order for a sealant to function well it should have good adhesive properties. The real difference is that sealants are elastic when compared to pure adhesives. This flexibility allows for more versatility than you could expect of a straight glue.

Knowing which of the multitude of products to use for the task at hand involves determining how much flexibility is required. Some products cure harder than others and have less elasticity. Some harden with age until they become brittle and fail. Silicones, for example, are so elastic they can contribute little if anything to the structural rigidity of the boat, while polyurethanes will stiffen the structure.

The number of sealants available in home renovation stores far exceed those available at marine stores — and prices are significantly cheaper. But this doesn't mean that specialty marine adhesives and sealants are merely repackaged house renovation products.

The added cost of marine adhesives is well justified. Hardware store products that are designed for the housing industry, don't have the performance-enhancing components in their chemistry that the marine environment requires.

Choosing the right material for the job may be more difficult than actually doing the job. Most marine stores stock at least three types of polysulfide, polyurethane and silicone products, including oil-based products traditionally used for hull seams.

Polyurethanes (3M 5200, Sikaflex 241 and others) are most commonly used for adhesive-sealant applications. These can be applied with complete confidence for use under water and, being ever so slightly elastic, they allow some wood movement. 3M Marine warns that the 5200 must be used within 24 hours of breaking the seal, so make sure you have enough jobs to warrant opening a cartridge. You'll also need Scotch-Grip #4 for clean up; nothing else will remove the stuff. When handling polyurethanes wear protective gloves. Don't use your bare finger to spread adhesives onto wood surfaces. To smooth adhesives or make an attractive fillet, here's a good trick: Dip your gloved finger in water before running it along a bead of polyurethane. The water prevents the adhesive from sticking to your glove and allows you to create a concave edge.

Polyurethane bonds are more or less permanent; it requires great patience to remove a plank that is fastened to its neighbor with polyurethane. The strategy for success involves cutting the seam with a sharp, thin blade. If the plank can be sacrificed, set your circular saw to the depth of the plank thickness and saw through the seam. Be sure to stay on the replacement plank as saw cuts in the adjacent good plank will require further repairs. Sawing into frames is poor form too, so double-check the depth setting before cutting.

When I was making mahogany launches as part of a professional boatbuilding team, we used epoxy for everything. Using epoxy for bedding is not so strange when you consider the permanence of polyurethane adhesive-sealants. It's actually easier to remove a piece of hardware bedded in epoxy than to remove one bedded in polyurethane. There are two methods to remove hardware set in epoxy. One is to strike it sharply with a dead-blow hammer, in a fashion that will cause shear failure. There is a certain risk in this, as the wood below may fail first. The second is to heat the part gently until the epoxy softens. This happens at a surprisingly low temperature, usually just a little too hot to touch comfortably.

Neither of these techniques will work with polyurethane. I have been told that using a guitar string (high E) stretched taut and heated via a model train transformer, will cut through it. I would like to hear from someone else who has tried this approach.

***When not messing about in his workshop, Wayne Redditt shares his expertise in boatbuilding, repair and restoration with the senior students of Georgian College's Marine Technology-Recreation course. Subsequent columns will discuss construction methods, restoration techniques, modern repair materials and other topics for builders and tinkerers of boats. Inquiries directed towards this column are welcome. Send your comments or questions via mail, fax or e-mail, attention ShopTalk.***

# Rx for heads

## Fear and Loathing in the Vanity

Add a stock of latex rubber gloves to your tool kit and read on because it's possible to solve most marine sanitation problems with repairs and upgrades.

***By Nick Bailey***

In the last issue (1997-#1) we covered all plumbing systems other than the head, otherwise known as the marine toilet or as commonly referred to as a marine sanitation device (MSD).

Of all of the onboard plumbing systems, the head has a redundant reputation as a real troublemaker. This notoriety is exaggerated, although not entirely undeserved. MSDs are seldom well-maintained and even less well-understood. Beware, neglect will lead to nasty surprises. If you thought the device was a bit disgusting even when it was working well, then just wait until it screws up!

## HEADS: The Front End of the Sanitation System

There are basically four kinds of marine toilets, classified by how the sewage is moved: manual pump, electric pump, vacuum and gravity.

The manual-pump toilet is the most common type. Well-known examples are made by Blake, Groco, PAR (made by Jabsco), Raritan and Wilcox Crittendon. Flush water is pumped in at the same time the sewage is pumped out, usually by a double-acting manual pump. The down stroke of the pump handle forces a piston down, pushing sewage out of the pump chamber through a one-way valve to the holding tank (or overboard to a thru-hull) while at the same time drawing in seawater for flushing from a thru-hull into the upper half of the pump chamber.

On the upstroke, the one-way inlet valve is pushed closed and the flush water is forced out along the toilet's rim. As the piston rises, sewage and used flush water are drawn into the pump chamber ready for the down stroke that again forces everything out the discharge hose. The head inlet valve usually has a small manual control labeled "Flush or Dry Bowl" so that you can control the amount of flush water — a bare minimum if you want to preserve your holding tank capacity, or lots of flush water if you want to purge the discharge hoses before leaving the boat at the end of the weekend. Regardless, the pumping and flushing procedure should end with the valve closed to leave a relatively dry bowl.

These traditional heads range widely in price from about $200 to more than $1,000 and vary in complexity. Most have a multitude of seals, gaskets, O-rings and valve surfaces that can foul, stick, clog, jam, wear out and otherwise cause aggravation. Most heads have complete rebuild kits available. The ability to field-strip, clean and rebuild a head is considered an essential life skill for any serious long-distance cruiser.

A unique alternative to the conventional manual head is the LaVac head by Blake. This remarkably simple head does away with the complicated pump assembly at the head itself and uses a pump similar to a diaphragm bilge pump but installed on the discharge hose from the head. The most unusual feature is the toilet bowl lid that forms an airtight seal on the bowl itself. When the bowl contents are pumped out, the suction draws seawater for flushing into the head via the usual inlet seacock and hose straight to the rim of the bowl. To pump dry, simply open the lid, which breaks the suction. This head has far fewer moving parts than others, which means less maintenance and trouble. However, large people are advised not to flush while seated on this head!

The electric toilet may simply be a powered version of the manual toilet with a hefty DC motor driving a reciprocating crank, which in turn actuates the same basic pump mechanism described above.

**TIPS** *GATE-FREE*

*If your boat has gate valves, replace them before they seize or break. Many seized gate valves are irrevocably seized to the thru-hull; be prepared to remove and replace the whole thru-hull. To do this, sever the thru-hull stem and free the valve with a mini-grinder or hacksaw. If the thru-hull nut is also seized, grind off the mushroom head on the outside of the hull, knocking the remnants through to the inside. Be careful not to gouge the hull.*

Alternatively, it may have a macerator pump.

The macerator-pump toilet is quite different in that it uses a rubber impeller pump to pull in flush water and, usually driven on the same shaft, a centrifugal or impeller discharge pump with a chopper or macerator blade (not unlike a garbage disposal unit) that purees the sewage so that it won't choke the pump. These heads have the convenience of push-button flushing, but because the rubber pump impeller will disintegrate if it's run dry, you don't have the option of controlling the amount of water used, which can be at least 7.5L (2 gal) per flush. This type of head could prove impractical if connected to a small holding tank system. PAR and Raritan make the most common macerator units.

Popular on larger powerboats, the Vacu-Flush head by Sealand (formerly Mansfield) is unique in the marketplace. It uses a vacuum pump — a powerful bellows pump with extra one-way "duck-bill" valves — in line with a vacuum accumulator tank that draws flush water from the potable water system. The vacuum system behaves like a pressure water system in reverse. When the "flush" foot pedal is pushed, a small amount of water is let into the bowl, the discharge valve in the toilet opens and the sewage promptly disappears with a "whoosh" down the discharge hose towards the vacuum tank. Simultaneously, somewhere down in the vessel's machinery spaces, an automatic pressure switch senses the sudden change in vacuum and engages the vacuum pump. The pump chugs away until it reaches full pressure then the pressure switch shuts it down. In the meantime, it has scavenged the sewage from the vacuum side of the system and delivered it down to the non-vacuum holding tank (or waste-treatment system or overboard).

This is a nice system. It has relatively low power consumption and it uses less flush water than any other. It is, however, costly to install, and although more reliable and less finicky than any other electric and most manual head systems, if things do go wrong, it can be expensive to fix. Vacuum leaks are particularly sneaky things to track.

The last category of heads is gravity powered. In these systems the sewage drops straight into the storage tank below. The most common variety is the portable-style (commonly referred to as porta-potties), which stores the waste in a small, removable tank section of the head. Some models have deck pump out fittings (mandatory in Canada), some have recirculating flush capability in which the sewage in the tank mixed with deodorizing additives gets pumped around for flushing. Some have a fairly large capacity and provision for pressure-water flushing. Unfortunately, some have a bad reputation as cheap, flimsy, prone to leakage, smelly and generally obnoxious. Many boaters prefer to use a bucket (which may or may not be legal in your jurisdiction) rather than carry around sewage in such a dubious container.

If your boat operates in waters designated as "No Discharge Zones" it must be fitted with what the U.S. Coast Guard (USCG) calls a Type III MSD. In these areas, it's not legal to pump any sewage overboard even if you have a treatment system on board. In most U.S. coastal waters (inside the three-mile limit), it's legal to discharge sewage only after it's treated by a USGC-certified Type I MSD (i.e. Raritan Lectra/San, Sealand

# Rx for Heads

SanX and others), or Type II MSD for boats over 9.8m (66'). These costly units (about US$2,000 complete with the head) are small onboard sewage treatment plants that macerate and disinfect the sewage until it meets very specific bacteria counts and standards for turbidity (suspended solids) prior to discharge.

## DISPOSAL: The Back End of the System

### Discharge Hose

Much has been written by various authorities on head hose. The consensus is that if you install the wrong kind of discharge hose it can be a major contributor to head odor. Head hose should be flexible and smooth-walled, preferably heavy-gauge PVC sanitation-grade hose or top-quality reinforced neoprene. The spiral-ribbed thin wall hose often used is okay for bilge pumps but is too thin for an odor-free head hose and the ribs trap sewage. Rigid Schedule 80 PVC pipe or household ABS (DWV service) offer a non-permeable alternative and are useful if you want to eliminate any low spots that tend to hold sewage. Be careful not to use light-gauge Schedule 40 pipe — it can crack, especially when very cold.

## Head Rebuild


***A rebuild kit includes replacement parts for all the perishable items and a parts list helps you identify other problem areas.***

**1 Preparation** Pump out the holding tank and flush the system well. Shut off any seacocks, disconnect discharge and intake lines, unscrew the mount bolts and remove the head from the boat in order to work on it in less cramped quarters (or remove the pump assembly only). Remove pump assembly from base. Open the head repair kit and carefully check the parts and the enlarged diagram provided.

**2 Inlet Valves** Remove the valve cover (typically six screws) and remove the flapper valve. Clean all mating surfaces carefully, replace all valve parts with new ones and replace any O-rings and seals on the inlet valve lever. Lightly smear sealing surfaces with silicone sealant.

**3 Piston Rings and Shaft Seal** Wrap the piston rod and carefully secure with vise grips. Unscrew the pump handle and release the piston to drop or knock out the bottom of the pump housing. Clean and lubricate the pump cylinder. Replace the piston rings or piston assembly, and remove and replace the piston rod seal. With an external seal, unscrew or remove the retaining ring; an internal rod seal must be pried out from the inside.

**4 Discharge Valves** Remove, clean sealing surfaces and replace the flapper valve at the pump base. Dismantle the discharge elbow, clean out and replace the duck bill or "joker" valve.

**5 Seals** Replace any sealing gaskets and O-rings, clean all mating surfaces and check carefully for cracks in all housings.

**6 Assembly** Reassemble carefully. Don't over-torque the plastic housings, which crack very easily. If cracked, they must be replaced.

**7 Clean up** Reinstall, hook up, open the seacocks and test for leaks.

When shopping for hose, the standard head discharge size is 1-1/2" inside diameter (ID) hose; some macerator-type heads will discharge via a 1" ID. Inlet suction hose is usually 3/4" ID and should be firm and non-collapsible.

## Vented Loops

Regardless of how well or poorly a marine sanitation system goes about its business, there is one thing it must never do and that is sink the boat. This happens more often than you might suspect simply because most heads in sailboats and some in powerboats are installed below the waterline and connected to a seawater inlet. Seawater siphoning into the head bowl results when one of the flapper valves on the head ("Flush or Dry Bowl") fails.

Sailboats spend a lot of time heeled over at angles up to 30° or more, which radically changes what fittings are below the "heeled" waterline. One solution is to always turn off the head inlet seacock when it's not in use, but this may not be practical if the seacock is inaccessible. Some boats even come equipped with a secondary (accessible) shut-off valve on the intake line. These security measures all depend on the operator to do the right thing, but to err is human. Besides, there are always guests and children and they might not always remember or understand instructions.

The proper head installation will incorporate an automatic method of disrupting any siphoning action. To accomplish this, configure the inlet hose with a tall loop above the waterline and close to the underside of the deck between the head pump and the bowl. This may require the removal and replacement of the standard hose fitted on the toilet. At the top of the loop, install a special U-shaped fitting known as a vented loop or anti-siphon vent. The vented loop incorporates a small one-way air valve that opens if any suction is present in the hose, allowing air to enter the line and break the siphoning action. A similar siphon break is required on the discharge hose if it's connected to a thru-hull.

There are a few problems with vented loops. The anti-siphon vent fitting can clog with debris, calcium or salt crystals and quit working. To prevent this, clean periodically. As well, sewage odors in the discharge line vent sometimes filter into the boat. To eliminate this, attach a small diameter hose to the nipple on top of the vented loop and lead it to an overboard vent fitting mounted well above the waterline or connect it to an existing holding tank vent. Alternatively, feed the hose into a cockpit scupper provided that it's above the waterline at all times.

## Thru-hulls

The head inlet and discharge thru-hulls should have reliable, quick-acting valves. Seacocks with integral quarter-turn valves or thru-hulls combined with a ball valve of stainless steel, bronze or Marelon are much preferred over gate valves.

## Holding Tanks

Many boating areas in North America, in particular most freshwater lakes and rivers, don't allow marine sanitation systems to discharge any sewage overboard whether it's treated or not. The boat must be without an installed toilet on board or the head must have a holding tank.

Holding tanks come in all types. On boats built for saltwater markets, the holding tank may be an afterthought, either too small, inaccessible for maintenance or generally substandard. The most common

# Rx for Heads

tanks are molded polyethylene, available in shapes to fit most locations. If made of linear (not crosslinked) heavy-gauge 6mm to 9mm (1/4" to 3/8") seamless polyethylene, they will give excellent service. Lighter gauge tanks are flimsy and prone to odor penetration. Heavy-gauge (2mm (3/32") or thicker) stainless-steel tanks are strongest and the least odor permeable. However, in the long-term (five-plus years) such tanks corrode from sewage acids. Corrosion attacks the seams first, leading to leakage and the need to remove and repair them. (Aluminum and other metals are unsuitable holding tank materials because they are less corrosion-resistant than stainless steel.)

Bladders or flexible-rubber tanks are sometimes used. They are difficult to secure and, as a result, they are subject to chafe, particularly in a sailboat. Flexible tanks are also tough on the fittings connected to them. These tanks must be inspected requently, so should be installed in an easy-to-access spot. Also, some head chemicals may "devour" the rubber, creating a repulsive smell more intense than any known head odor.

Remember, sewage weighs 3.6kg per 3.8L (8lb per gal), which is a lot of mass sloshing about. When choosing a tank it makes sense to spend the extra money for a good one.

## Add a Holding Tank

If you need to fit a tank, decide first what size you need. Do you use the boat for day trips, weekends, or extended cruises? The minimum average flush volume per person per day is about 11.3L (3 gal). Therefore, a couple on a weekend cruise will need a tank capacity of 45L (12 gal). For two couples, 91L (24 gal) is the minimum. The other consideration is how big a tank you can fit into the boat. Stock polyethylene tanks are available in many shapes and sizes and custom stainless-steel tanks can be built to suit your available space. (Refer to **Figures 1, 2** and **3** for typical holding tank installations.)

It's also possible to build a fiberglass or wood-epoxy tank or glass in an existing seat locker and convert it into a tank. In order to resist stress cracking and avoid pinhole leaks, it should be heavily built and thoroughly epoxy-barrier coated on the inside to prevent

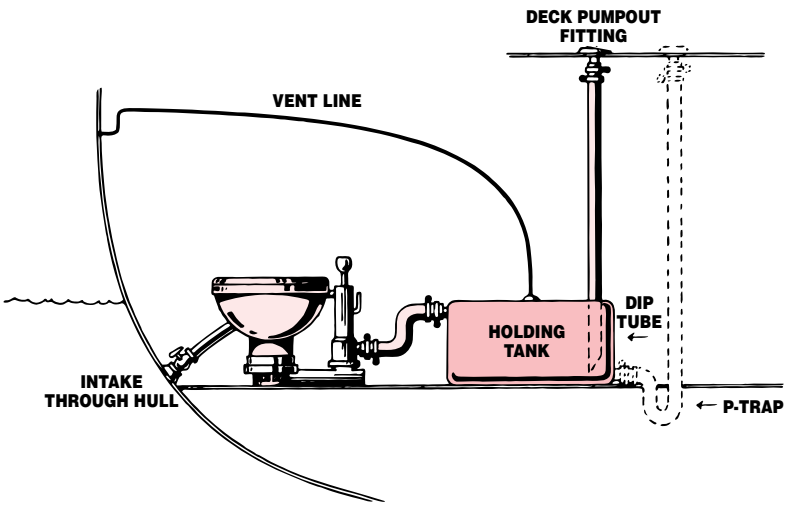



**Figure 1**

*"No discharge" deck pumpout only.*

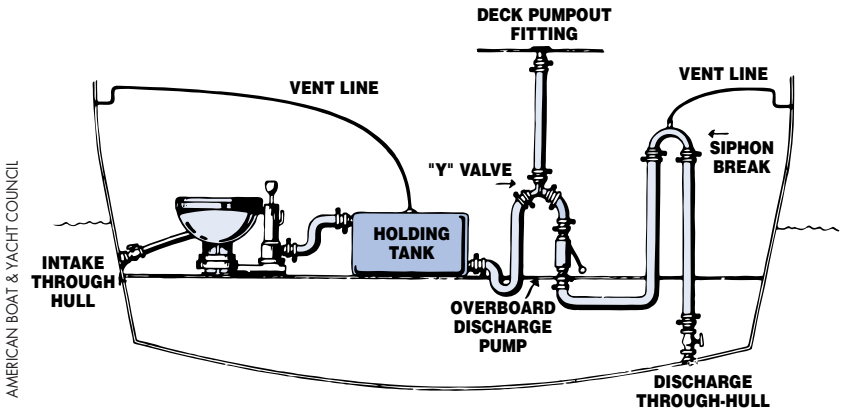



**Figure 2**

***Overboard discharge option after the holding tank.***

moisture penetration. (See DIY Projects on page 27 for instructions on building a wood-epoxy tank.)

Any installed tank must be strong enough to carry the full sewage load and it must be securely blocked or clamped in place. Any movement or flex puts stress on the inlet, discharge and vent connections and either cracks the tank at the fitting or the fitting itself cracks. When space is tight, convert your water tank to a sewage holding tank and then squeeze a bladder tank into some nook and use it for water. At least if the bladder tank leaks you won't be subjected to a horrifying stench.

If your existing water tank is polyethylene with the usual 1-1/2" fill fitting and 1/2" vent and outlets, you will have some difficulty replacing the 1/2" outlet with a 1-1/2" pumpout discharge fitting. If the tank is heavily reinforced, the water outlet can be enlarged with a holesaw to accept a 1- 1/2" hose barb mushroom-style thru-hull (preferably reinforced plastic) with backing nut. Caulk the thru-hull well with a polyurethane sealant (3M 5200, Sikaflex or other). This modification has been done successfully but because polyethylene does not bond well to most sealants, the seal may fail. I recommend replacing the tank with another the same size but equipped with the correct fittings.

All hose connections should be double-clamped with stainless-steel clamps, and any head installations below the waterline should have vented loops on the intake and dis-

# Rx for Heads

charge lines. To prevent noxious odors emitting from a vented loop, attach a hose from the valve to an overboard vent mounted above the waterline (**Figure 4**) or tie it into the holding tank vent or cockpit scupper. It's also worthwhile installing the largest practical vent diameter or two vents on the tank to assist with the oxygenation of the sewage (see "Odor Control" below). Note: On boats with optional overboard discharge, the Y-valve must be secured with a padlock, cable tie or the valve handle removed when operating within the three-mile limit.

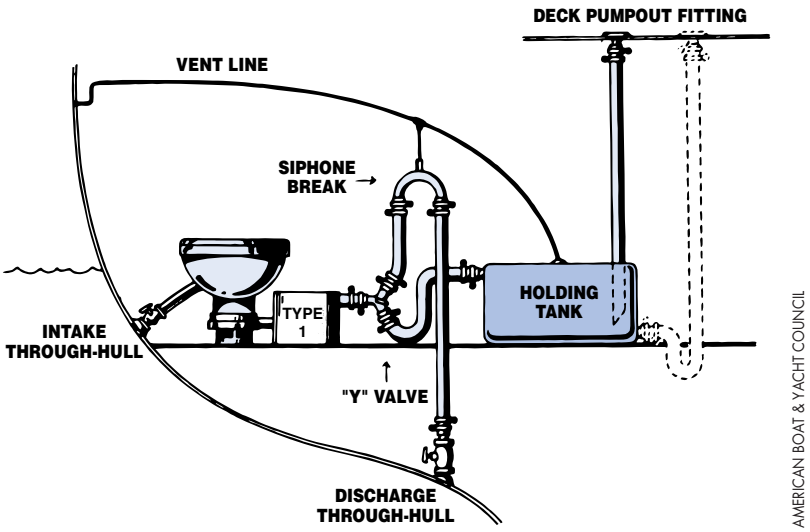



**Figure 3**

***Overboard discharge option before the holding tank.***

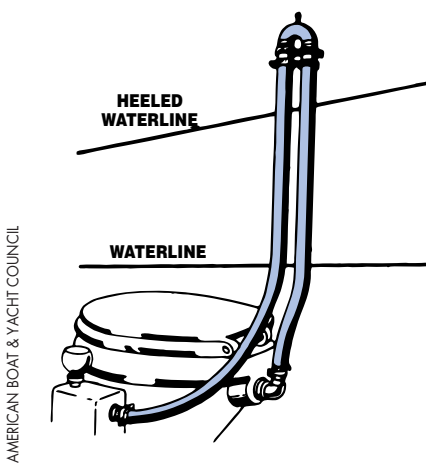



**Figure 4**

***To prevent water from siphoning back into the head, install a vented loop in the inlet hose (and the discharge hose if connected to a thru-hull) located above the maximum-heeled waterline.***

## Odor Control

There are several sources of head odor of which leaks are the worst cause — find them and fix them. Discharge hoses, even top-quality ones, eventually become saturated and odor penetrates the walls. To check your head hose for odor permeability, try the rag test. Wipe the outer surface of the hose with a damp cloth. If the cloth smells, the hose is permeable. Replace immediately. To eliminate hose odor, avoid sewage remaining in the line for long periods. Flush well or even revise your hose routing to minimize low spots or traps. Consider replacing hoses with straight-through plastic pipe but keep in mind that the proper size head-to-pipe or hose-to-pipe adapters may be hard to find.

The inlet hose can be another cause of odor, particularly in saltwater. Marine growth decomposing in the stagnant water of an intake line can mean the first flush of the weekend will reek. A strainer on the inlet line can help solve this. Periodic purging of the entire inlet line with a 30% solution of vinegar and fresh water will also help. Never use bleach or other commercial cleaners in a marine toilet; it can attack the rubber and metal parts.

Low-cost in-line head chemical dispensers, such as the Head-O-Matic Tank-ette (**Figure 5**), treat all water pumped to the head to eliminate intake odor. Easy to install, the Tank-ette (CDN$59.95/US$39.95) clamps onto a 3/4" intake line (use adapters for other hose sizes) mounted above the waterline. A bullet of blue solid chemical drops into the unit and is replaced after one month or when the water runs clear. Replacement bullets cost $9 or less. An optional E-Z Flush cap facilitates winterizing or flushing of the head.

The discharge joker valve can leak allowing sewage to back up into the head. Or if the piston rings are worn, sewage can leak past


**Figure 5**

***The Head-O-Matic Tank-ette installs in the intake line and auto-feeds head chemicals to treat water pumped to the head.***

into the flush-water side, contaminating it. Then it's time for head repairs. Another source of odor is generally head area cleanliness and, although unpopular (and probably unenforceable), a "guys sit to pee" rule will reduce splash, odor and cleaning.

Cheap, lightweight, polyethylene tanks are odor permeable; heavy-gauge tanks are much less so but odors may eventually seep through. Septic-tank sewage odor is a by-product of the anaerobic bacteria that thrive in the oxygen-deprived, carbon-dioxide-rich environment of most holding tanks. This is why municipal sewage treatment plants aerate sewage to promote the growth of aerobic oxygen-loving bacteria, which give off much less odor as they naturally break down the sewage. The same is true of backyard composters.

Peggie Hall of Peal Products, a company specializing in marine sanitation systems in Atlanta, Georgia, advocates a simple, innovative approach to naturally eliminate sewage smells in the tank. The key is to fit the largest practical cross-flow vent system to the tank — usually two independent vent lines of 2.54m (1") diameter hose to each side of the boat (Figure 6). This sets up true cross-flow ventilation of the tank, clears out the carbon dioxide and prevents oxygen starvation, which allows the aerobic bacteria to gain the upper hand over the smelly anaerobic types while breaking down the sewage by natural fermentation. Although it might seem counter-intuitive, this enlarged vent system is reported to eliminate most holding tank odors. For the idea to work, the vent hoses must be as short as possible and free of low spots that can trap air. It's also important that the hoses aren't restricted by filters or tiny screened fittings on the outboard end. With sailboat installations, care must be taken that the vents come straight up from the tank top to avoid filling while the boat is heeled. They should exit at locations above the waterline at all times (i.e. the bow or the transom). According to Hall, the rule is: The less fresh air a holding tank gets, the more it will stink.

Vent maintenance is also important in odor control. Vent lines are easily blocked by spider webs or by sewage if the tank has been overfilled and "ram fed" by the head pump — especially if the outside hull vent fitting is tiny and screened. This can lead to a dangerous situation since the fermenting sewage produces gases and pressure builds. It doesn't help if your guests stand on the pump handle to pump the head due to the back pressure. I have seen heavy-gauge rectangular polyethylene tanks blow up like balloons and break the joinery meant to contain them. There's also the urban legend of the couple in fancy dress whites taking their friends by boat to the Commodore's Ball. They realize they need a last minute pump out, blissfully unaware that a 6m (20') geyser of raw sewage would erupt when the deck fitting was opened.

The opposite happens when the vent is clogged during a pump out. The large diaphragm pumps will easily suck a heavy stainless-steel tank flat into a crumpled pancake. So check the vents periodically for blockages and spider webs. A ruptured holding tank is the smelliest one of all.

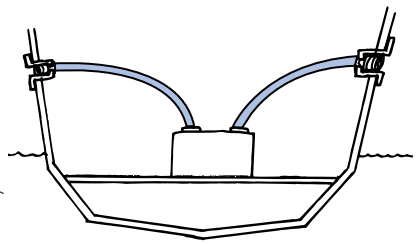
**TIPS** *DRIP PAN*

*A plastic pan or cut-off jug bottom placed underneath the lowest point in the system will prevent any unpleasant extract from spilling into the bilge when you drain it for maintenance.*

## More Routine Maintenance

Maintenance Rule #1 is to make sure that everyone who uses the head understands that it's not connected to the town drain and that it is by nature a finicky, cantankerous, spiteful device. All instructions must be strictly obeyed, such as "Don't put anything in the head unless you have eaten it first." It's claimed that the legendary Wilcox Crittenden Skipper head can flush an overcoat, but for the rest the only exception to the "eat first" rule is

# Rx for Heads



Anne-Marie Hendry

**Figure 6**

***Eliminate most holding tank odors caused by oxygen-starved bacteria by fitting the largest practical cross-flow vent system to the tank.***

marine or ultra-cheap one-ply toilet paper.

If Rule #1 is followed, heads don't need much maintenance. Check that the vents are clear — be aware of any sudden resistance in pumping effort and never force the pump. Experts recommend occasionally flushing half a toilet bowl of warm water with biodegradable laundry detergent through the system followed by two ounces of mineral or baby oil (not vegetable oil, which slimes up the lines and tank). Periodic greasing of the piston rod is also recommended. The oil will help the head and the detergent will emulsify the oil in the tank to preserve good bacteria. If the boat is equipped with a Type I or Type II MSD, do not flush cleaner or treatment into the system unless it was specifically designed and sold for that purpose.

Many pros recommend a complete head rebuild every two years as the best preventative maintenance program. (Add this task to your spring recommissioning list.) This ensures the head is always in top shape and it also guarantees that you will be familiar with the unit when repairs are needed.

In saltwater, calcium can build up in the toilet and lines and almost becomes like a hard coral growth due possibly to microscopic diatoms. Periodic flushing with vinegar will help dissolve these deposits, but if they are severe and the head becomes difficult to pump, you may have to replace the hoses or carefully flush the system at least once with diluted hydrochloric acid (muriatic acid). This must be done carefully as the acid can slowly attack metal parts in the head system.

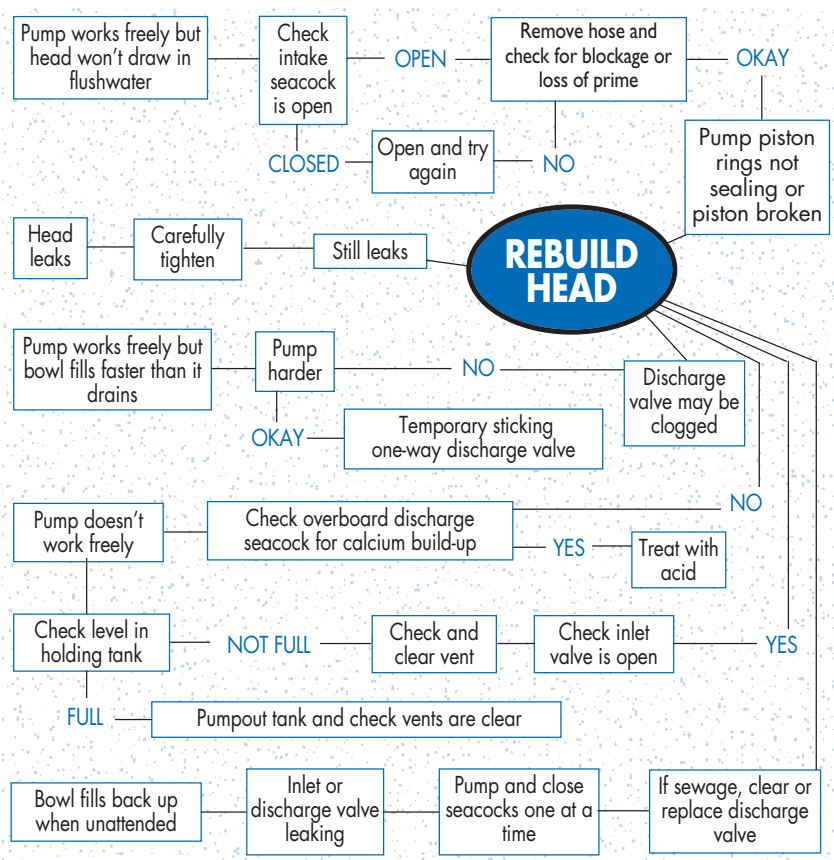
Regularly check all hose connections for new signs of leakage. To check the operation of the anti-siphon valve, blow through a piece of hose fitted over the nipple.

Simple maintenance habits also help to minimize odor; the last flush of the cruise, especially at the end of the weekend, should always be a thorough one to eliminate sewage standing in the discharge line.

***Nick Bailey has been in the marine service profession for more than 20 years and currently is service manager of Bristol Marine in Mississauga, Ont. He and his wife own and race a wooden Thunderbird on Lake Ontario.***

## TIPS HEAD FILL-IN

*What do you do when the head is not working? Carry a supply of Flush-Me-Nots. Line the head bowl (or a bucket or whatever else fits) with the plastic bag then add some high-tech powdered absorbent (it's part of the package). After use, seal the bag with a twist-tie and dispose of it as you would a diaper.*



POWERBOAT RIGGING

# GOOD VIBRATIONS

Install an automatic engine synchronizer to eliminate engine vibration and save fuel in a twin-engine boat.

## Tools & Materials

- Drill and bits
- Pliers
- Assorted screwdrivers
- Socket set
- Wrenches
- Wire cutters and crimping tool
- Wire ring terminals
- 19mm (3/4") marine-grade plywood (optional)
- 1 33C or 43C control cable
- 2 .187"-diameter drive cables
- Switch kit
- 2 tach senders (optional if required)
- 12-gauge two-conductor wire
- 4 5/16" lag bolts

Owners of twin-engine boats know the importance of having both engines synchronized so they operate at exactly the same rpm. Inboard and sterndrive engines that are out of sync by as little as 15 rpm can cause excessive vibration that radiates through the hull and deck, creating extra noise and producing an uncomfortable ride. Vibration can also cause wearing of the stuffing box, propeller and bearings, loosening of engine mounts and fittings, and make steering difficult. Engines that are not synchronized also burn more fuel because they are not sharing the load equally.

Twin engines can be synchronized manually with the help of tachometers or indicator lights. As few tachometers are perfectly calibrated — some units differ as much as 100 rpm or more — many experienced operators rely on their ears, listening for the familiar "purring" when engines are synchronized. On a boat with twin diesels, this sound is heard when the operating difference is within 10 to 15 rpm, which is adequate when running in optimum conditions. Operating a boat with loud mufflers or from a flybridge, especially in strong winds and rough seas, puts the driver out of earshot of the engines and beyond the "sound" of synchronization. Blinking indictor lights help determine when the engines are in sync, but they can be a distraction.

Manually synchronizing engines requires constant adjustment of the throttles. A change in boat speed or a slight movement in the throttle springs will cause the engines to go out of sync and it's back to fiddling with the throttles. (High-end digital tachs can come within a 1 or 2 rpm difference but still require nursing the throttles.)

The only way to accurately and continuously synchronize twin engines is by using an automatic synchronizer. The automatic synchronizer made by Glendinning Marine Products eliminates a tedious chore by making throttle adjustments automatically. Just pull a switch at the bridge to engage the synchronizer. Set the throttle of one engine (known as the lead or master), and the synchronizer will adjust the other engine (known as the slave) to the identical rpm. When conditions demand manual control of the engines (when docking, for example), the unit can be switched off at any speed. And, if something happens that the synchronizer is unable to match the rpm of the slave engine to the lead, it shuts off automatically.

This is a very simple electromechanical device. Two drive cables lead from the tachometer take-offs on the engines to the ends of two geared shafts on the synchronizer. As these shafts spin, a third gear equalizes the speeds (rpm) of both shafts, moving the bridge throttle control of the slave

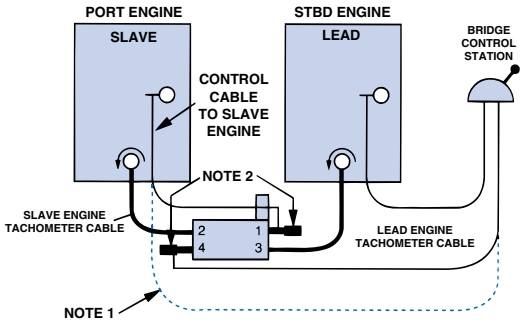



**Figure 1**

***A typical synchronizer installation on twin engines with pull-to-open throttle cables and counter-clockwise rotation. The bridge control cable for the slave engine (shown as a dotted line) and tach senders are removed from the engine and attached to the synchronizer.***

engine to a position identical to that of the lead engine.

Glendinning's synchronizer can be installed on any diesel or gasoline engine and is easily adapted to any type of control system: push-pull cables, hydraulic, air or electronic controls.

## Installation

The system consists of the synchronizer control box, mounted in the engine compartment, and a switch and pilot light at the bridge. Also required but not included is a 12- or 14-gauge duplex wire, cable ties, wire terminals, a Morse 33C or 44C or equivalent engine control cable and two .187"-diameter drive cables. Installation is not difficult but does require some mechanical ability: a professional installer takes five to 10 hours, so you may want to reserve a weekend to complete the job.

The synchronizer is mounted in the engine compartment on its base, on a bulkhead or inverted on the ceiling. Select a location that aligns the synchronizer with the throttle control cable that runs from the bridge to the slave engine. (Usually the port engine is the slave.) The cable (two cables on dual-station boats) from the synchronizer to the engine must not exceed 2.4m (8'); the drive cable from the engine's tachometer take-off must be less than 4.2m (14'). Care must be given to cable routing — avoid sharp bends or "S" curves. Mount the synchronizer using 5/16" lag bolts (not supplied) to a flat surface; if necessary, use 19mm (3/4") marine-grade plywood.

There are different take-offs on the synchronizer for attaching control cables. Determine which one to use depends on whether increasing speed is a push-to-open or pull-to-open action and on the rotation of the engines — either clockwise or counter-clockwise on both engines or different on each one. (Most diesel engines have clockwise rotation, while the rotation of most gasoline engines is one clockwise and the other counter-clockwise.) The following instructions offer general guidelines to install a single-station control with pull-to-open throttle cables and engines that both rotate clockwise. Instructions for other engine set-ups are well-described in the manual supplied with the unit. To help with the explanation, some components are numbered and identified in **Figure 2**.

Remove the throttle control cable from the slave engine. Connect the short new 33C cable (referred to as the engine control cable) to the slave engine, then attach it to the solenoid side of the synchronizer (**1**). Route the cable so there are no sharp bends. Secure the cable under the clamp on the housing, then attach the terminal eye (provided) to the cable end. Slip the terminal eye over the pivot pin (**2**) on the end of the governor control rod (**3**) and adjust the eye so the governor lever is not restricted by the cable in either idle or wide-open-throttle positions. Install the cotter pin to hold the terminal eye in place.

Boats equipped with Hynautic hydraulic controls need an adapter kit (US$45) mounted to the synchronizer. Kits are also available for pneumatic controls made by Kobelt, Rexroth and others (US$120).

Red stop collars (**4**) on the unit's governor control rod limit its travel and activate micro-switches that shut down the synchronizer before the rod can exceed the preset high- and low-speed positions. These collars must be adjusted in both idle and wide-open positions — the installation manual tells you how to do this.

Now take the throttle control cable (or cables for dual stations) that was removed from the slave engine and attach it to the opposite side of the synchronizer (**5**) and place it in the clamp (**6**). Refer to the instructions to check and adjust the cable overtravel before connecting the terminal eye (**7**) to the pivot pin (**8**).

The next step is to install the drive cable connections. These are two heavy cables (not supplied), less than 4.2m (14') long, that run from the synchronizer to the tachometer connection on each engine. Remove the existing tach

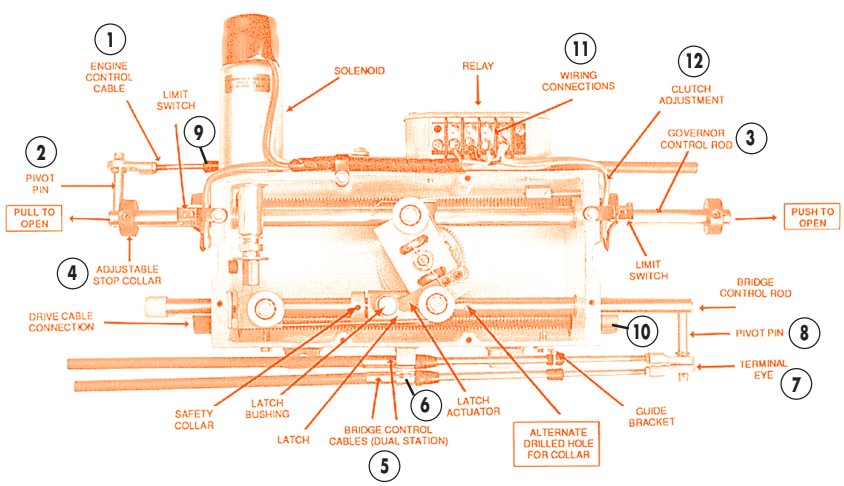



**Figure 2**

***Cut-away of the Glendinning Automatic Synchronizer showing setup for a pull-to-open operation.***

cable from each engine and replace them with the new drive cables of the proper length. Connect the other end to the correct take-off on the synchronizer. On a boat with both engines having clockwise rotation and pull-to-open cables, the slave cable attaches to **9** and the lead to **10**, as shown in **Figure 2**. If the engines have electric tach senders, these are removed and mounted to the ends of the governor control rods (not shown) using extensions (US$18 each). Engines without electric tach senders (including Volvo diesel, Ford Lehman, Cummins B, C and D Series, Detroit Diesel 8.2L, Perkins 6/354 and V8/540, Caterpillar 3116 and all gasoline inboards) also need mechanical drive adapters. These install on each engine using the existing crankshaft bolt, and the drive cable from the synchronizer screws onto each adapter.

The last step involves installing and wiring the on/off switch and pilot light. Mount both in a visible location on the dash near the throttle controls. Run a two-conductor wire (12-gauge for 12-volt system, 14-gauge for a 24 volt system) from the synchronizer (**11**) to the switch and light, following the wiring diagram in the manual. A 10-amp in-line fuse (included) is installed between the synchronizer and the ignition switch of the slave engine.

## Maintenance

The synchronizer is prelubricated at the factory and requires only a light spray of moisture-displacing lubricant once a year. After 100 to 200 hours of operation, the clutch that keeps tension on the synchronizer rods may need adjusting, which is easily done by an adjustment screw (**12**). The drive cables, like all mechanical cables, will eventually wear out over time and need replacing.

## EQUIPMENT LIST

The following shows the typical cost to install a single-station synchronizer. Prices listed are in U.S. dollars.

| | |
|---|---|
| 1 12-volt Synchronizer | $725 |
| 1 Morse control cable, 2.1m/7′ | $32.49 |
| 2 Drive cables, 2.7m/9′ and 3.3m/11′ | $86.38 |
| 12-Gauge wire, terminals, cable ties | $40 |
| 1 Single-station switch with fuse | $12.50 |
| 2 Tach sender extensions | $36 |
| **Total** | $932.37 |

**Options**

| | |
|---|---|
| 2 Mechanical drive adapters | $160 |
| (credit of $36 for tach sender extensions) | |
| 1 Dual-station switch kit | $34.50 |

*For further information contact: Glendinning Marine Products, 740 Century Circle, Conway, SC 29526; Tel: (800) 500-2381, (803) 399-6146, Fax: (803) 399-5005.*

ENGINE TROUBLESHOOTING

# Preventing Outboard Theft

Theft-deterrent options are expensive but you can probably purchase everything you need for less than your insurance deductible.

***Heavy, galvanized chain didn't stop thieves from lifting our one-week-old outboard, and without a trace — the black residue on the transom is finger-print powder.***

The times they are a changing. Ten years ago, we never locked anything. Now there are chains with padlocks on cockpit hatches, the stern locker, downriggers — even the boat is chained to the dock. Our investment seemed theft-proof, or so we believed.

Our naiveté was shattered when the six-year-old, 5-hp outboard on our test boat was lifted from the kicker bracket while the boat was docked. Secured with a padlock through the motor's clamp screws, the outboard seemed invincible. An insurance claim was filed, we paid the $500 deductible, and within a few weeks received a new, current-model replacement engine. This time we were taking no chances and mounted the engine on the bracket with heavy, galvanized anchor chain, securing it to the clamp bracket and transom eye bolts with hardened steel padlocks. Just one week out of the box and the engine disappeared again, only this time the boat rested on a trailer within 30m (100') of a friend's house. Needless to say, we were mad as hell and decided it was time to take control.

## Fighting Back

Thousands of outboards are stolen every summer. Our engine was just one of 41 outboards stolen in our area that weekend alone. A thief equipped with bolt cutters, a hacksaw, sledge hammer, torque wrench, drill, even an ax can remove an outboard in short order. The clamp screws are gray metal and snap off easily with a few good whacks with a hammer. Outboards mounted to the transom are slightly more secure, unless the thieves have bolt cutters or a torque wrench, and a drill is all that's required to remove bracket-mounted motors.

Just like a car, outboards cannot be made totally theft-free, but you can create enough of a deterrent that the thieves will, hopefully, go elsewhere.

There are several different locking devices owners can buy for less than $40 to thwart outboard thieves. These attach to the clamp screws or mounting bolts of outboards up to about 40 hp.

The Fulton Outboard Motor Lok (CDN$29.83/US$23.31) is a bar-type lock that mounts over the twin clamp screws of most small outboards. It consists of two pieces: the screws are wedged between the two halves, one which has a foam insert to reduce vibration, and a key lock is tightened to compress everything together. When installed on a bracket-mounted outboard, there must be sufficient clearance to enable raising of the bracket.

Moor-Aid (CDN$14/US$10), made by Douglas R. Hughes, fits any single or double clamp-on outboard. Made of heavy-duty steel, a slotted bracket slides under the base of one clamp screw and a steel cap covers the screw handle. This cap mounts into a captive slot in the bracket and is secured with a hardened-steel padlock (included). A series of holes allows for adjustment of the cap and the padlock to ensure a tight fit. The bracket base has four slots that dig into the transom when the device is forced by turning it.

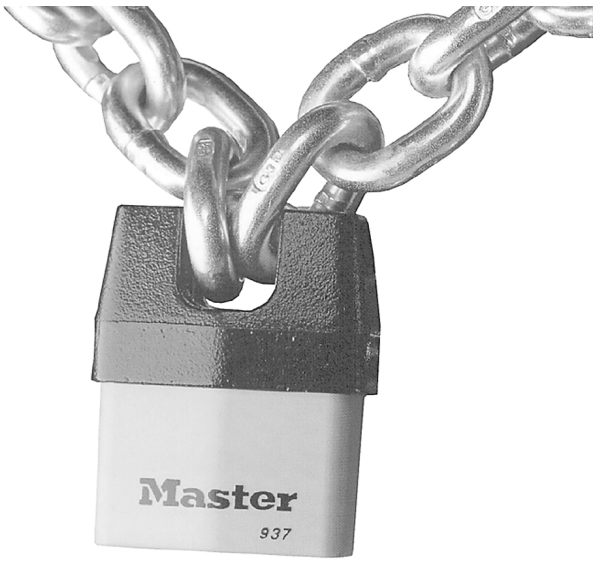
McGard's outboard lock (US$26) fits outboards that are bolted to the transom bracket with 8mm- (5/16") or 12mm- (1/2") diameter bolts. A collar replaces one of the nuts holding the outboard motor, then is tightened with the special key tool provided in each set. The collar spins freely if it's not first loosened with the key.

The Stern Safe (CDN$40.50 / US$27.95) installs on outboards that are thru-bolted to the transom. The original locking nut is removed

and replaced with a hardened steel housing. The nut is reinstalled and tightened, special washers slide over the stud and the housing is secured with a stainless-steel lock.

## Two's Better

All these devices help resist motor theft, but given the right equipment and enough time, a determined thief still can walk away with your engine. Locks that secure the clamp screws prevent the turning of the screws but




***The ultimate crime fighter: A construction-grade padlock with a shackle and chain made of hardened boron-alloy steel can only be cut with an acetylene torch or high-speed grinder.***

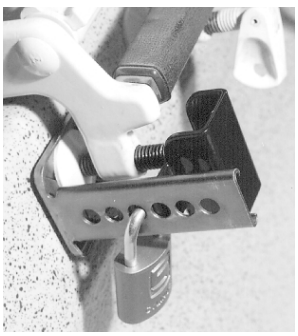
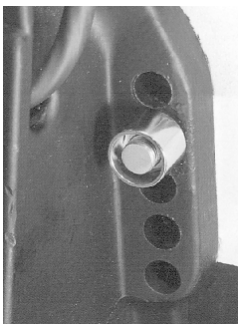
rely on the strength of them and they aren't very strong. And, devices that cover the transom bolt can surely be removed by a skilled thief sporting some heavy-duty hardware. So, how do you stop outboard theft?

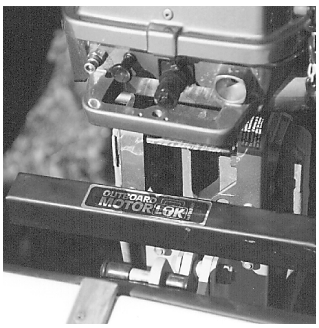
One solution is to add more locking devices. On transom-mounted motors, add a second bolt lock. Or install one of the outboard locks mentioned above and chain the outboard to the boat. But not any chain or lock will do. You'll need a chain and padlock with a shackle made of hardened boron alloy — there's nothing stronger. It can't be cut or sawed-off — the only way to remove boron alloy is with an acetylene torch or high-speed grinder, which, hopefully, the thieves didn't pack with them.

Stuff made of boron is expensive. A 7mm (9/32") chain sells for about $14 per foot. Padlocks with boron-alloy shackles, available from Master Lock (Pro Series) and Medeco, cost $30 to $150, depending on the size and thickness of the shackle. These locks provide up to 6,750kg (15,000lb) of resistance to bolt cutter attacks and are not easily drilled or picked.

ENGINE TROUBLESHOOTING

Our new outboard sports an outboard lock and a boron-alloy chain that runs through the carrying handle to a transom eye and is secured with a Pro Series padlock. The total investment is CDN$166 (about US$130), which is one-third of our insurance deductible. When you consider that every insurance claim increases your rate by as much as 15%, the expense of installing theft-deterrent devices is well worth the money.



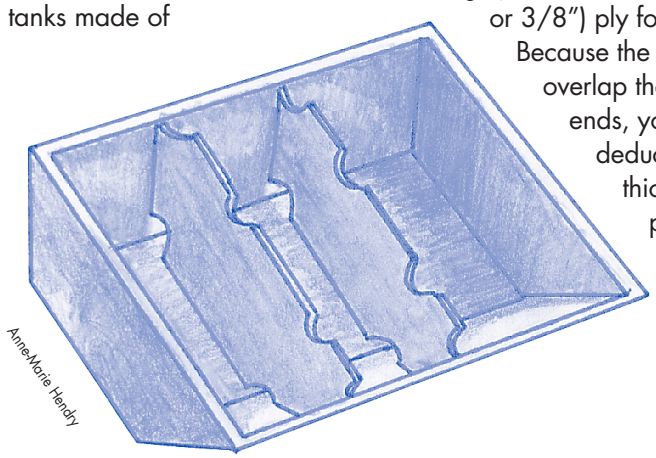
***One way to deter thieves is with an outboard motor lock: (left to right) Moor-Aid, McGard, Stern Safe and Fulton.***

DIY PROJECTS

## MADE-TO-MEASURE TANKS

When you need extra tankage consider making your own. Potable water and holding tanks made of plywood coated with epoxy resin are inexpensive, simple to build and are easily custom-made to fit any tank shape or hull contour. Epoxy is the ideal tank material. It waterproofs the plywood yet won't contaminate drinking water and is resistant to head chemicals. I've used wood-epoxy water tanks on *Nutcracker* for 12 years without any bad tastes or odors. The tanks were constructed with West System brand epoxy, but I'm sure other resins would net similar results.

Carefully measure the space for the tank, then make a cardboard template. Assemble the pieces using masking tape to hold it all together. Dry-fit the template, then trace the patterns onto the plywood. Building a rectangular tank is straightforward: cut the ends, sides, bottom, top and baffles out of 1/4" marine-grade plywood for tanks up to 151L (40 gal); use 8mm or 9mm (5/16" or 3/8") ply for larger tanks. Because the bottom and top overlap the sides and ends, you'll need to deduct double the thickness of the plywood from your height measurements. Decrease the width of the sides by the same amount to allow for the overlap of the ends. To build a tank that conforms to the contour of the hull, laminate multiple sheets of thin veneer to the required thickness over a wood form (mold), then join as described below.



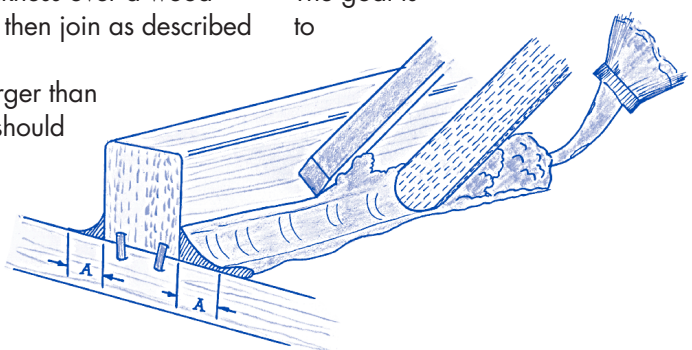
Anne-Marie Hendry

**Figure 1**

***A tank constructed of plywood and "waterproofed" with multiple coats of epoxy resin. Baffles prevent the contents from surging in the tank and scallop-shaped cutouts in the corners vent each compartment.***

Tanks larger than 19L (5 gal) should have internal baffles to prevent the liquid from surging inside the tank. The number of baffles depends on the size of the tank. A 151L (40 gal) water tank, for example, requires two or three baffles spaced 30cm (12") or less apart to ensure sufficient support. Cut deep scallops in the lower and upper corners of each baffle (see **Figure 1**) so the contents flow freely between compartments.

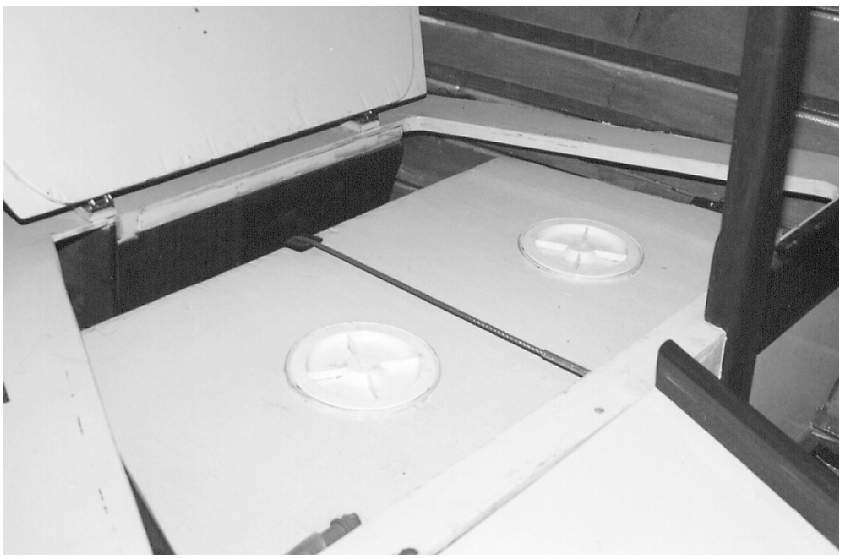
Assemble the tank in two sections: the main tank with the baffles, then the top. Both are assembled separately and completely finished, then the top is glued in place. Join the sides, ends and bottom panels using cleats (2.5cm/1") triangular pieces of wood) attached with thickened resin. Use staples, small copper nails or pipe clamps to hold the panels in place until the glue sets. Alternatively, bond the panels together using fillets: epoxy thickened with colloidal silica to a peanut-butter consistency that, when applied to an inside corner, forms a cove-shape bead over the join (**Figure 2**). For added strength on larger tanks, cover the fillet with fiberglass tape and resin. The goal is to




Anne-Marie Hendry

**Figure 2**

***To form a fillet, apply a bead of thickened epoxy (use a syringe or a heavy-duty plastic bag with a small hole cut in one corner), then pass a tongue depressor held at a 45° angle over the mixture to remove excess and form a smooth fillet. Use a putty knife to scrape the excess epoxy on either side of the fillet for a smooth concave edge (A).***



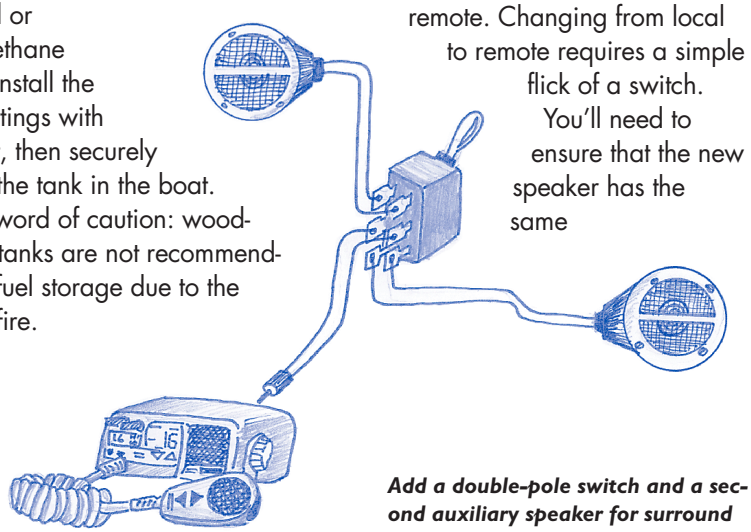
*A removable wood-epoxy water tank fits snugly in the vee-berth and has two inspection ports for cleaning. A stainless-steel cable with adjustable turnbuckle attaches to the bulkhead and leads around the tank to a floor-mounted pad eye to hold the tank securely in place. A rubber gasket under the wire on the forward edge protects the tank from chafe.*

have rounded, smooth corners. With either method, apply thickened epoxy to all plywood mating surfaces. Scrape or sand off any excess epoxy, then sand the wood (and fillets) with 120-grit paper. Coat the interior of the box and the underside of the top with a minimum of four coats of unthickened resin. Apply three coats "green on green" — recoat when the resin is just slightly tacky and before it reaches its final cure stage (about 2-1/2 to 3 hours at room temperature). After the third coat let it cure thoroughly, then sand to a glass-smooth finish with 120-grit paper. This ensures an easy-to-clean surface. Because epoxy is transparent, add a white pigment (paste or powder) to the last coat at the rate of 5% by weight so you can easily see the scum when cleaning the tank.

Cut holes in the top for large clean-out ports: install 10cm or 15cm (4" or 6") screw-in plastic inspection ports, positioned so they provide access to the entire tank for cleaning. On tanks with multiple baffles, locate the ports between each baffled section. Mark the placement for the vent, fill and discharge hose fittings, then glue backing blocks made of 12mm (1/2") stock to the top exterior where marked. When cured, drill the holes. A typical potable water tank has a 16mm (5/8") vent, 3cm (1-1/2") fill and 12mm (1/2") outlet; a holding tank has one or two 16mm (5/8") vents and 3cm (1-1/2") inlet and pumpout.

Glue the top to the tank, and hold in place with staples or clamps until set. Apply three coats of resin to the exterior of the tank, followed by two coats of an enamel or polyurethane paint. Install the hose fittings with sealant, then securely mount the tank in the boat.

A word of caution: wood-epoxy tanks are not recommended for fuel storage due to the risk of fire.



*Add a double-pole switch and a second auxiliary speaker for surround VHF reception.*

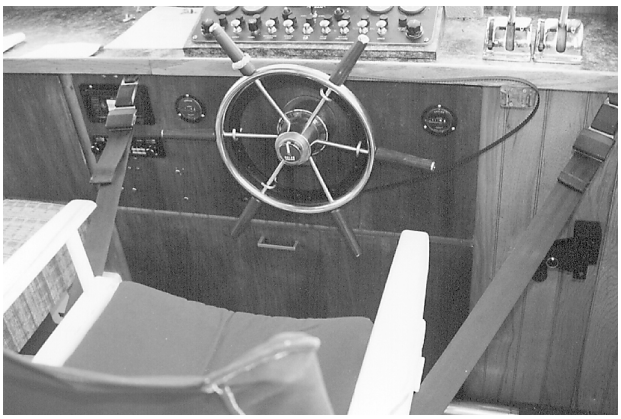
## Remote Speaker Switch

Many VHF transceivers have an internal speaker and an audio jack, which permits connection for a remote speaker. When the remote speaker is plugged in, the internal speaker doesn't operate. The jack and plug connections are usually behind the transceiver in an inaccessible location. Changing from local to remote is a nuisance. To improve this situation on board our Morgan 32, I added a switch and another speaker. The new local speaker takes the place of the internal speaker when connecting the remote. Changing from local to remote requires a simple flick of a switch.

You'll need to ensure that the new speaker has the same impedance as your other speakers (usually 8 ohms); this information is in your VHF specifications sheet. *Kevin Dean, Via Sophia, North Vancouver, B.C.*

## Sitting Securely

My powerboat's helm station is a stand-up one and during long passages I get tired of standing. In order to be able to sit at the same height as standing, I purchased a folding high-back director's chair (the kind with a canvas seat). I now sit comfortably and really enjoy the cruise. Sometimes, I get too comfortable and lean back, then the wake of a passing boat knocks me and the chair flat on our backs.



***A sit-down helm station has a director's chair securely fastened with automotive seat belts.***

To secure the seat to the edge of the instrument panel I installed seat belts. A local auto-recycling depot was eager to assist with a set of lap-style seat belts — they're even color-coordinated to the upholstery. These were mounted upside down to hide the auto logo and the adjustable sections were mounted to the chair at the center point with the ends of the belt facing up for easy adjustment.

Now safely secured behind the wheel, I can relax and enjoy the passage with the knowledge that whatever the sea state or mind state, I will remain seated at the helm.

*Bill Macklin, Stratford, Ont.*

**Share a boat-tested project with other DIY readers. If we publish it, we'll send you $25 to $150 depending on the published length.**

SAILBOAT RIGGING

# ATTACHING JIB SHEETS

There are many different ways of attaching jib sheets. Some boaters splice sheets to a snap shackle or tie bowlines. The former method allows for quick sail changes but is the least preferred — a flogging shackle makes a dangerous projectile on a heaving foredeck. Bowlines are more secure but take time to release when changing sails — assuming you don't have a set of sheets for every foresail.

The following is a modified application of the toggle cord for attaching jib sheets. There are other similiar methods — a single cord with an eye splice in one end and a big figure eight or stevedore knot in the other, for example — but I prefer this quick-and-dirty one. I've used it for many years on two small cruisers and it has never failed.

Use a short piece of braided polyester line of a diameter that, when doubled to form an eye, will just pass snugly through the clew grommet of the jib(s). This is important; the fit should be snug, but not tight.

Fold the line in half and tie a simple overhand or figure-eight knot in the matched bitter ends. The doubled length should be just long enough to freely clear the corner of the jib by a few inches when the knotted end is passed through the loop. Thread the loop through the grommet, then pass the knotted end through the loop. Yank back hard and the doubled loop will jam; the knotted end acts as a toggle to prevent the loop eye from pulling out of the grommet. Haul the toggle cord back hard through the grommet against the rope toggle. Mark where the midpoint is. Remove the toggle cord.

***Make the toggle cord just long enough so it fits snug against the clew. It's shown larger than it needs to be for clarity.***

Double the jib sheet, if using one continuous jib sheet (it must be long enough to pass down each side of the boat) and lay the bight of the doubled end back onto itself, to form a sliding doubled eye. Pass the loop eye of the toggle cord through the doubled-back jib sheet loops and cinch the sheet tight at the marked midpoint. To attach two separate sheets, tie each to the toggle cord at its midpoint with a buntline hitch (see Knotty Know-How on the next page). Now, pass the eye of the cinch loop through the clew grommet, lock it on the other side with the knotted end and set it with a tug.

The harder the pull on the sheets, the tighter the toggle cord locks. When the sail flogs, the loop stays locked. (The limp quality of double-braid line prevents the eye from opening and releasing the knotted end.)

Only one set of jib sheets is required with the toggle-and-cinch attachment. To change headsails, "unlock" the toggle loop, pull it out of the clew grommet and insert it into another sail.

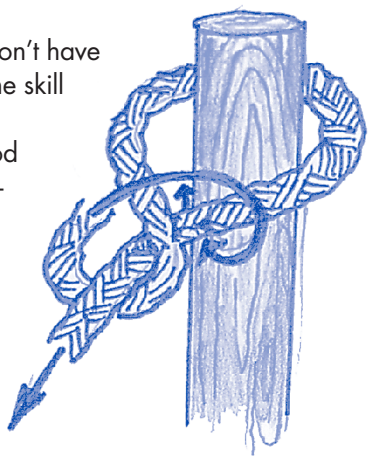
This is one "fastener" I don't much mind being flogged in the head with and it's much faster than attaching jib sheets to the clew with bowlines. It's also much handier than having separate jib sheets for each sail, as I don't have to run new sheets aft with each headsail change. (I almost always sail single-handed, so I appreciate labor-saving methods.)

This gadget has never come loose in use, despite hard headsail floggings while reefing the main. Wear hasn't been a problem; the grommets don't seem to chafe the double braid. Even so, replacement is easy and cheap.

***Allen Parks is former owner and publisher of a weekly newspaper in central Idaho. He prefers small trailer cruisers outfitted for "water camping" and over the past 27 years, has sailed mountain waters in Utah, Idaho, Oregon and Washington's Puget Sound and the San Juan Islands. From his home port of Oak Harbor in Whidbey Island, Wash., Parks and his wife cruise the Pacific Northwest in* Rigel, *a self-restored '60s vintage JOG/MORC class English-built Signet 20 and* Poteet, *a West Wight Potter 15.***

# KNOTTY KNOW-HOW

## Buntline hitch Knot



When you don't have the time or the skill to do an eye splice, a good knot to dead-end braided lines to a bail, becket, post or a rope eye is the buntline hitch. It's nearly as strong as a splice and gives a very fair lead. This knot can also be used to bend two lines together, such as tying sheets to the clew of a jib or a toggle cord (see Sailboat Rigging). Properly tied, this knot gives a secure hold that's easy to untie after loading.

It looks complicated to tie, but it's simply two half-hitches tied backwards. To make it, lead the bitter end through the eye (metal or rope) or around the post, then tie a figure-eight knot around the standing part. Pull hard on the standing part to seat the knot against the eye. If the line is real slippery, tuck in another turn or two, or seize the bitter end down.

ANNE-MARIE HENDRY

# ELECTRONICS

## REDUCING YOUR ELECTRICAL DEMAND

Conserve battery power without sacrificing comfort or safety. Here's how.

***By Kevin Jeffery***

One of the best ways to make sure there's always enough battery power onboard is to reduce your electrical demand. This doesn't mean giving up conveniences or safety gear you've come to enjoy and rely on. Most boaters can reduce their electrical load significantly simply by choosing efficient appliances and operating them wisely.

The first step is to have a good estimate of your current electrical load, since your load and your ability to replace this load (either with 12-volt charging gear or other power sources) must be evenly matched. This approach allows you to view your total energy budget and target problem areas effectively. The results may surprise you. (For a quick review of how to estimate your electrical load see **Figure 1** on page 34.) Now, go through your appliance list and choose loads that can be reduced. Start with the most universal and easiest to alter, lighting.

### Cabin & Deck Lighting

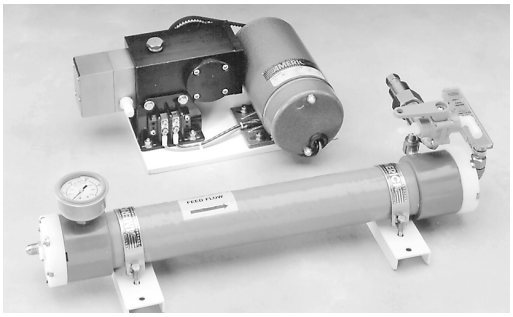
Kerosene lanterns are hard to beat for atmosphere and low battery draw, but electric lighting is one of the simple luxuries of our times. Cabin lighting typically accounts for a large portion of a boater's electric load, but you can reduce consumption by up to 75% with energy-efficient fluorescent lights or up to 20% with halogen lamps. Lighting efficiency is measured in lumens per watt, or the light output in relation to the energy consumed. Incandescent bulbs are notorious energy wasters, operating in similar fashion to heating elements — only about 10% of the electricity consumed is turned into light, while 90% dissipates as heat. A typical 8-watt fluorescent lamp delivering 60 lumens-per-watt gives the same light output (lumen level) as a 40-watt incandescent bulb yielding 12 lumens-per-watt.

***Energy-efficient transistorized lights with fluorescent bulbs (these are from Hella) consume only one-fifth of the power of incandescent bulbs.***

On one boat I owned there were 11 8-watt fluorescent cabin fixtures, and if all were on at once the total draw was still less than a single 100-watt incandescent bulb. On a typical evening we would operate the equivalent of four cabin lights for about four hours, so our average cabin lighting load was 0.67 amps per light x four lights x four hours per night or just over 10 amp-hours per night, about the same as using one 30- to 35-watt incandescent bulb.

Most anchor lights, including those incorporated into a sailboat's masthead tricolor light, have a large electrical load. They consume between 10 amp-hours (if a 12-watt bulb is used) and 20 amp-hours (with a 25-watt bulb) in one night. A good alternative is to get a low-drain anchor light. Battery-powered versions that hang in the rigging, some with photoelectric switches that shut the unit off at dawn, are readily available or can be easily made. I made one out of a fractured glass preserve jar, two 100-milliampere high-intensity DC lamps from Radio Shack, an automatic light-sensitive "eye," and some exterior-grade wire that doubled as the hanging lanyard. It produced as much or more light than a kerosene lantern, consumed only 2 amp-hours per night, and cost around $10. (Plans for an automatic battery-powered anchor light will appear in a future issue.)

Sailors can greatly reduce the total electrical draw of their boat's running lights by switching to a masthead tricolor fixture. It uses only one 25-watt incandescent bulb instead of three separate deck-mounted lights for port, starboard and stern, which together can consume 60 amp-hours of electricity if on for 10 hours. Using a tricolor reduces the load to 20 amp-hours. (Keep your deck-



***An efficient 12-volt watermaker such as the Village Marine Little Wonder (CDN$3,900/ US$2,899) produces 22.7L (6 gal) of water in an hour using only 15 amp-hours of electricity.***

mounted running lights for use when under power or in areas of heavy traffic.) Make sure that your energy system is sized so that you always have enough energy for running lights.

## Refrigeration & Water Making

On-board refrigeration places you in a fairly high energy category, especially when cruising in warm climates. Powerboaters can reduce their electrical load by choosing modest-sized, efficient marine or RV refrigerators (check the energy-use rating on the label). Or they can cut their electrical load significantly by converting to a built-in system with a super-insulated, top-loading box with multiple lid seals (similar to those used on sailboats as described below), as opposed to an upright box with modest insulation where the cold is released every time you open the door.

Sailors have several types of refrigeration systems from which to choose. Engine-driven refrigeration using holding plates (plates that "store" cold and keep box temperatures low for 24 hours or more) is perhaps the most complete method to reducing electrical consumption, since it eliminates it altogether. In fact, the boat's main engine, or one of the many small diesel chargers on the market, can be powering a refrigeration compressor as well as a water-maker pump and a high-output alternator for charging batteries. The downside of this type of system is that you must run an engine every day and you'll get no contribution to your refrigeration or water-making loads from renewable energy sources, such as solar or wind power. An alternative is to have an efficient 12-volt holding plate refrigeration system, such as those offered by Glacier Bay, Grunert, Nova Kool, Sea Frost, Technautics and others. With a 12-volt holding plate system, if renewable charging sources can't keep up with the load, you simply run an engine-driven high-output alternator to sup-

ply electricity for refrigeration, water-making and storing surplus electricity.

## Other Equipment

**STOVES** Eliminate appliances with heating elements where possible by cooking with propane. If you like to use a coffee-maker, despite its 100-amp draw when brewing, drip the coffee into a thermal carafe and turn off the machine. If your model has a built-in clock or timer, disconnect it when it's not being used to eliminate the "phantom" load (see below). Microwave ovens are fairly efficient, especially when used for warming food quickly, but they can drain batteries rapidly if used indiscriminately.

**RECHARGEABLES** Rechargeable communication devices and cordless appliances use an AC plug-in transformer or "power cube" — a small device that transforms standard AC power into low-voltage AC or DC power. These appliances draw modest amounts of power when charging or running, but they never completely shut off. If the power is supplied by a large inverter, this phantom load — drawing power even when appliances are turned off — means the inverter may never go into its standby mode, therefore wasting a lot of power. Since most gear can be recharged quickly, it's best to recharge the battery pack,

### FIGURE 1: Calculating Electrical Loads

To estimate your electrical load, set up an appliance load chart similar to the one to the right. List all electrical appliances you would like to have on board. If you plan to upgrade your boat soon, this is a good time to think about future electrical demand. List your DC loads first, followed by your AC loads as this allows you to assess your DC charging sources as well as various methods of providing AC power.

Next to each appliance, note the average current draw. Average current draw takes into account the fact that, for some appliances such as autopilots, the current draw varies with how hard the appliance is working when operating. Average draw also accounts for appliances with multiple speed or other operation settings.

In the next column, bring time into the equation by noting how many hours on average each appliance is used. Take into account that some appliances are used every day while others are used occasionally, and that some appliances are operated mostly in port and some are used exclusively at sea. To find the average daily hours of use for occasional loads, calculate average hours of use per week and divide by seven days.

Now multiply the average current draw in column two by the average daily hours of use in column three to get your average daily electrical energy consumption in amp-hours. You'll find that some appliances with high power draws consume a modest amount of energy if operated only for short periods of time, whereas a relatively low-draw appliance like an anchor light consumes a surprising amount of electricity when operated nightly for 10 or more hours. Add the values in column 4 to determine your total average daily load.

then disconnect the power cube from the circuit. You can do this by placing all your rechargeable gear on one power strip that can be manually turned on for an hour or two when needed. (Caution: Never use an electric timer for the charging cycles — it also has a constant power draw.)

**INVERTERS** Today's inverters are very efficient at converting battery power to household AC power, but they still consume about 10% of the available electricity in the process. Use 12-volt appliances where possible and disconnect all rechargeable AC gear when not in use so that the inverter can revert to its standby mode (see above).

**COMPUTERS** Laptop computers use only a fraction of the power of desktop models, especially once the laptop's internal battery is charged. Use a direct DC charger if possible. If an AC power cube is used, disconnect it from the power source whenever you can.

**ENTERTAINMENT** TVs, VCRs, stereos and other entertainment appliances vary widely in the amount of power they draw. In general, DC equipment for the automotive and marine markets is much more energy-efficient. Electricity use is proportional to a stereo's

## Sample Appliance Load Chart

| APPLIANCE | AVERAGE CURRENT DRAW (amps) | AVERAGE USE (hours/ day) | AVERAGE CONSUMPTION (amp-hours /day) |
|---|---|---|---|
| DC LOADS | | | |
| Cabin lights | 3 | 4 | 12 |
| Running lights | 2 | 2 | 4 |
| Standard anchor light | 1 | 10 | 10 |
| VHF receive | 0.5 | 4 | 2 |
| transmit | 5 | 0.4 | 2 |
| GPS | 0.5 | 3 | 1.5 |
| Instruments | 0.5 | 3 | 1.5 |
| Stereo/tape deck | 2 | 2 | 4.0 |
| Bilge pump | 4 | 0.1 | 0.4 |
| Marine refrigeration | 5 | 12 | 60 |
| Autopilot | 2 | 2 | 4 |
| AC LOADS | | | |
| TV/VCR | 6 | 0.5 | 3 |
| Laptop computer | 1 | 2 | 2 |
| Microwave oven | 80 | 0.17 | 13.6 |
| Coffee mill | 8 | 0.01 | 0.08 |
| Coffee-maker (brewing) | 100 | 0.13 | 13 |

*Total Average Daily Load = 133 amp-hours per day*

wattage ratings, so be selective when buying. Phantom loads in the entertainment arena include timers, lights and the instant-on feature on most TVs. To conserve energy, simply disconnect these appliances when not in use.

**COMMUNICATIONS** Here's a time when it's not better to give than receive. Communication devices such as VHF and SSB radios draw 10 times more power when transmitting as when receiving. Keep your communication transmissions to a minimum.

**VACUUM-LESS** Keeping your boat clean is important, but don't sacrifice your batteries for the sake of convenience. Non-electric sweepers and small brooms have lost favor over the years, but they can be almost as convenient, less noisy and certainly more energy-efficient than high-draw electric vacuums.

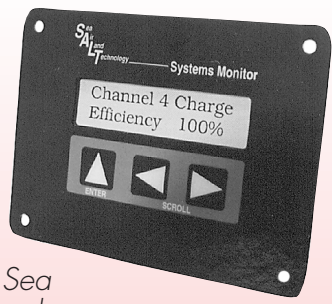
**WATER PUMPS** Most onboard water pumps draw between 3 and 5 amps when running, but they are only on for short periods of time. Using hand- or foot-operated pumps helps conserve electricity while regulating freshwater use. For seawater electric pumps, keep intake strainers and waterlines clear of debris and marine growth. A seawater pump can draw many times more electrical power than normal, if restrictions are present.

As you can see, reducing your electrical demand has a lot to do with making intelligent choices about appliances and how you use them. If, after making those choices, your batteries are still feeling down, you may have to alter your lifestyle a bit or

TIPS

## FINDING CURRENT DRAW

*A digital system monitor provides a convenient method for finding the current draw of all appliances already on board. Begin by making sure all charging sources and appliance loads are off, then turn off appliances one at a time. The Link 10, available from Heart Interface, or Cruising Equipment's E-Meter are a good single-bank system monitor that displays charging or load amps, battery voltage, and amp-hours. For more sophisticated monitoring, the SALT Systems Monitor, available*

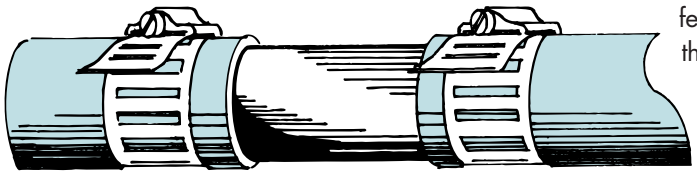

*from Sea Air Land Technologies, is an accurate, simple-to-use device that can monitor up to four battery banks or charging sources, has programmable alarm functions and can even connect to a PC.*

upgrade your charging ability. Only you can decide when conservation measures become draconian and rob you of simple pleasures on board.

***Kevin Jeffrey is an independent energy designer and consultant, author and publisher of* The Independent Energy Guide*, and co-author and publisher of* The Sailor's Multihull Guide *and* Adventuring With Children. ***He lives on Prince Edward Island and has sailed extensively with his family on several cruising catamarans.***

# Good Boatkeeping

## Hose Patchers

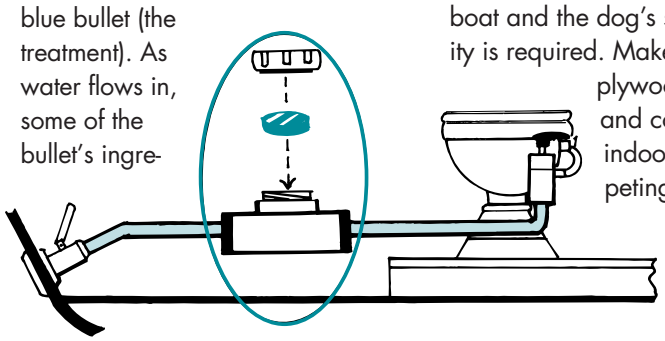


Carry spare lengths of hose for fuel and water applications or at least note the diameters of all hoses and carry appropriate-sized pieces of plastic adapters. If you discover a damaged hose, you can cut away the bad section and rejoin the two cut ends with a center "patch" and hose clamps.

## Head Lines

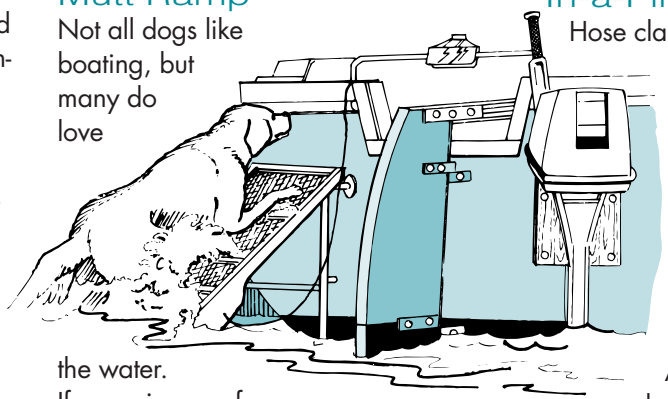
Nobody really wants to acknowledge, much less deal with, the problem of odor wafting from the head, but here's one practical solution.

Incoming water is often a big source of smell. The Head-O-Matic Tank-ette is a treatment-dispensing gadget that attacks that initial source of odor. Install the Tank-ette (the device) in the head's water-intake hose, then pop in a Head-O-Matic blue bullet (the treatment). As water flows in, some of the bullet's ingredient flows with it to control odor, break down waste, lubricate the pumping mechanism and keep the holding tank fresh. The Tank-ette differs from other similar-looking units because you can adjust the amount of treatment feeding through the system. Contact: Alex Milne Associates, 3700 Weston Rd., North York, ON M9L 2Z4; Tel: (800) 563-5947, (416) 742-4911 Fax: (416) 742-6005.



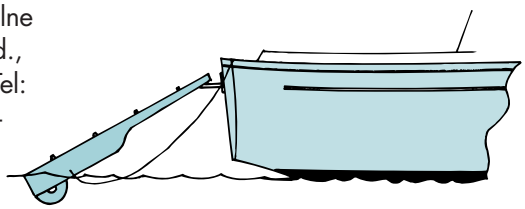
## Mutt Ramp

Not all dogs like boating, but many do love the water. If yours is one of the latter, save yourself a lot of on-off hoisting by rigging a doggie platform.



Actual dimensions and attachment methods vary will with each boat and the dog's size, so ingenuity is required. Make the ramp of plywood or fiberglass, and cover it with indoor/outdoor carpeting. A few interim wood strips, also carpeted, offer added traction.

The boat end of the ramp is loosely hinged around the top rung of a transom boarding ladder. Attach a length of line to the water end of the ramp to hoist the ramp to a vertical, stowing position and fasten to the stern pulpit. When in the "down" position, the water end of the ramp is supported by a small fender underneath. The ramp floats up and down to accommodate wave action and the dog's weight.



## In-a-Pinch Holders

Hose clamps are high on the list of spares to carry but sometimes you run out of the size you need. If that happens to you, take a short length of wire and use pliers to twist and tie. Another temporary clamp is created by wrapping old line or twine around the hose a few times. Slide a cotter pin over the wraps and twist it until tight, then tie or tape the pin to hold it in place.

Before using either of these substitutes, wrap tape (electric or duct) around the hose so the metal or line twists don't damage it.